

## iVoro on CIFAR-100 Dataset (5 Phases)

```
[1]: import matplotlib.pyplot as plt
import os
import pickle
import numpy as np
import pandas as pd
import seaborn as sns
import time
import sys
sys.path.append('../')
sys.path.append('../analysis/')
import copy
import platform
import json
import pickle
import random

import torch
from scipy.stats import mode
```

```
[194]: from ResNet import resnet18_cbam

data_name      = 'CIFAR100' # 'Subset' # 'Tiny' # 'CIFAR100' # 'MNIST'
total_nc       = 100 # 200 # 100 # 10
fg_nc          = 50 # 100 # 40 # 50 # 4
task_num       = 5 # 20 # 5 # 10 # 2

# constant params
class_set      = list(range(total_nc))
ROTATION       = True
EMB2D         = False
DESIGN         = True
virtual_class  = 4*total_nc if ROTATION else total_nc
suffix         = 'voro' # 'prob' 'voro'
assert (total_nc - fg_nc)%task_num == 0
task_size      = int((total_nc - fg_nc)/task_num)
file_name      =
    ↳data_name+'_'+str(fg_nc)+'_'+str(task_num)+'x'+str(task_size)+suffix
```

```
print(file_name)

brother      = False # True False
```

CIFAR100\_50\_5x10voro

```
[195]: save_path = '../checkpoints/'
path    = save_path + file_name + '/'
filename = path + '%d_model.pkl' % (fg_nc+0) # +5
model    = torch.load(filename)
model.eval()
print('> loaded base phase model from:', filename)
```

> loaded base phase model from: ../checkpoints/CIFAR100\_50\_5x10voro/50\_model.pkl

```
[196]: from voro_helper import num_param, t2n, \
        load_feat, sanity_check, \
        id2emb_, num_samp, merge_sc, funbtch

num_param(model)

# voronoi centers:
vcenter = t2n(model.module.classifier.weight.data / 2.)
print(vcenter.shape)
```

```
module.classifier.weight      torch.Size([200, 512])  102400  True
total: 102400
(200, 512)
```

```
[197]: '''
CIFAR:
    'CIFAR100_50_5x10_test.pkl'
    'CIFAR100_50_5x10_train.pkl'
    'CIFAR100_40_20x3_test.pkl'
    'CIFAR100_40_20x3_train.pkl'
more CIFAR:
    'CIFAR100_40_12x5_test.pkl'
    'CIFAR100_40_12x5_train.pkl'
    'CIFAR100_30_14x5_test.pkl'
    'CIFAR100_30_14x5_train.pkl'
    'CIFAR100_20_16x5_test.pkl'
    'CIFAR100_20_16x5_train.pkl'
    'CIFAR100_10_18x5_test.pkl'
    'CIFAR100_10_18x5_train.pkl'
Tiny:
    'Tiny_100_20x5_test.pkl'
    'Tiny_100_20x5_train.pkl'
TinyL3:
    'Tiny_100_5x20_test.pkl'
```

```

    'Tiny_100_5x20_train.pkl'
Subset:
    'Subset_50_10x5_test.pkl'
    'Subset_50_10x5_train.pkl'
'''
ffile = '../embedding/prob/' + 'CIFAR100_50_5x10_test.pkl' # prob probL3
data_phas, last_tsk = load_feat(ffile)

labs, embeds, outputs = data_phas[last_tsk][last_tsk]
false_id, pred_ = sanity_check(labs, embeds, outputs)

```

```

feature file: ../embedding/prob/CIFAR100_50_5x10_test.pkl
> loaded tasks: dict_keys([5])
> classes: [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18,
19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38,
39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58,
59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78,
79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98,
99]
> samples: 10000
> embedding: 512
> classification: 400
~ acc (single): 63.45%
~ acc (quadruple): 54.53%

```

```

[198]: ffile = '../embedding/prob/' + 'CIFAR100_50_5x10_train.pkl' # prob probL3
data_phas, last_tsk = load_feat(ffile)

labst, embedst, outputst = data_phas[last_tsk][last_tsk]
false_id, pred_ = sanity_check(labst, embedst, outputst)

```

```

feature file: ../embedding/prob/CIFAR100_50_5x10_train.pkl
> loaded tasks: dict_keys([5])
> classes: [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18,
19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38,
39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58,
59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78,
79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98,
99]
> samples: 50000
> embedding: 512
> classification: 400
~ acc (single): 78.83%
~ acc (quadruple): 71.71%

```

```

[199]: embs = id2emb_(labs, embeds, brother=brother)
embst = id2emb_(labst, embedst, brother=brother)

```

```
sam_max, sam_min = num_samp(embst)
print('> loading data done!')
```

```
0 500,1 500,2 500,3 500,4 500,5 500,6 500,7 500,8 500,9 500,10 500,11 500,12
500,13 500,14 500,15 500,16 500,17 500,18 500,19 500,20 500,21 500,22 500,23
500,24 500,25 500,26 500,27 500,28 500,29 500,30 500,31 500,32 500,33 500,34
500,35 500,36 500,37 500,38 500,39 500,40 500,41 500,42 500,43 500,44 500,45
500,46 500,47 500,48 500,49 500,50 500,51 500,52 500,53 500,54 500,55 500,56
500,57 500,58 500,59 500,60 500,61 500,62 500,63 500,64 500,65 500,66 500,67
500,68 500,69 500,70 500,71 500,72 500,73 500,74 500,75 500,76 500,77 500,78
500,79 500,80 500,81 500,82 500,83 500,84 500,85 500,86 500,87 500,88 500,89
500,90 500,91 500,92 500,93 500,94 500,95 500,96 500,97 500,98 500,99 500,
max samples: 500
min samples: 500
> loading data done!
```

```
[200]: for k,v in embst.items():
        if v.shape[0] < sam_max:
            rid = np.random.choice(v.shape[0], sam_max-v.shape[0], replace=False)
            print('filling', sam_max-v.shape[0], 'samples')
            embst[k] = np.vstack((v, v[rid]))
```

```
[201]: from voro_helper import get_task_data, feat_trans, NC_o, tsk_cls, fun, \
        ↪acc_brother, forgetting

i = task_num
support_data_, support_label_, query_data_, query_label_, n_ways_, n_shot_, _ = \
    get_task_data(embst, embs, i, fg_nc, class_set, task_size, brother=brother)
```

```
##### current_task: 5 #####
current classes [90, 91, 92, 93, 94, 95, 96, 97, 98, 99]
[output] all classes 0 -> 99
```

```
[202]: #%% =====
        ↪=====

be      = 1. # 1.
l2      = False # False True
protots = np.mean(feat_trans(support_data_, beta=be, l2=l2), axis=1)
```

```
[203]: i = 0
support_data, support_label, query_data, query_label, n_ways, n_shot, classes = \
    get_task_data(embst, embs, i, fg_nc, class_set, task_size, brother=brother)
acc, _, nn_pre = NC_o(support_data, support_label,
                      query_data, query_label,
                      n_ways, n_shot,
                      beta = be, l2 = l2,
                      given_cen = protots[classes], given_only = True,
```

```
brother = brother)
```

```
##### current_task: 0 #####  
current classes [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17,  
18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37,  
38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49]  
[output] all classes 0 -> 49  
0.8038
```

```
[204]: local      = False # True / False  
nn_acc    = []  
savefile  = path+'NN' if brother else None # NN / NNp / NN3 / only saved NN  
→results!  
savefil2  = path+'NN3'  
forget    = True # True False # calculate forgetting  
class_ladder = []  
a         = []  
for i in range(task_num + 1):  
    support_data, support_label, query_data, query_label, n_ways, n_shot,   
→classes = \  
        get_task_data(embst, embs, i, fg_nc, class_set, task_size,  
                        local = local, brother = brother) # False  
    if forget:  
        class_ladder.append(classes)  
    acc, _, nn_pre = NC_o(support_data, support_label,  
                          query_data, query_label,  
                          n_ways, n_shot,  
                          beta = be, l2 = l2,  
                          given_cen = protots[classes] if local else protots[:  
→classes[-1]+1],  
                          given_only = True,  
                          brother = brother,  
                          savefile = savefile+'_'+str(i) if brother else None,  
                          savefile2 = None, # savefil2+'_'+str(i), # None, #  
                          weights = [0.7, 0.3],  
                          class_ladder = class_ladder,  
                          acc_all = a  
    )  
    nn_acc.append(acc)  
    # if all classes up2now: local = False, and protots[:classes[-1]+1]  
print('local:', local, '| beta:', be, '| l2:', l2)  
if brother:  
    for accs in nn_acc:  
        print('\t'.join([str(i) for i in accs]))  
else:  
    print('\n'.join([str(i) for i in nn_acc]))
```

```

if forget:
    avgf = forgetting(a, task_num)
    print(avgf)

```

```

##### current_task: 0 #####
current classes [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17,
18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37,
38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49]
[output] all classes 0 -> 49
0.8038

```

```

##### current_task: 1 #####
current classes [50, 51, 52, 53, 54, 55, 56, 57, 58, 59]
[output] all classes 0 -> 59
0.7255

```

```

##### current_task: 2 #####
current classes [60, 61, 62, 63, 64, 65, 66, 67, 68, 69]
[output] all classes 0 -> 69
0.6759

```

```

##### current_task: 3 #####
current classes [70, 71, 72, 73, 74, 75, 76, 77, 78, 79]
[output] all classes 0 -> 79
0.6255

```

```

##### current_task: 4 #####
current classes [80, 81, 82, 83, 84, 85, 86, 87, 88, 89]
[output] all classes 0 -> 89
0.5930

```

```

##### current_task: 5 #####
current classes [90, 91, 92, 93, 94, 95, 96, 97, 98, 99]
[output] all classes 0 -> 99
0.5606

```

```

local: False | beta: 1.0 | l2: False

```

```

0.8038
0.7255
0.6758571428571428
0.6255
0.593
0.5606
[[0.8038 0.      0.      0.      0.      0.      ]
 [0.754  0.583  0.      0.      0.      0.      ]
 [0.7334 0.536  0.528  0.      0.      0.      ]
 [0.7188 0.501  0.473  0.436  0.      0.      ]
 [0.6968 0.48   0.456  0.418  0.499  0.      ]

```

```
[0.6852 0.466 0.433 0.387 0.47 0.424 ]]
[0, 4.9799999999999995, 5.8699999999999992, 7.3999999999999995, 7.5,
8.171999999999999]
```

```
[205]: def predict(model, x, voro=True):
        x = torch.from_numpy(x.astype(np.float32)).cuda()
        with torch.no_grad():
            predi = model.module.classifier(x)
        if voro:
            predi += - torch.sum((model.module.classifier.weight/2.）**2, dim=1)
        return predi

classes_all = []
test_share = []
paccS = []
for i in range(task_num + 1):
    support_data, support_label, query_data, query_label, n_ways, n_shot, \
    →classes = \
        get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                        local = True, brother = brother)

    # load model:
    if brother:
        cls_01 = classes[-1]+1
        assert cls_01 % 4 == 0
        filename = path + '%d_model.pkl' % (int(cls_01/4))
    else:
        filename = path + '%d_model.pkl' % (classes[-1]+1)
    model = torch.load(filename)
    model.eval()
    print('> loaded base phase model from:', filename)
    num_param(model)
    # do prediction:
    min_cls = min(classes)
    if brother:
        pred = predict(model, query_data)
    else:
        pred = predict(model, query_data)[:,:,:4]
    pmax = torch.max(pred, dim=1)[1]
    pacc = np.mean(t2n(pmax) == query_label - min_cls)
    print(pacc)
    if brother:
        accs = acc_brother(t2n(pred), t2n(pmax), query_label - min_cls, \
    →forLG=True)
        pacc = [pacc] + accs
    paccS.append(pacc)
    classes_all.append(classes)
    test_share.append(len(query_label))
```

```

print('all logistic locally:')
if brother:
    for accs in paccS:
        print('\t'.join([str(i) for i in accs]))
else:
    print('\n'.join([str(i) for i in paccS]))

```

```

##### current_task: 0 #####
[output] current classes [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15,
16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35,
36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49]
all classes 0 -> 49
> loaded base phase model from: ../checkpoints/CIFAR100_50_5x10voro/50_model.pkl
module.classifier.weight      torch.Size([200, 512])  102400  True
total: 102400
0.8052

```

```

##### current_task: 1 #####
[output] current classes [50, 51, 52, 53, 54, 55, 56, 57, 58, 59]
all classes 0 -> 59
> loaded base phase model from: ../checkpoints/CIFAR100_50_5x10voro/60_model.pkl
module.classifier.weight      torch.Size([40, 512])   20480  True
total: 20480
0.844

```

```

##### current_task: 2 #####
[output] current classes [60, 61, 62, 63, 64, 65, 66, 67, 68, 69]
all classes 0 -> 69
> loaded base phase model from: ../checkpoints/CIFAR100_50_5x10voro/70_model.pkl
module.classifier.weight      torch.Size([40, 512])   20480  True
total: 20480
0.822

```

```

##### current_task: 3 #####
[output] current classes [70, 71, 72, 73, 74, 75, 76, 77, 78, 79]
all classes 0 -> 79
> loaded base phase model from: ../checkpoints/CIFAR100_50_5x10voro/80_model.pkl
module.classifier.weight      torch.Size([40, 512])   20480  True
total: 20480
0.839

```

```

##### current_task: 4 #####
[output] current classes [80, 81, 82, 83, 84, 85, 86, 87, 88, 89]
all classes 0 -> 89
> loaded base phase model from: ../checkpoints/CIFAR100_50_5x10voro/90_model.pkl
module.classifier.weight      torch.Size([40, 512])   20480  True
total: 20480

```



0.877

```
##### current_task: 5 #####
[output] current classes [90, 91, 92, 93, 94, 95, 96, 97, 98, 99]
all classes 0 -> 99
> loaded base phase model from:
../checkpoints/CIFAR100_50_5x10voro/100_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
0.909
all logistic locally:
0.8052
0.844
0.822
0.839
0.877
0.909
```

```
[206]: for i in range(task_num + 1):
        support_data, support_label, query_data, query_label, n_ways, n_shot, \
        classes = \
            get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                          local = True, brother = brother)
        pred_all = []
        for classes in classes_all:
            # load model:
            if brother:
                cls_01 = classes[-1]+1
                assert cls_01 % 4 == 0
                filename = path + '%d_model.pkl' % (int(cls_01/4))
            else:
                filename = path + '%d_model.pkl' % (classes[-1]+1)
            model = torch.load(filename)
            model.eval()
            print('> loaded base phase model from:', filename)
            num_param(model)
            # do prediction:
            min_cls = min(classes)
            if brother:
                pred = predict(model, query_data)
            else:
                pred = predict(model, query_data)[:,:,:4]
            pmax = torch.max(pred, dim=1)[1]
            # pacc = np.mean(t2n(pmax) == query_label - min_cls)
            # print(pacc)
            if brother:
                labs_01 = query_label[:4]//4
```

```

        acc_, sc_pre = merge_sc(t2n(pred), labs_01,
                                mth='softmax', forLG=True, return_pre=True)
        min_cls = int(min_cls / 4)
        pred_all.append( (sc_pre + min_cls).tolist() )
    else:
        pred_all.append( (t2n(pmax) + min_cls).tolist() )
pred_all = np.array(pred_all)
print(pred_all.shape)

if i == 0:
    pred_in_clique = copy.deepcopy(pred_all)
else:
    pred_in_clique = np.hstack((pred_in_clique, pred_all))

```

##### current\_task: 0 #####

[output] current classes [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49]

all classes 0 -> 49

> loaded base phase model from: ../checkpoints/CIFAR100\_50\_5x10voro/50\_model.pkl  
module.classifier.weight torch.Size([200, 512]) 102400 True

total: 102400

> loaded base phase model from: ../checkpoints/CIFAR100\_50\_5x10voro/60\_model.pkl  
module.classifier.weight torch.Size([40, 512]) 20480 True

total: 20480

> loaded base phase model from: ../checkpoints/CIFAR100\_50\_5x10voro/70\_model.pkl  
module.classifier.weight torch.Size([40, 512]) 20480 True

total: 20480

> loaded base phase model from: ../checkpoints/CIFAR100\_50\_5x10voro/80\_model.pkl  
module.classifier.weight torch.Size([40, 512]) 20480 True

total: 20480

> loaded base phase model from: ../checkpoints/CIFAR100\_50\_5x10voro/90\_model.pkl  
module.classifier.weight torch.Size([40, 512]) 20480 True

total: 20480

> loaded base phase model from:

../checkpoints/CIFAR100\_50\_5x10voro/100\_model.pkl

module.classifier.weight torch.Size([40, 512]) 20480 True

total: 20480

(6, 5000)

##### current\_task: 1 #####

[output] current classes [50, 51, 52, 53, 54, 55, 56, 57, 58, 59]

all classes 0 -> 59

> loaded base phase model from: ../checkpoints/CIFAR100\_50\_5x10voro/50\_model.pkl  
module.classifier.weight torch.Size([200, 512]) 102400 True

total: 102400

> loaded base phase model from: ../checkpoints/CIFAR100\_50\_5x10voro/60\_model.pkl

```

module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/CIFAR100_50_5x10voro/70_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/CIFAR100_50_5x10voro/80_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/CIFAR100_50_5x10voro/90_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from:
../checkpoints/CIFAR100_50_5x10voro/100_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
(6, 1000)

```

##### current\_task: 2 #####

```

[output] current classes [60, 61, 62, 63, 64, 65, 66, 67, 68, 69]
all classes 0 -> 69
> loaded base phase model from: ../checkpoints/CIFAR100_50_5x10voro/50_model.pkl
module.classifier.weight      torch.Size([200, 512])  102400   True
total: 102400
> loaded base phase model from: ../checkpoints/CIFAR100_50_5x10voro/60_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/CIFAR100_50_5x10voro/70_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/CIFAR100_50_5x10voro/80_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/CIFAR100_50_5x10voro/90_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from:
../checkpoints/CIFAR100_50_5x10voro/100_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
(6, 1000)

```

##### current\_task: 3 #####

```

[output] current classes [70, 71, 72, 73, 74, 75, 76, 77, 78, 79]
all classes 0 -> 79
> loaded base phase model from: ../checkpoints/CIFAR100_50_5x10voro/50_model.pkl
module.classifier.weight      torch.Size([200, 512])  102400   True
total: 102400
> loaded base phase model from: ../checkpoints/CIFAR100_50_5x10voro/60_model.pkl

```

```

module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/CIFAR100_50_5x10voro/70_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/CIFAR100_50_5x10voro/80_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/CIFAR100_50_5x10voro/90_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from:
../checkpoints/CIFAR100_50_5x10voro/100_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
(6, 1000)

```

##### current\_task: 4 #####

```

[output] current classes [80, 81, 82, 83, 84, 85, 86, 87, 88, 89]
all classes 0 -> 89
> loaded base phase model from: ../checkpoints/CIFAR100_50_5x10voro/50_model.pkl
module.classifier.weight      torch.Size([200, 512])  102400   True
total: 102400
> loaded base phase model from: ../checkpoints/CIFAR100_50_5x10voro/60_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/CIFAR100_50_5x10voro/70_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/CIFAR100_50_5x10voro/80_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/CIFAR100_50_5x10voro/90_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from:
../checkpoints/CIFAR100_50_5x10voro/100_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
(6, 1000)

```

##### current\_task: 5 #####

```

[output] current classes [90, 91, 92, 93, 94, 95, 96, 97, 98, 99]
all classes 0 -> 99
> loaded base phase model from: ../checkpoints/CIFAR100_50_5x10voro/50_model.pkl
module.classifier.weight      torch.Size([200, 512])  102400   True
total: 102400
> loaded base phase model from: ../checkpoints/CIFAR100_50_5x10voro/60_model.pkl

```

```

module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/CIFAR100_50_5x10voro/70_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/CIFAR100_50_5x10voro/80_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/CIFAR100_50_5x10voro/90_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from:
../checkpoints/CIFAR100_50_5x10voro/100_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
(6, 1000)

```

```

[207]: print('cliques by test samples:', pred_in_clique.shape)

# compute prototypes
be      = 0.6 # 1.
l2      = True # False True
bias    = 0 # 0.05
protots = np.mean(feats_trans(support_data_, beta=be, l2=l2, bias=bias), axis=1)
query_pts = feats_trans(query_data_, beta=be, l2=l2, bias=bias)
# acenss = feats_trans(acens, beta=be, l2=l2, bias=bias)
if brother:
    dist = funbtch(query_pts, protots) # protots / acenss
else:
    dist = fun(query_pts, protots) # protots / acenss

test_splt = [sum(test_share[:t+1]) for t in range(len(test_share))]

```

cliques by test samples: (6, 10000)

```

[208]: dist_in_clique = np.zeros_like(pred_in_clique, dtype=np.float32)
for c_id, clique in enumerate(pred_in_clique):
    for s_id, samp in enumerate(clique):
        dist_in_clique[c_id][s_id] = dist[s_id][samp]

```

```

[209]: for i in range(task_num + 1):
    clique_dist = dist_in_clique[:i+1,:test_splt[i]]
    clique_pred = np.argmax(clique_dist, axis=0)
    merge_pred = [pred_in_clique[cli,s_id] for s_id, cli in
    ↪ enumerate(clique_pred)]
    merge_acc = np.mean(merge_pred == query_label_[:test_splt[i]])
    print(merge_acc)
print('DaC:', 'beta:', be, '| l2:', l2)

```

```
0.8052
0.7376666666666667
0.6882857142857143
0.64025
0.6087777777777778
0.5725
DaC: beta: 0.6 | 12: True
```

```
[28]: print('===== Experiment Done! =====')
```

```
===== Experiment Done! =====
```

## iVoro-AC/AI on CIFAR-100 Dataset (5 Phases)

```
[1]: import matplotlib.pyplot as plt
import os
import pickle
import numpy as np
import pandas as pd
import seaborn as sns
import time
import sys
sys.path.append('../')
sys.path.append('../analysis/')
import copy
import platform
import json
import pickle
import random

import torch
from scipy.stats import mode
```

```
[211]: from ResNet import resnet18_cbam

data_name      = 'CIFAR100' # 'Subset' # 'Tiny' # 'CIFAR100' # 'MNIST'
total_nc       = 100 # 200 # 100 # 10
fg_nc          = 50 # 100 # 40 # 50 # 4
task_num       = 5 # 20 # 5 # 10 # 2

# constant params
class_set      = list(range(total_nc))
ROTATION       = True
EMB2D          = False
DESIGN         = True
virtual_class  = 4*total_nc if ROTATION else total_nc
suffix         = 'voro' # 'prob' 'voro'
assert (total_nc - fg_nc)%task_num == 0
task_size      = int((total_nc - fg_nc)/task_num)
file_name      =
    ↳data_name+'_'+str(fg_nc)+'_'+str(task_num)+'x'+str(task_size)+suffix
```

```
print(file_name)

brother      = True # True False
```

CIFAR100\_50\_5x10voro

```
[212]: save_path = '../checkpoints/'
path    = save_path + file_name + '/'
filename = path + '%d_model.pkl' % (fg_nc+0) # +5
model    = torch.load(filename)
model.eval()
print('> loaded base phase model from:', filename)
```

> loaded base phase model from: ../checkpoints/CIFAR100\_50\_5x10voro/50\_model.pkl

```
[213]: from voro_helper import num_param, t2n, \
        load_feat, sanity_check, \
        id2emb_, num_samp, merge_sc, funbtch

num_param(model)

# voronoi centers:
vcenter = t2n(model.module.classifier.weight.data / 2.)
print(vcenter.shape)
```

```
module.classifier.weight      torch.Size([200, 512])  102400  True
total: 102400
(200, 512)
```

```
[214]: '''
CIFAR:
    'CIFAR100_50_5x10_test.pkl'
    'CIFAR100_50_5x10_train.pkl'
    'CIFAR100_40_20x3_test.pkl'
    'CIFAR100_40_20x3_train.pkl'
more CIFAR:
    'CIFAR100_40_12x5_test.pkl'
    'CIFAR100_40_12x5_train.pkl'
    'CIFAR100_30_14x5_test.pkl'
    'CIFAR100_30_14x5_train.pkl'
    'CIFAR100_20_16x5_test.pkl'
    'CIFAR100_20_16x5_train.pkl'
    'CIFAR100_10_18x5_test.pkl'
    'CIFAR100_10_18x5_train.pkl'
Tiny:
    'Tiny_100_20x5_test.pkl'
    'Tiny_100_20x5_train.pkl'
TinyL3:
    'Tiny_100_5x20_test.pkl'
```



```

        'Tiny_100_5x20_train.pkl'
Subset:
        'Subset_50_10x5_test.pkl'
        'Subset_50_10x5_train.pkl'
'''
ffile = '../embedding/prob/' + 'CIFAR100_50_5x10_test.pkl' # prob probL3
data_phas, last_tsk = load_feat(ffile)

labs, embeds, outputs = data_phas[last_tsk][last_tsk]
false_id, pred_ = sanity_check(labs, embeds, outputs)

```

```

feature file: ../embedding/prob/CIFAR100_50_5x10_test.pkl
> loaded tasks: dict_keys([5])
> classes: [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18,
19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38,
39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58,
59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78,
79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98,
99]
> samples: 10000
> embedding: 512
> classification: 400
~ acc (single): 63.45%
~ acc (quadruple): 54.53%

```

```

[215]: ffile = '../embedding/prob/' + 'CIFAR100_50_5x10_train.pkl' # prob probL3
data_phas, last_tsk = load_feat(ffile)

labst, embedst, outputst = data_phas[last_tsk][last_tsk]
false_id, pred_ = sanity_check(labst, embedst, outputst)

```

```

feature file: ../embedding/prob/CIFAR100_50_5x10_train.pkl
> loaded tasks: dict_keys([5])
> classes: [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18,
19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38,
39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58,
59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78,
79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98,
99]
> samples: 50000
> embedding: 512
> classification: 400
~ acc (single): 78.83%
~ acc (quadruple): 71.71%

```

```

[216]: embs = id2emb_(labs, embeds, brother=brother)
embst = id2emb_(labst, embedst, brother=brother)

```

```
sam_max, sam_min = num_samp(embst)
print('> loading data done!')
```

```
0 500,1 500,2 500,3 500,4 500,5 500,6 500,7 500,8 500,9 500,10 500,11 500,12
500,13 500,14 500,15 500,16 500,17 500,18 500,19 500,20 500,21 500,22 500,23
500,24 500,25 500,26 500,27 500,28 500,29 500,30 500,31 500,32 500,33 500,34
500,35 500,36 500,37 500,38 500,39 500,40 500,41 500,42 500,43 500,44 500,45
500,46 500,47 500,48 500,49 500,50 500,51 500,52 500,53 500,54 500,55 500,56
500,57 500,58 500,59 500,60 500,61 500,62 500,63 500,64 500,65 500,66 500,67
500,68 500,69 500,70 500,71 500,72 500,73 500,74 500,75 500,76 500,77 500,78
500,79 500,80 500,81 500,82 500,83 500,84 500,85 500,86 500,87 500,88 500,89
500,90 500,91 500,92 500,93 500,94 500,95 500,96 500,97 500,98 500,99 500,100
500,101 500,102 500,103 500,104 500,105 500,106 500,107 500,108 500,109 500,110
500,111 500,112 500,113 500,114 500,115 500,116 500,117 500,118 500,119 500,120
500,121 500,122 500,123 500,124 500,125 500,126 500,127 500,128 500,129 500,130
500,131 500,132 500,133 500,134 500,135 500,136 500,137 500,138 500,139 500,140
500,141 500,142 500,143 500,144 500,145 500,146 500,147 500,148 500,149 500,150
500,151 500,152 500,153 500,154 500,155 500,156 500,157 500,158 500,159 500,160
500,161 500,162 500,163 500,164 500,165 500,166 500,167 500,168 500,169 500,170
500,171 500,172 500,173 500,174 500,175 500,176 500,177 500,178 500,179 500,180
500,181 500,182 500,183 500,184 500,185 500,186 500,187 500,188 500,189 500,190
500,191 500,192 500,193 500,194 500,195 500,196 500,197 500,198 500,199 500,200
500,201 500,202 500,203 500,204 500,205 500,206 500,207 500,208 500,209 500,210
500,211 500,212 500,213 500,214 500,215 500,216 500,217 500,218 500,219 500,220
500,221 500,222 500,223 500,224 500,225 500,226 500,227 500,228 500,229 500,230
500,231 500,232 500,233 500,234 500,235 500,236 500,237 500,238 500,239 500,240
500,241 500,242 500,243 500,244 500,245 500,246 500,247 500,248 500,249 500,250
500,251 500,252 500,253 500,254 500,255 500,256 500,257 500,258 500,259 500,260
500,261 500,262 500,263 500,264 500,265 500,266 500,267 500,268 500,269 500,270
500,271 500,272 500,273 500,274 500,275 500,276 500,277 500,278 500,279 500,280
500,281 500,282 500,283 500,284 500,285 500,286 500,287 500,288 500,289 500,290
500,291 500,292 500,293 500,294 500,295 500,296 500,297 500,298 500,299 500,300
500,301 500,302 500,303 500,304 500,305 500,306 500,307 500,308 500,309 500,310
500,311 500,312 500,313 500,314 500,315 500,316 500,317 500,318 500,319 500,320
500,321 500,322 500,323 500,324 500,325 500,326 500,327 500,328 500,329 500,330
500,331 500,332 500,333 500,334 500,335 500,336 500,337 500,338 500,339 500,340
500,341 500,342 500,343 500,344 500,345 500,346 500,347 500,348 500,349 500,350
500,351 500,352 500,353 500,354 500,355 500,356 500,357 500,358 500,359 500,360
500,361 500,362 500,363 500,364 500,365 500,366 500,367 500,368 500,369 500,370
500,371 500,372 500,373 500,374 500,375 500,376 500,377 500,378 500,379 500,380
500,381 500,382 500,383 500,384 500,385 500,386 500,387 500,388 500,389 500,390
500,391 500,392 500,393 500,394 500,395 500,396 500,397 500,398 500,399 500,
max samples: 500
min samples: 500
> loading data done!
```

```
[217]: for k,v in embst.items():
        if v.shape[0] < sam_max:
            rid = np.random.choice(v.shape[0], sam_max-v.shape[0], replace=False)
            print('filling', sam_max-v.shape[0], 'samples')
            embst[k] = np.vstack((v, v[rid]))
```

```
[218]: from voro_helper import get_task_data, feat_trans, NC_o, tsk_cls, fun, \
        ↪acc_brother, forgetting

i = task_num
support_data_, support_label_, query_data_, query_label_, n_ways_, n_shot_, _ = \
    get_task_data(embst, embs, i, fg_nc, class_set, task_size, brother=brother)
```

```
##### current_task: 5 #####
current classes [360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375
376 377
378 379 380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395
396 397 398 399]
[output] all classes 0 -> 399
```

```
[219]: ### =====
        ↪=====
be      = 1. # 1.
l2      = False # False True
protots = np.mean(feat_trans(support_data_, beta=be, l2=l2), axis=1)
```

```
[203]: i = 0
support_data, support_label, query_data, query_label, n_ways, n_shot, classes = \
    get_task_data(embst, embs, i, fg_nc, class_set, task_size, brother=brother)
acc, _, nn_pre = NC_o(support_data, support_label,
                      query_data, query_label,
                      n_ways, n_shot,
                      beta = be, l2 = l2,
                      given_cen = protots[classes], given_only = True,
                      brother = brother)
```

```
##### current_task: 0 #####
current classes [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17,
18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37,
38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49]
[output] all classes 0 -> 49
0.8038
```

```
[220]: local      = False # True / False
nn_acc      = []
```

```

savefile = path+'NN' if brother else None # NN / NNp / NN3 / only saved NN
→results!
savefil2 = path+'NN3'
forget = True # True False # calculate forgetting
class_ladder = []
a = []
for i in range(task_num + 1):
    support_data, support_label, query_data, query_label, n_ways, n_shot,
→classes = \
        get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                        local = local, brother = brother) # False
    if forget:
        class_ladder.append(classes)
    acc, _, nn_pre = NC_o(support_data, support_label,
                          query_data, query_label,
                          n_ways, n_shot,
                          beta = be, l2 = l2,
                          given_cen = protots[classes] if local else protots[:
→classes[-1]+1],

                          given_only = True,
                          brother = brother,
                          savefile = savefile+'_'+str(i) if brother else None,
                          savefile2 = None, # savefil2+'_'+str(i), # None, #
                          weights = [0.7, 0.3],
                          class_ladder = class_ladder,
                          acc_all = a
                          )

    nn_acc.append(acc)
    # if all classes up2now: local = False, and protots[:classes[-1]+1]
print('local:', local, '| beta:', be, '| l2:', l2)
if brother:
    for accs in nn_acc:
        print('\t'.join([str(i) for i in accs]))
else:
    print('\n'.join([str(i) for i in nn_acc]))
if forget:
    avgf = forgetting(a, task_num)
    print(avgf)

```

##### current\_task: 0 #####

```

current classes [ 0  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15
16 17
18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35
36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53
54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71
72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89

```

```

    90  91  92  93  94  95  96  97  98  99 100 101 102 103 104 105 106 107
108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125
126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143
144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161
162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179
180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197
198 199]
[output] all classes 0 -> 199
<<< loaded from: ../checkpoints/CIFAR100_50_5x10voro/NN_0.npy
0.7144

##### current_task: 1 #####
current classes [200 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215
216 217
    218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235
    236 237 238 239]
[output] all classes 0 -> 239
<<< loaded from: ../checkpoints/CIFAR100_50_5x10voro/NN_1.npy
0.6462

##### current_task: 2 #####
current classes [240 241 242 243 244 245 246 247 248 249 250 251 252 253 254 255
256 257
    258 259 260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275
    276 277 278 279]
[output] all classes 0 -> 279
<<< loaded from: ../checkpoints/CIFAR100_50_5x10voro/NN_2.npy
0.5952

##### current_task: 3 #####
current classes [280 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295
296 297
    298 299 300 301 302 303 304 305 306 307 308 309 310 311 312 313 314 315
    316 317 318 319]
[output] all classes 0 -> 319
<<< loaded from: ../checkpoints/CIFAR100_50_5x10voro/NN_3.npy
0.5451

##### current_task: 4 #####
current classes [320 321 322 323 324 325 326 327 328 329 330 331 332 333 334 335
336 337
    338 339 340 341 342 343 344 345 346 347 348 349 350 351 352 353 354 355
    356 357 358 359]
[output] all classes 0 -> 359
<<< loaded from: ../checkpoints/CIFAR100_50_5x10voro/NN_4.npy
0.5117

##### current_task: 5 #####

```

```

current classes [360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375
376 377
378 379 380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395
396 397 398 399]
[output] all classes 0 -> 399
<<< loaded from: ../checkpoints/CIFAR100_50_5x10voro/NN_5.npy
0.4803
local: False | beta: 1.0 | l2: False
0.7144 0.9428 0.9276 0.9266 0.885
0.64625 0.8903333333333333 0.6545 0.6506666666666666 0.568
0.5952142857142857 0.8385714285714285 0.6034285714285714
0.6004285714285714 0.5241428571428571
0.54509375 0.786875 0.559 0.554375 0.483125
0.5116944444444444 0.7596666666666667 0.503 0.4988888888888889
0.4417777777777777
0.48035 0.7204 0.5042 0.5002 0.443
[[0.7144 0. 0. 0. 0. 0. ]
[0.6842 0.4565 0. 0. 0. 0. ]
[0.66855 0.429 0.39475 0. 0. 0. ]
[0.6589 0.40525 0.34725 0.31375 0. 0. ]
[0.641 0.385 0.335 0.30325 0.377 0. ]
[0.6267 0.36675 0.3135 0.293 0.36025 0.3365 ]]
[0, 3.0200000000000005, 3.6675000000000004, 5.141666666666667, 5.378749999999998,
5.9239999999999995]

```

```

[222]: def predict(model, x, voro=True):
        x = torch.from_numpy(x.astype(np.float32)).cuda()
        with torch.no_grad():
            predi = model.module.classifier(x)
        if voro:
            predi += - torch.sum((model.module.classifier.weight/2.)**2, dim=1)
        return predi

classes_all = []
test_share = []
paccS = []
for i in range(task_num + 1):
    support_data, support_label, query_data, query_label, n_ways, n_shot, \
    classes = \
        get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                        local = True, brother = brother)

    # load model:
    if brother:
        cls_01 = classes[-1]+1
        assert cls_01 % 4 == 0
        filename = path + '%d_model.pkl' % (int(cls_01/4))
    else:

```

```

        filename = path + '%d_model.pkl' % (classes[-1]+1)
        model = torch.load(filename)
        model.eval()
        print('> loaded base phase model from:', filename)
        num_param(model)
        # do prediction:
        min_cls = min(classes)
        if brother:
            pred = predict(model, query_data)
        else:
            pred = predict(model, query_data)[:,:,:4]
            pmax = torch.max(pred, dim=1)[1]
            pacc = np.mean(t2n(pmax) == query_label - min_cls)
        print(pacc)
        if brother:
            accs = acc_brother(t2n(pred), t2n(pmax), query_label - min_cls,
→forLG=True)
            pacc = [pacc] + accs
            paccS.append(pacc)
            classes_all.append(classes)
            test_share.append(len(query_label))
    print('all logistic locally:')
    if brother:
        for accs in paccS:
            print('\t'.join([str(i) for i in accs]))
    else:
        print('\n'.join([str(i) for i in paccS]))

```

```

##### current_task: 0 #####
[output] current classes [ 0  1  2  3  4  5  6  7  8  9 10 11 12
13 14 15 16 17
18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35
36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53
54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71
72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89
90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107
108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125
126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143
144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161
162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179
180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197
198 199]
all classes 0 -> 199
> loaded base phase model from: ../checkpoints/CIFAR100_50_5x10voro/50_model.pkl
module.classifier.weight      torch.Size([200, 512])  102400  True
total: 102400
0.7182

```

```

##### current_task: 1 #####
[output] current classes [200 201 202 203 204 205 206 207 208 209 210 211 212
213 214 215 216 217
  218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235
  236 237 238 239]
all classes 0 -> 239
> loaded base phase model from: ../checkpoints/CIFAR100_50_5x10voro/60_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
0.691

##### current_task: 2 #####
[output] current classes [240 241 242 243 244 245 246 247 248 249 250 251 252
253 254 255 256 257
  258 259 260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275
  276 277 278 279]
all classes 0 -> 279
> loaded base phase model from: ../checkpoints/CIFAR100_50_5x10voro/70_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
0.64225

##### current_task: 3 #####
[output] current classes [280 281 282 283 284 285 286 287 288 289 290 291 292
293 294 295 296 297
  298 299 300 301 302 303 304 305 306 307 308 309 310 311 312 313 314 315
  316 317 318 319]
all classes 0 -> 319
> loaded base phase model from: ../checkpoints/CIFAR100_50_5x10voro/80_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
0.6345

##### current_task: 4 #####
[output] current classes [320 321 322 323 324 325 326 327 328 329 330 331 332
333 334 335 336 337
  338 339 340 341 342 343 344 345 346 347 348 349 350 351 352 353 354 355
  356 357 358 359]
all classes 0 -> 359
> loaded base phase model from: ../checkpoints/CIFAR100_50_5x10voro/90_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
0.6895

##### current_task: 5 #####
[output] current classes [360 361 362 363 364 365 366 367 368 369 370 371 372
373 374 375 376 377

```



```

378 379 380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395
396 397 398 399]
all classes 0 -> 399
> loaded base phase model from:
../checkpoints/CIFAR100_50_5x10voro/100_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
0.72325
all logistic locally:
0.7182  0.9408  0.9704  0.0      0.9736
0.691   0.946   0.872   0.0      0.975
0.64225 0.925   0.893   0.0      0.965
0.6345  0.968   0.973   0.0      0.983
0.6895  0.976   0.95    0.0      0.991
0.72325 0.98    0.984   0.0      0.994

```

```

[223]: for i in range(task_num + 1):
        support_data, support_label, query_data, query_label, n_ways, n_shot, \
        classes = \
            get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                           local = True, brother = brother)
        pred_all = []
        for classes in classes_all:
            # load model:
            if brother:
                cls_01 = classes[-1]+1
                assert cls_01 % 4 == 0
                filename = path + '%d_model.pkl' % (int(cls_01/4))
            else:
                filename = path + '%d_model.pkl' % (classes[-1]+1)
            model = torch.load(filename)
            model.eval()
            print('> loaded base phase model from:', filename)
            num_param(model)
            # do prediction:
            min_cls = min(classes)
            if brother:
                pred = predict(model, query_data)
            else:
                pred = predict(model, query_data)[:,:,:4]
            pmax = torch.max(pred, dim=1)[1]
            # pacc = np.mean(t2n(pmax) == query_label - min_cls)
            # print(pacc)
            if brother:
                labs_01 = query_label[:4]//4
                acc_, sc_pre = merge_sc(t2n(pred), labs_01,
                                         mth='softmax', forLG=True, return_pre=True)

```

```

        min_cls = int(min_cls / 4)
        pred_all.append( (sc_pre + min_cls).tolist() )
    else:
        pred_all.append( (t2n(pmax) + min_cls).tolist() )
pred_all = np.array(pred_all)
print(pred_all.shape)

if i == 0:
    pred_in_clique = copy.deepcopy(pred_all)
else:
    pred_in_clique = np.hstack((pred_in_clique, pred_all))

```

##### current\_task: 0 #####

[output] current classes [ 0 1 2 3 4 5 6 7 8 9 10 11 12  
13 14 15 16 17

18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35  
36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53  
54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71  
72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89  
90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107  
108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125  
126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143  
144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161  
162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179  
180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197  
198 199]

all classes 0 -> 199

> loaded base phase model from: ../checkpoints/CIFAR100\_50\_5x10voro/50\_model.pkl  
module.classifier.weight torch.Size([200, 512]) 102400 True  
total: 102400

> loaded base phase model from: ../checkpoints/CIFAR100\_50\_5x10voro/60\_model.pkl  
module.classifier.weight torch.Size([40, 512]) 20480 True  
total: 20480

> loaded base phase model from: ../checkpoints/CIFAR100\_50\_5x10voro/70\_model.pkl  
module.classifier.weight torch.Size([40, 512]) 20480 True  
total: 20480

> loaded base phase model from: ../checkpoints/CIFAR100\_50\_5x10voro/80\_model.pkl  
module.classifier.weight torch.Size([40, 512]) 20480 True  
total: 20480

> loaded base phase model from: ../checkpoints/CIFAR100\_50\_5x10voro/90\_model.pkl  
module.classifier.weight torch.Size([40, 512]) 20480 True  
total: 20480

> loaded base phase model from:  
../checkpoints/CIFAR100\_50\_5x10voro/100\_model.pkl  
module.classifier.weight torch.Size([40, 512]) 20480 True  
total: 20480  
(6, 5000)

```
##### current_task: 1 #####
[output] current classes [200 201 202 203 204 205 206 207 208 209 210 211 212
213 214 215 216 217
 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235
 236 237 238 239]
all classes 0 -> 239
> loaded base phase model from: ../checkpoints/CIFAR100_50_5x10voro/50_model.pkl
module.classifier.weight      torch.Size([200, 512])  102400  True
total: 102400
> loaded base phase model from: ../checkpoints/CIFAR100_50_5x10voro/60_model.pkl
module.classifier.weight      torch.Size([40, 512])   20480  True
total: 20480
> loaded base phase model from: ../checkpoints/CIFAR100_50_5x10voro/70_model.pkl
module.classifier.weight      torch.Size([40, 512])   20480  True
total: 20480
> loaded base phase model from: ../checkpoints/CIFAR100_50_5x10voro/80_model.pkl
module.classifier.weight      torch.Size([40, 512])   20480  True
total: 20480
> loaded base phase model from: ../checkpoints/CIFAR100_50_5x10voro/90_model.pkl
module.classifier.weight      torch.Size([40, 512])   20480  True
total: 20480
> loaded base phase model from:
../checkpoints/CIFAR100_50_5x10voro/100_model.pkl
module.classifier.weight      torch.Size([40, 512])   20480  True
total: 20480
(6, 1000)
```

```
##### current_task: 2 #####
[output] current classes [240 241 242 243 244 245 246 247 248 249 250 251 252
253 254 255 256 257
 258 259 260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275
 276 277 278 279]
all classes 0 -> 279
> loaded base phase model from: ../checkpoints/CIFAR100_50_5x10voro/50_model.pkl
module.classifier.weight      torch.Size([200, 512])  102400  True
total: 102400
> loaded base phase model from: ../checkpoints/CIFAR100_50_5x10voro/60_model.pkl
module.classifier.weight      torch.Size([40, 512])   20480  True
total: 20480
> loaded base phase model from: ../checkpoints/CIFAR100_50_5x10voro/70_model.pkl
module.classifier.weight      torch.Size([40, 512])   20480  True
total: 20480
> loaded base phase model from: ../checkpoints/CIFAR100_50_5x10voro/80_model.pkl
module.classifier.weight      torch.Size([40, 512])   20480  True
total: 20480
> loaded base phase model from: ../checkpoints/CIFAR100_50_5x10voro/90_model.pkl
module.classifier.weight      torch.Size([40, 512])   20480  True
```

```

total: 20480
> loaded base phase model from:
../checkpoints/CIFAR100_50_5x10voro/100_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
(6, 1000)

##### current_task: 3 #####
[output] current classes [280 281 282 283 284 285 286 287 288 289 290 291 292
293 294 295 296 297
298 299 300 301 302 303 304 305 306 307 308 309 310 311 312 313 314 315
316 317 318 319]
all classes 0 -> 319
> loaded base phase model from: ../checkpoints/CIFAR100_50_5x10voro/50_model.pkl
module.classifier.weight      torch.Size([200, 512])  102400   True
total: 102400
> loaded base phase model from: ../checkpoints/CIFAR100_50_5x10voro/60_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/CIFAR100_50_5x10voro/70_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/CIFAR100_50_5x10voro/80_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/CIFAR100_50_5x10voro/90_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from:
../checkpoints/CIFAR100_50_5x10voro/100_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
(6, 1000)

##### current_task: 4 #####
[output] current classes [320 321 322 323 324 325 326 327 328 329 330 331 332
333 334 335 336 337
338 339 340 341 342 343 344 345 346 347 348 349 350 351 352 353 354 355
356 357 358 359]
all classes 0 -> 359
> loaded base phase model from: ../checkpoints/CIFAR100_50_5x10voro/50_model.pkl
module.classifier.weight      torch.Size([200, 512])  102400   True
total: 102400
> loaded base phase model from: ../checkpoints/CIFAR100_50_5x10voro/60_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/CIFAR100_50_5x10voro/70_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True

```

```

total: 20480
> loaded base phase model from: ../checkpoints/CIFAR100_50_5x10voro/80_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/CIFAR100_50_5x10voro/90_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from:
../checkpoints/CIFAR100_50_5x10voro/100_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
(6, 1000)

```

```
##### current_task: 5 #####
```

```

[output] current classes [360 361 362 363 364 365 366 367 368 369 370 371 372
373 374 375 376 377
378 379 380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395
396 397 398 399]
all classes 0 -> 399
> loaded base phase model from: ../checkpoints/CIFAR100_50_5x10voro/50_model.pkl
module.classifier.weight      torch.Size([200, 512])  102400   True
total: 102400
> loaded base phase model from: ../checkpoints/CIFAR100_50_5x10voro/60_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/CIFAR100_50_5x10voro/70_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/CIFAR100_50_5x10voro/80_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/CIFAR100_50_5x10voro/90_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from:
../checkpoints/CIFAR100_50_5x10voro/100_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
(6, 1000)

```

```

[207]: print('cliques by test samples:', pred_in_clique.shape)

# compute prototypes
be      = 0.6 # 1.
l2      = True # False True
bias    = 0 # 0.05
protots = np.mean(feats_trans(support_data_, beta=be, l2=l2, bias=bias), axis=1)

```

```

query_pts = feat_trans(query_data_, beta=be, l2=l2, bias=bias)
# acenss    = feat_trans(acens, beta=be, l2=l2, bias=bias)
if brother:
    dist     = funbtch(query_pts, protots) # protots / acenss
else:
    dist     = fun(query_pts, protots) # protots / acenss

test_splt = [sum(test_share[:t+1]) for t in range(len(test_share))]

```

cliques by test samples: (6, 10000)

```

[208]: dist_in_clique = np.zeros_like(pred_in_clique, dtype=np.float32)
for c_id, clique in enumerate(pred_in_clique):
    for s_id, samp in enumerate(clique):
        dist_in_clique[c_id][s_id] = dist[s_id][samp]

```

```

[210]: for i in range(task_num + 1):
        clique_dist = dist_in_clique[:i+1,:test_splt[i]]
        clique_pred = np.argmin(clique_dist, axis=0)
        merge_pred = [pred_in_clique[cli,s_id] for s_id, cli in
            →enumerate(clique_pred)]
        merge_acc    = np.mean(merge_pred == query_label_[:test_splt[i]])
        print(merge_acc)
print('DaC:', 'beta:', be, '| l2:', l2)

```

```

[28]: print('===== Experiment Done! =====')

```

```

===== Experiment Done! =====

```

## iVoro on CIFAR-100 Dataset (10 Phases)

```
[1]: import matplotlib.pyplot as plt
import os
import pickle
import numpy as np
import pandas as pd
import seaborn as sns
import time
import sys
sys.path.append('../')
sys.path.append('../analysis/')
import copy
import platform
import json
import pickle
import random

import torch
from scipy.stats import mode
```

```
[224]: from ResNet import resnet18_cbam

data_name      = 'CIFAR100' # 'Subset' # 'Tiny' # 'CIFAR100' # 'MNIST'
total_nc       = 100 # 200 # 100 # 10
fg_nc          = 50 # 100 # 40 # 50 # 4
task_num       = 10 # 20 # 5 # 10 # 2

# constant params
class_set      = list(range(total_nc))
ROTATION       = True
EMB2D          = False
DESIGN         = True
virtual_class  = 4*total_nc if ROTATION else total_nc
suffix         = 'voro' # 'prob' 'voro'
assert (total_nc - fg_nc)%task_num == 0
task_size      = int((total_nc - fg_nc)/task_num)
file_name      =
    ↳data_name+'_'+str(fg_nc)+'_'+str(task_num)+'x'+str(task_size)+suffix
```

```
print(file_name)

brother      = False # True False
```

CIFAR100\_50\_10x5voro

```
[225]: save_path = '../checkpoints/'
path    = save_path + file_name + '/'
filename = path + '%d_model.pkl' % (fg_nc+0) # +5
model    = torch.load(filename)
model.eval()
print('> loaded base phase model from:', filename)
```

> loaded base phase model from: ../checkpoints/CIFAR100\_50\_10x5voro/50\_model.pkl

```
[226]: from voro_helper import num_param, t2n, \
        load_feat, sanity_check, \
        id2emb_, num_samp, merge_sc, funbtch

num_param(model)

# voronoi centers:
vcenter = t2n(model.module.classifier.weight.data / 2.)
print(vcenter.shape)
```

```
module.classifier.weight      torch.Size([200, 512])  102400  True
total: 102400
(200, 512)
```

```
[227]: '''
CIFAR:
    'CIFAR100_50_5x10_test.pkl'
    'CIFAR100_50_5x10_train.pkl'
    'CIFAR100_40_20x3_test.pkl'
    'CIFAR100_40_20x3_train.pkl'
more CIFAR:
    'CIFAR100_40_12x5_test.pkl'
    'CIFAR100_40_12x5_train.pkl'
    'CIFAR100_30_14x5_test.pkl'
    'CIFAR100_30_14x5_train.pkl'
    'CIFAR100_20_16x5_test.pkl'
    'CIFAR100_20_16x5_train.pkl'
    'CIFAR100_10_18x5_test.pkl'
    'CIFAR100_10_18x5_train.pkl'
Tiny:
    'Tiny_100_20x5_test.pkl'
    'Tiny_100_20x5_train.pkl'
TinyL3:
    'Tiny_100_5x20_test.pkl'
```



```

    'Tiny_100_5x20_train.pkl'
Subset:
    'Subset_50_10x5_test.pkl'
    'Subset_50_10x5_train.pkl'
'''
ffile = '../embedding/prob/' + 'CIFAR100_50_5x10_test.pkl' # prob probL3
data_phas, last_tsk = load_feat(ffile)

labs, embeds, outputs = data_phas[last_tsk][last_tsk]
false_id, pred_ = sanity_check(labs, embeds, outputs)

```

```

feature file: ../embedding/prob/CIFAR100_50_5x10_test.pkl
> loaded tasks: dict_keys([5])
> classes: [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18,
19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38,
39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58,
59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78,
79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98,
99]
> samples: 10000
> embedding: 512
> classification: 400
~ acc (single): 63.45%
~ acc (quadruple): 54.53%

```

```

[228]: ffile = '../embedding/prob/' + 'CIFAR100_50_5x10_train.pkl' # prob probL3
data_phas, last_tsk = load_feat(ffile)

labst, embedst, outputst = data_phas[last_tsk][last_tsk]
false_id, pred_ = sanity_check(labst, embedst, outputst)

```

```

feature file: ../embedding/prob/CIFAR100_50_5x10_train.pkl
> loaded tasks: dict_keys([5])
> classes: [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18,
19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38,
39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58,
59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78,
79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98,
99]
> samples: 50000
> embedding: 512
> classification: 400
~ acc (single): 78.83%
~ acc (quadruple): 71.71%

```

```

[229]: embs = id2emb_(labs, embeds, brother=brother)
embst = id2emb_(labst, embedst, brother=brother)

```

```
sam_max, sam_min = num_samp(embst)
print('> loading data done!')
```

```
0 500,1 500,2 500,3 500,4 500,5 500,6 500,7 500,8 500,9 500,10 500,11 500,12
500,13 500,14 500,15 500,16 500,17 500,18 500,19 500,20 500,21 500,22 500,23
500,24 500,25 500,26 500,27 500,28 500,29 500,30 500,31 500,32 500,33 500,34
500,35 500,36 500,37 500,38 500,39 500,40 500,41 500,42 500,43 500,44 500,45
500,46 500,47 500,48 500,49 500,50 500,51 500,52 500,53 500,54 500,55 500,56
500,57 500,58 500,59 500,60 500,61 500,62 500,63 500,64 500,65 500,66 500,67
500,68 500,69 500,70 500,71 500,72 500,73 500,74 500,75 500,76 500,77 500,78
500,79 500,80 500,81 500,82 500,83 500,84 500,85 500,86 500,87 500,88 500,89
500,90 500,91 500,92 500,93 500,94 500,95 500,96 500,97 500,98 500,99 500,
max samples: 500
min samples: 500
> loading data done!
```

```
[230]: for k,v in embst.items():
        if v.shape[0] < sam_max:
            rid = np.random.choice(v.shape[0], sam_max-v.shape[0], replace=False)
            print('filling', sam_max-v.shape[0], 'samples')
            embst[k] = np.vstack((v, v[rid]))
```

```
[231]: from voro_helper import get_task_data, feat_trans, NC_o, tsk_cls, fun, \
        ↪acc_brother, forgetting

i = task_num
support_data_, support_label_, query_data_, query_label_, n_ways_, n_shot_, _ = \
    get_task_data(embst, embs, i, fg_nc, class_set, task_size, brother=brother)
```

```
##### current_task: 10 #####
current classes [95, 96, 97, 98, 99]
[output] all classes 0 -> 99
```

```
[232]: #%% =====
        ↪=====
be      = 1. # 1.
l2      = False # False True
protots = np.mean(feat_trans(support_data_, beta=be, l2=l2), axis=1)
```

```
[233]: i = 0
support_data, support_label, query_data, query_label, n_ways, n_shot, classes = \
    get_task_data(embst, embs, i, fg_nc, class_set, task_size, brother=brother)
acc, _, nn_pre = NC_o(support_data, support_label,
                      query_data, query_label,
                      n_ways, n_shot,
                      beta = be, l2 = l2,
                      given_cen = protots[classes], given_only = True,
```

```
brother = brother)
```

```
##### current_task: 0 #####  
current classes [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17,  
18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37,  
38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49]  
[output] all classes 0 -> 49  
0.8038
```

```
[234]: local      = False # True / False  
nn_acc    = []  
savefile  = path+'NN' if brother else None # NN / NNp / NN3 / only saved NN  
→results!  
savefil2  = path+'NN3'  
forget    = True # True False # calculate forgetting  
class_ladder = []  
a         = []  
for i in range(task_num + 1):  
    support_data, support_label, query_data, query_label, n_ways, n_shot,  
→classes = \  
        get_task_data(embst, embs, i, fg_nc, class_set, task_size,  
                        local = local, brother = brother) # False  
    if forget:  
        class_ladder.append(classes)  
    acc, _, nn_pre = NC_o(support_data, support_label,  
                           query_data, query_label,  
                           n_ways, n_shot,  
                           beta = be, l2 = l2,  
                           given_cen = protots[classes] if local else protots[:  
→classes[-1]+1],  
                           given_only = True,  
                           brother = brother,  
                           savefile = savefile+'_'+str(i) if brother else None,  
                           savefile2 = None, # savefil2+'_'+str(i), # None, #  
                           weights = [0.7, 0.3],  
                           class_ladder = class_ladder,  
                           acc_all = a  
                           )  
    nn_acc.append(acc)  
    # if all classes up2now: local = False, and protots[:classes[-1]+1]  
print('local:', local, '| beta:', be, '| l2:', l2)  
if brother:  
    for accs in nn_acc:  
        print('\t'.join([str(i) for i in accs]))  
else:  
    print('\n'.join([str(i) for i in nn_acc]))
```

```
if forget:
    avgf = forgetting(a, task_num)
    print(avgf)
```

```
##### current_task: 0 #####
current classes [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17,
18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37,
38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49]
[output] all classes 0 -> 49
0.8038
```

```
##### current_task: 1 #####
current classes [50, 51, 52, 53, 54]
[output] all classes 0 -> 54
0.7602
```

```
##### current_task: 2 #####
current classes [55, 56, 57, 58, 59]
[output] all classes 0 -> 59
0.7255
```

```
##### current_task: 3 #####
current classes [60, 61, 62, 63, 64]
[output] all classes 0 -> 64
0.6986
```

```
##### current_task: 4 #####
current classes [65, 66, 67, 68, 69]
[output] all classes 0 -> 69
0.6759
```

```
##### current_task: 5 #####
current classes [70, 71, 72, 73, 74]
[output] all classes 0 -> 74
0.6455
```

```
##### current_task: 6 #####
current classes [75, 76, 77, 78, 79]
[output] all classes 0 -> 79
0.6255
```

```
##### current_task: 7 #####
current classes [80, 81, 82, 83, 84]
[output] all classes 0 -> 84
0.6042
```

```
##### current_task: 8 #####
```

```
current classes [85, 86, 87, 88, 89]
[output] all classes 0 -> 89
0.5930
```

```
##### current_task: 9 #####
current classes [90, 91, 92, 93, 94]
[output] all classes 0 -> 94
0.5781
```

```
##### current_task: 10 #####
current classes [95, 96, 97, 98, 99]
[output] all classes 0 -> 99
0.5606
local: False | beta: 1.0 | l2: False
0.8038
```

```
0.7601818181818182
```

```
0.7255
```

```
0.6986153846153846
```

```
0.6758571428571428
```

```
0.6454666666666666
```

```
0.6255
```

```
0.6042352941176471
```

```
0.593
```

```
0.5781052631578948
```

```
0.5606
```

```
[[0.8038 0.      0.      0.      0.      0.      0.      0.      0.      0.
  0.      ]
```

```
[0.77  0.662 0.      0.      0.      0.      0.      0.      0.      0.
  0.      ]
```

```
[0.754 0.63  0.536 0.      0.      0.      0.      0.      0.      0.
  0.      ]
```

```
[0.7426 0.582 0.522 0.552 0.      0.      0.      0.      0.      0.
  0.      ]
```

```
[0.7334 0.574 0.498 0.522 0.534 0.      0.      0.      0.      0.
  0.      ]
```

```
[0.7264 0.554 0.476 0.476 0.5  0.412 0.      0.      0.      0.
  0.      ]
```

```
[0.7188 0.536 0.466 0.474 0.472 0.404 0.468 0.      0.      0.
  0.      ]
```

```
[0.7056 0.52  0.454 0.46  0.462 0.398 0.456 0.466 0.      0.
  0.      ]
```

```
[0.6968 0.518 0.442 0.46  0.452 0.394 0.442 0.442 0.556 0.
  0.      ]
```

```
[0.6926 0.508 0.44  0.45  0.444 0.374 0.438 0.416 0.544 0.444
  0.      ]
```

```
[0.6852 0.502 0.43  0.436 0.43  0.36  0.414 0.408 0.532 0.44
  0.408 ]]
```

```
[0, 3.3799999999999994, 4.089999999999999, 5.173333333333333, 5.6600000000000001,
```

```
7.1080000000000005, 7.15, 7.317142857142857, 7.337500000000002,
7.591111111111114, 7.966000000000002]
```

```
[235]: def predict(model, x, voro=True):
        x = torch.from_numpy(x.astype(np.float32)).cuda()
        with torch.no_grad():
            predi = model.module.classifier(x)
        if voro:
            predi += - torch.sum((model.module.classifier.weight/2.)**2, dim=1)
        return predi

classes_all = []
test_share = []
paccS = []
for i in range(task_num + 1):
    support_data, support_label, query_data, query_label, n_ways, n_shot, \
    →classes = \
        get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                        local = True, brother = brother)

    # load model:
    if brother:
        cls_01 = classes[-1]+1
        assert cls_01 % 4 == 0
        filename = path + '%d_model.pkl' % (int(cls_01/4))
    else:
        filename = path + '%d_model.pkl' % (classes[-1]+1)
    model = torch.load(filename)
    model.eval()
    print('> loaded base phase model from:', filename)
    num_param(model)
    # do prediction:
    min_cls = min(classes)
    if brother:
        pred = predict(model, query_data)
    else:
        pred = predict(model, query_data)[:,:,:4]
    pmax = torch.max(pred, dim=1)[1]
    pacc = np.mean(t2n(pmax) == query_label - min_cls)
    print(pacc)
    if brother:
        accs = acc_brother(t2n(pred), t2n(pmax), query_label - min_cls, \
    →forLG=True)
        pacc = [pacc] + accs
    paccS.append(pacc)
    classes_all.append(classes)
    test_share.append(len(query_label))
print('all logistic locally:')
```

```

if brother:
    for accs in paccS:
        print('\t'.join([str(i) for i in accs]))
else:
    print('\n'.join([str(i) for i in paccS]))

```

```

##### current_task: 0 #####
[output] current classes [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15,
16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35,
36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49]
all classes 0 -> 49
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/50_model.pkl
module.classifier.weight      torch.Size([200, 512])  102400  True
total: 102400
0.8052

```

```

##### current_task: 1 #####
[output] current classes [50, 51, 52, 53, 54]
all classes 0 -> 54
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240  True
total: 10240
0.936

```

```

##### current_task: 2 #####
[output] current classes [55, 56, 57, 58, 59]
all classes 0 -> 59
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240  True
total: 10240
0.94

```

```

##### current_task: 3 #####
[output] current classes [60, 61, 62, 63, 64]
all classes 0 -> 64
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240  True
total: 10240
0.924

```

```

##### current_task: 4 #####
[output] current classes [65, 66, 67, 68, 69]
all classes 0 -> 69
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240  True
total: 10240
0.886

```

```

##### current_task: 5 #####
[output] current classes [70, 71, 72, 73, 74]
all classes 0 -> 74
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.916

##### current_task: 6 #####
[output] current classes [75, 76, 77, 78, 79]
all classes 0 -> 79
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.886

##### current_task: 7 #####
[output] current classes [80, 81, 82, 83, 84]
all classes 0 -> 84
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.934

##### current_task: 8 #####
[output] current classes [85, 86, 87, 88, 89]
all classes 0 -> 89
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.928

##### current_task: 9 #####
[output] current classes [90, 91, 92, 93, 94]
all classes 0 -> 94
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.93

##### current_task: 10 #####
[output] current classes [95, 96, 97, 98, 99]
all classes 0 -> 99
> loaded base phase model from:
../checkpoints/CIFAR100_50_10x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240

```



```

0.956
all logistic locally:
0.8052
0.936
0.94
0.924
0.886
0.916
0.886
0.934
0.928
0.93
0.956

```

```

[236]: for i in range(task_num + 1):
        support_data, support_label, query_data, query_label, n_ways, n_shot, \
        classes = \
            get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                           local = True, brother = brother)
        pred_all = []
        for classes in classes_all:
            # load model:
            if brother:
                cls_01 = classes[-1]+1
                assert cls_01 % 4 == 0
                filename = path + '%d_model.pkl' % (int(cls_01/4))
            else:
                filename = path + '%d_model.pkl' % (classes[-1]+1)
            model = torch.load(filename)
            model.eval()
            print('> loaded base phase model from:', filename)
            num_param(model)
            # do prediction:
            min_cls = min(classes)
            if brother:
                pred = predict(model, query_data)
            else:
                pred = predict(model, query_data)[:,:,:4]
            pmax = torch.max(pred, dim=1)[1]
            # pacc = np.mean(t2n(pmax) == query_label - min_cls)
            # print(pacc)
            if brother:
                labs_01 = query_label[:4]//4
                acc_, sc_pre = merge_sc(t2n(pred), labs_01,
                                         mth='softmax', forLG=True, return_pre=True)
                min_cls = int(min_cls / 4)
            pred_all.append( (sc_pre + min_cls).tolist() )

```

```

        else:
            pred_all.append( (t2n(pmax) + min_cls).tolist() )
    pred_all = np.array(pred_all)
    print(pred_all.shape)

    if i == 0:
        pred_in_clique = copy.deepcopy(pred_all)
    else:
        pred_in_clique = np.hstack((pred_in_clique, pred_all))

```

```

##### current_task: 0 #####
[output] current classes [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15,
16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35,
36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49]
all classes 0 -> 49
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/50_model.pkl
module.classifier.weight      torch.Size([200, 512])  102400  True
total: 102400
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240  True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240  True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240  True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240  True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240  True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240  True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240  True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240  True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240  True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_50_10x5voro/100_model.pkl

```

```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(11, 5000)

##### current_task: 1 #####
[output] current classes [50, 51, 52, 53, 54]
all classes 0 -> 54
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/50_model.pkl
module.classifier.weight      torch.Size([200, 512])  102400    True
total: 102400
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_50_10x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(11, 500)

##### current_task: 2 #####
[output] current classes [55, 56, 57, 58, 59]
all classes 0 -> 59
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/50_model.pkl
module.classifier.weight      torch.Size([200, 512])  102400    True

```

```

total: 102400
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_50_10x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(11, 500)

```

```
##### current_task: 3 #####
```

```
[output] current classes [60, 61, 62, 63, 64]
```

```
all classes 0 -> 64
```

```

> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/50_model.pkl
module.classifier.weight      torch.Size([200, 512])   102400   True
total: 102400
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True

```

```

total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_50_10x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(11, 500)

```

```
##### current_task: 4 #####
```

```
[output] current classes [65, 66, 67, 68, 69]
```

```
all classes 0 -> 69
```

```

> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/50_model.pkl
module.classifier.weight      torch.Size([200, 512])   102400   True
total: 102400
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True

```

```

total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_50_10x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(11, 500)

```

```
##### current_task: 5 #####
```

```
[output] current classes [70, 71, 72, 73, 74]
```

```
all classes 0 -> 74
```

```

> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/50_model.pkl
module.classifier.weight      torch.Size([200, 512])  102400   True
total: 102400
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240    True

```

```

total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_50_10x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(11, 500)

##### current_task: 6 #####
[output] current classes [75, 76, 77, 78, 79]
all classes 0 -> 79
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/50_model.pkl
module.classifier.weight      torch.Size([200, 512])  102400   True
total: 102400
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_50_10x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(11, 500)

##### current_task: 7 #####
[output] current classes [80, 81, 82, 83, 84]

```

```

all classes 0 -> 84
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/50_model.pkl
module.classifier.weight      torch.Size([200, 512])  102400  True
total: 102400
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_50_10x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
(11, 500)

```

```
##### current_task: 8 #####
```

```
[output] current classes [85, 86, 87, 88, 89]
```

```
all classes 0 -> 89
```

```

> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/50_model.pkl
module.classifier.weight      torch.Size([200, 512])  102400  True
total: 102400
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True

```



```

total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_50_10x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(11, 500)

```

```

##### current_task: 9 #####
[output] current classes [90, 91, 92, 93, 94]
all classes 0 -> 94
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/50_model.pkl
module.classifier.weight      torch.Size([200, 512])   102400   True
total: 102400
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True

```

```

total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_50_10x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(11, 500)

```

```
##### current_task: 10 #####
```

```
[output] current classes [95, 96, 97, 98, 99]
```

```
all classes 0 -> 99
```

```

> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/50_model.pkl
module.classifier.weight      torch.Size([200, 512])  102400   True
total: 102400
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240    True

```

```

total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_50_10x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(11, 500)

```

```

[237]: print('cliques by test samples:', pred_in_clique.shape)

# compute prototypes
be      = 0.6 # 1.
l2      = True # False True
bias    = 0 # 0.05
protots = np.mean(feats_trans(support_data_, beta=be, l2=l2, bias=bias), axis=1)
query_pts = feats_trans(query_data_, beta=be, l2=l2, bias=bias)
# acenss = feats_trans(acens, beta=be, l2=l2, bias=bias)
if brother:
    dist = funbtch(query_pts, protots) # protots / acenss
else:
    dist = fun(query_pts, protots) # protots / acenss

test_splt = [sum(test_share[:t+1]) for t in range(len(test_share))]

```

cliques by test samples: (11, 10000)

```

[238]: dist_in_clique = np.zeros_like(pred_in_clique, dtype=np.float32)
for c_id, clique in enumerate(pred_in_clique):
    for s_id, samp in enumerate(clique):
        dist_in_clique[c_id][s_id] = dist[s_id][samp]

```

```

[239]: for i in range(task_num + 1):
        clique_dist = dist_in_clique[:i+1,:test_splt[i]]
        clique_pred = np.argmax(clique_dist, axis=0)
        merge_pred = [pred_in_clique[cli,s_id] for s_id, cli in
→enumerate(clique_pred)]
        merge_acc = np.mean(merge_pred == query_label_[:test_splt[i]])
        print(merge_acc)
print('DaC:', 'beta:', be, '| l2:', l2)

```

```

0.8052
0.7674545454545455
0.7331666666666666
0.7064615384615385
0.684
0.6545333333333333
0.63575

```

```
0.6143529411764705
0.6026666666666667
0.5867368421052631
0.5675
DaC: beta: 0.6 | 12: True
```

```
[28]: print('===== Experiment Done! =====')
```

```
===== Experiment Done! =====
```

## iVoro-AC/AI on CIFAR-100 Dataset (10 Phases)

```
[240]: import matplotlib.pyplot as plt
import os
import pickle
import numpy as np
import pandas as pd
import seaborn as sns
import time
import sys
sys.path.append('../')
sys.path.append('../analysis/')
import copy
import platform
import json
import pickle
import random

import torch
from scipy.stats import mode
```

```
[241]: from ResNet import resnet18_cbam

data_name      = 'CIFAR100' # 'Subset' # 'Tiny' # 'CIFAR100' # 'MNIST'
total_nc       = 100 # 200 # 100 # 10
fg_nc          = 50 # 100 # 40 # 50 # 4
task_num       = 10 # 20 # 5 # 10 # 2

# constant params
class_set      = list(range(total_nc))
ROTATION       = True
EMB2D          = False
DESIGN         = True
virtual_class  = 4*total_nc if ROTATION else total_nc
suffix         = 'voro' # 'prob' 'voro'
assert (total_nc - fg_nc)%task_num == 0
task_size      = int((total_nc - fg_nc)/task_num)
file_name      =
    ↳data_name+'_'+str(fg_nc)+'_'+str(task_num)+'x'+str(task_size)+suffix
```

```
print(file_name)

brother      = True # True False
```

CIFAR100\_50\_10x5voro

```
[242]: save_path = '../checkpoints/'
path    = save_path + file_name + '/'
filename = path + '%d_model.pkl' % (fg_nc+0) # +5
model    = torch.load(filename)
model.eval()
print('> loaded base phase model from:', filename)
```

> loaded base phase model from: ../checkpoints/CIFAR100\_50\_10x5voro/50\_model.pkl

```
[243]: from voro_helper import num_param, t2n, \
        load_feat, sanity_check, \
        id2emb_, num_samp, merge_sc, funbtch

num_param(model)

# voronoi centers:
vcenter = t2n(model.module.classifier.weight.data / 2.)
print(vcenter.shape)
```

```
module.classifier.weight      torch.Size([200, 512])  102400  True
total: 102400
(200, 512)
```

```
[244]: '''
CIFAR:
    'CIFAR100_50_5x10_test.pkl'
    'CIFAR100_50_5x10_train.pkl'
    'CIFAR100_40_20x3_test.pkl'
    'CIFAR100_40_20x3_train.pkl'
more CIFAR:
    'CIFAR100_40_12x5_test.pkl'
    'CIFAR100_40_12x5_train.pkl'
    'CIFAR100_30_14x5_test.pkl'
    'CIFAR100_30_14x5_train.pkl'
    'CIFAR100_20_16x5_test.pkl'
    'CIFAR100_20_16x5_train.pkl'
    'CIFAR100_10_18x5_test.pkl'
    'CIFAR100_10_18x5_train.pkl'
Tiny:
    'Tiny_100_20x5_test.pkl'
    'Tiny_100_20x5_train.pkl'
TinyL3:
    'Tiny_100_5x20_test.pkl'
```

```

    'Tiny_100_5x20_train.pkl'
Subset:
    'Subset_50_10x5_test.pkl'
    'Subset_50_10x5_train.pkl'
'''
ffile = '../embedding/prob/' + 'CIFAR100_50_5x10_test.pkl' # prob probL3
data_phas, last_tsk = load_feat(ffile)

labs, embeds, outputs = data_phas[last_tsk][last_tsk]
false_id, pred_ = sanity_check(labs, embeds, outputs)

```

```

feature file: ../embedding/prob/CIFAR100_50_5x10_test.pkl
> loaded tasks: dict_keys([5])
> classes: [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18,
19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38,
39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58,
59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78,
79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98,
99]
> samples: 10000
> embedding: 512
> classification: 400
~ acc (single): 63.45%
~ acc (quadruple): 54.53%

```

```

[245]: ffile = '../embedding/prob/' + 'CIFAR100_50_5x10_train.pkl' # prob probL3
data_phas, last_tsk = load_feat(ffile)

labst, embedst, outputst = data_phas[last_tsk][last_tsk]
false_id, pred_ = sanity_check(labst, embedst, outputst)

```

```

feature file: ../embedding/prob/CIFAR100_50_5x10_train.pkl
> loaded tasks: dict_keys([5])
> classes: [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18,
19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38,
39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58,
59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78,
79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98,
99]
> samples: 50000
> embedding: 512
> classification: 400
~ acc (single): 78.83%
~ acc (quadruple): 71.71%

```

```

[246]: embs = id2emb_(labs, embeds, brother=brother)
embst = id2emb_(labst, embedst, brother=brother)

```

```
sam_max, sam_min = num_samp(embst)
print('> loading data done!')
```

```
0 500,1 500,2 500,3 500,4 500,5 500,6 500,7 500,8 500,9 500,10 500,11 500,12
500,13 500,14 500,15 500,16 500,17 500,18 500,19 500,20 500,21 500,22 500,23
500,24 500,25 500,26 500,27 500,28 500,29 500,30 500,31 500,32 500,33 500,34
500,35 500,36 500,37 500,38 500,39 500,40 500,41 500,42 500,43 500,44 500,45
500,46 500,47 500,48 500,49 500,50 500,51 500,52 500,53 500,54 500,55 500,56
500,57 500,58 500,59 500,60 500,61 500,62 500,63 500,64 500,65 500,66 500,67
500,68 500,69 500,70 500,71 500,72 500,73 500,74 500,75 500,76 500,77 500,78
500,79 500,80 500,81 500,82 500,83 500,84 500,85 500,86 500,87 500,88 500,89
500,90 500,91 500,92 500,93 500,94 500,95 500,96 500,97 500,98 500,99 500,100
500,101 500,102 500,103 500,104 500,105 500,106 500,107 500,108 500,109 500,110
500,111 500,112 500,113 500,114 500,115 500,116 500,117 500,118 500,119 500,120
500,121 500,122 500,123 500,124 500,125 500,126 500,127 500,128 500,129 500,130
500,131 500,132 500,133 500,134 500,135 500,136 500,137 500,138 500,139 500,140
500,141 500,142 500,143 500,144 500,145 500,146 500,147 500,148 500,149 500,150
500,151 500,152 500,153 500,154 500,155 500,156 500,157 500,158 500,159 500,160
500,161 500,162 500,163 500,164 500,165 500,166 500,167 500,168 500,169 500,170
500,171 500,172 500,173 500,174 500,175 500,176 500,177 500,178 500,179 500,180
500,181 500,182 500,183 500,184 500,185 500,186 500,187 500,188 500,189 500,190
500,191 500,192 500,193 500,194 500,195 500,196 500,197 500,198 500,199 500,200
500,201 500,202 500,203 500,204 500,205 500,206 500,207 500,208 500,209 500,210
500,211 500,212 500,213 500,214 500,215 500,216 500,217 500,218 500,219 500,220
500,221 500,222 500,223 500,224 500,225 500,226 500,227 500,228 500,229 500,230
500,231 500,232 500,233 500,234 500,235 500,236 500,237 500,238 500,239 500,240
500,241 500,242 500,243 500,244 500,245 500,246 500,247 500,248 500,249 500,250
500,251 500,252 500,253 500,254 500,255 500,256 500,257 500,258 500,259 500,260
500,261 500,262 500,263 500,264 500,265 500,266 500,267 500,268 500,269 500,270
500,271 500,272 500,273 500,274 500,275 500,276 500,277 500,278 500,279 500,280
500,281 500,282 500,283 500,284 500,285 500,286 500,287 500,288 500,289 500,290
500,291 500,292 500,293 500,294 500,295 500,296 500,297 500,298 500,299 500,300
500,301 500,302 500,303 500,304 500,305 500,306 500,307 500,308 500,309 500,310
500,311 500,312 500,313 500,314 500,315 500,316 500,317 500,318 500,319 500,320
500,321 500,322 500,323 500,324 500,325 500,326 500,327 500,328 500,329 500,330
500,331 500,332 500,333 500,334 500,335 500,336 500,337 500,338 500,339 500,340
500,341 500,342 500,343 500,344 500,345 500,346 500,347 500,348 500,349 500,350
500,351 500,352 500,353 500,354 500,355 500,356 500,357 500,358 500,359 500,360
500,361 500,362 500,363 500,364 500,365 500,366 500,367 500,368 500,369 500,370
500,371 500,372 500,373 500,374 500,375 500,376 500,377 500,378 500,379 500,380
500,381 500,382 500,383 500,384 500,385 500,386 500,387 500,388 500,389 500,390
500,391 500,392 500,393 500,394 500,395 500,396 500,397 500,398 500,399 500,
max samples: 500
min samples: 500
> loading data done!
```



```
[247]: for k,v in embst.items():
        if v.shape[0] < sam_max:
            rid = np.random.choice(v.shape[0], sam_max-v.shape[0], replace=False)
            print('filling', sam_max-v.shape[0], 'samples')
            embst[k] = np.vstack((v, v[rid]))
```

```
[248]: from voro_helper import get_task_data, feat_trans, NC_o, tsk_cls, fun,
        ↪acc_brother, forgetting

i = task_num
support_data_, support_label_, query_data_, query_label_, n_ways_, n_shot_, _ = \
    get_task_data(embst, embs, i, fg_nc, class_set, task_size, brother=brother)
```

```
##### current_task: 10 #####
current classes [380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395
396 397
398 399]
[output] all classes 0 -> 399
```

```
[249]: #%% =====
        ↪=====
be      = 1. # 1.
l2      = False # False True
protots = np.mean(feat_trans(support_data_, beta=be, l2=l2), axis=1)
```

```
[233]: i = 0
support_data, support_label, query_data, query_label, n_ways, n_shot, classes = \
    get_task_data(embst, embs, i, fg_nc, class_set, task_size, brother=brother)
acc, _, nn_pre = NC_o(support_data, support_label,
                      query_data, query_label,
                      n_ways, n_shot,
                      beta = be, l2 = l2,
                      given_cen = protots[classes], given_only = True,
                      brother = brother)
```

```
##### current_task: 0 #####
current classes [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17,
18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37,
38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49]
[output] all classes 0 -> 49
0.8038
```

```
[250]: local      = False # True / False
nn_acc      = []
savefile = path+'NN' if brother else None # NN / NNp / NN3 / only saved NN
        ↪results!
```

```

savefil2 = path+'NN3'
forget    = True # True False # calculate forgetting
class_ladder = []
a         = []
for i in range(task_num + 1):
    support_data, support_label, query_data, query_label, n_ways, n_shot, \
    →classes = \
        get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                        local = local, brother = brother) # False
    if forget:
        class_ladder.append(classes)
    acc, _, nn_pre = NC_o(support_data, support_label,
                           query_data, query_label,
                           n_ways, n_shot,
                           beta = be, l2 = l2,
                           given_cen = protots[classes] if local else protots[:
    →classes[-1]+1],

                           given_only = True,
                           brother = brother,
                           savefile = savefile+'_'+str(i) if brother else None,
                           savefile2 = None, # savefil2+'_'+str(i), # None, #
                           weights = [0.7, 0.3],
                           class_ladder = class_ladder,
                           acc_all = a
                           )

    nn_acc.append(acc)
    # if all classes up2now: local = False, and protots[:classes[-1]+1]
print('local:', local, '| beta:', be, '| l2:', l2)
if brother:
    for accs in nn_acc:
        print('\t'.join([str(i) for i in accs]))
else:
    print('\n'.join([str(i) for i in nn_acc]))
if forget:
    avgf = forgetting(a, task_num)
    print(avgf)

```

##### current\_task: 0 #####

```

current classes [ 0  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15
16 17
18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35
36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53
54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71
72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89
90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107
108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125

```

```

126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143
144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161
162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179
180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197
198 199]
[output] all classes 0 -> 199
<<< loaded from: ../checkpoints/CIFAR100_50_10x5voro/NN_0.npy
0.7131

##### current_task: 1 #####
current classes [200 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215
216 217
218 219]
[output] all classes 0 -> 219
<<< loaded from: ../checkpoints/CIFAR100_50_10x5voro/NN_1.npy
0.6740

##### current_task: 2 #####
current classes [220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235
236 237
238 239]
[output] all classes 0 -> 239
<<< loaded from: ../checkpoints/CIFAR100_50_10x5voro/NN_2.npy
0.6458

##### current_task: 3 #####
current classes [240 241 242 243 244 245 246 247 248 249 250 251 252 253 254 255
256 257
258 259]
[output] all classes 0 -> 259
<<< loaded from: ../checkpoints/CIFAR100_50_10x5voro/NN_3.npy
0.6181

##### current_task: 4 #####
current classes [260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275
276 277
278 279]
[output] all classes 0 -> 279
<<< loaded from: ../checkpoints/CIFAR100_50_10x5voro/NN_4.npy
0.5945

##### current_task: 5 #####
current classes [280 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295
296 297
298 299]
[output] all classes 0 -> 299
<<< loaded from: ../checkpoints/CIFAR100_50_10x5voro/NN_5.npy
0.5667

```

```
##### current_task: 6 #####
current classes [300 301 302 303 304 305 306 307 308 309 310 311 312 313 314 315
316 317
318 319]
[output] all classes 0 -> 319
<<< loaded from: ../checkpoints/CIFAR100_50_10x5voro/NN_6.npy
0.5448
```

```
##### current_task: 7 #####
current classes [320 321 322 323 324 325 326 327 328 329 330 331 332 333 334 335
336 337
338 339]
[output] all classes 0 -> 339
<<< loaded from: ../checkpoints/CIFAR100_50_10x5voro/NN_7.npy
0.5237
```

```
##### current_task: 8 #####
current classes [340 341 342 343 344 345 346 347 348 349 350 351 352 353 354 355
356 357
358 359]
[output] all classes 0 -> 359
<<< loaded from: ../checkpoints/CIFAR100_50_10x5voro/NN_8.npy
0.5108
```

```
##### current_task: 9 #####
current classes [360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375
376 377
378 379]
[output] all classes 0 -> 379
<<< loaded from: ../checkpoints/CIFAR100_50_10x5voro/NN_9.npy
0.4964
```

```
##### current_task: 10 #####
current classes [380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395
396 397
398 399]
[output] all classes 0 -> 399
<<< loaded from: ../checkpoints/CIFAR100_50_10x5voro/NN_10.npy
0.4800
```

```
local: False | beta: 1.0 | l2: False
0.7131 0.9432 0.9288 0.926 0.8772
0.6739545454545455 0.9230909090909091 0.6861818181818182
0.6790909090909091 0.5827272727272728
0.64575 0.8935 0.6568333333333334 0.6508333333333334 0.553
0.6181153846153846 0.8649230769230769 0.6286153846153846
0.6244615384615385 0.5341538461538462
0.5945 0.8405714285714285 0.6048571428571429 0.6014285714285714
```

```

0.5125714285714286
0.5667 0.8073333333333333 0.5782666666666667 0.5748 0.4912
0.5448125 0.788125 0.561125 0.557 0.474125
0.5237058823529411 0.7674117647058823 0.5168235294117647
0.5130588235294118 0.44388235294117645
0.5108333333333334 0.7607777777777778 0.5061111111111111
0.5022222222222222 0.43477777777777776
0.49642105263157893 0.7411578947368421 0.5111578947368421
0.5070526315789474 0.43957894736842107
0.479975 0.7219 0.5062 0.5029 0.4366
[[0.7131 0. 0. 0. 0. 0. 0. 0. 0.
  0. 0. ]
[0.69465 0.467 0. 0. 0. 0. 0. 0. 0.
  0. 0. ]
[0.68295 0.444 0.4755 0. 0. 0. 0. 0. 0.
  0. 0. ]
[0.6747 0.423 0.467 0.3985 0. 0. 0. 0. 0.
  0. 0. ]
[0.66695 0.4125 0.452 0.378 0.411 0. 0. 0. 0.
  0. 0. ]
[0.6618 0.399 0.4345 0.338 0.386 0.325 0. 0. 0.
  0. 0. ]
[0.65705 0.387 0.427 0.334 0.3625 0.3205 0.3155 0. 0.
  0. 0. ]
[0.6458 0.379 0.4115 0.3265 0.3545 0.3145 0.3105 0.3485 0.
  0. 0. ]
[0.63815 0.375 0.4 0.324 0.3485 0.3115 0.304 0.3305 0.42
  0. 0. ]
[0.63405 0.3605 0.3975 0.3135 0.337 0.302 0.302 0.319 0.408
  0.352 0. ]
[0.62415 0.354 0.38 0.309 0.321 0.2945 0.3005 0.314 0.406
  0.3515 0.3275 ]]
[0, 1.8449999999999966, 2.6575000000000015, 3.0299999999999994,
3.6162499999999986, 4.915999999999997, 5.034166666666665, 5.189999999999995,
5.280624999999999, 5.561666666666665, 5.714499999999998]

```

```

[251]: def predict(model, x, voro=True):
        x = torch.from_numpy(x.astype(np.float32)).cuda()
        with torch.no_grad():
            predi = model.module.classifier(x)
        if voro:
            predi += - torch.sum((model.module.classifier.weight/2.)**2, dim=1)
        return predi

classes_all = []
test_share = []
paccS = []

```

```

for i in range(task_num + 1):
    support_data, support_label, query_data, query_label, n_ways, n_shot, \
    →classes = \
        get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                        local = True, brother = brother)

    # load model:
    if brother:
        cls_01 = classes[-1]+1
        assert cls_01 % 4 == 0
        filename = path + '%d_model.pkl' % (int(cls_01/4))
    else:
        filename = path + '%d_model.pkl' % (classes[-1]+1)
    model = torch.load(filename)
    model.eval()
    print('> loaded base phase model from:', filename)
    num_param(model)
    # do prediction:
    min_cls = min(classes)
    if brother:
        pred = predict(model, query_data)
    else:
        pred = predict(model, query_data)[:,:,:4]
    pmax = torch.max(pred, dim=1)[1]
    pacc = np.mean(t2n(pmax) == query_label - min_cls)
    print(pacc)
    if brother:
        accs = acc_brother(t2n(pred), t2n(pmax), query_label - min_cls, \
    →forLG=True)
        pacc = [pacc] + accs
        paccS.append(pacc)
        classes_all.append(classes)
        test_share.append(len(query_label))
    print('all logistic locally:')
    if brother:
        for accs in paccS:
            print('\t'.join([str(i) for i in accs]))
    else:
        print('\n'.join([str(i) for i in paccS]))

```

##### current\_task: 0 #####

```

[output] current classes [ 0  1  2  3  4  5  6  7  8  9 10 11 12
13 14 15 16 17
18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35
36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53
54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71
72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89

```

```

 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107
108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125
126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143
144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161
162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179
180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197
198 199]
all classes 0 -> 199
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/50_model.pkl
module.classifier.weight      torch.Size([200, 512])  102400  True
total: 102400
0.7182

##### current_task: 1 #####
[output] current classes [200 201 202 203 204 205 206 207 208 209 210 211 212
213 214 215 216 217
218 219]
all classes 0 -> 219
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240  True
total: 10240
0.701

##### current_task: 2 #####
[output] current classes [220 221 222 223 224 225 226 227 228 229 230 231 232
233 234 235 236 237
238 239]
all classes 0 -> 239
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240  True
total: 10240
0.841

##### current_task: 3 #####
[output] current classes [240 241 242 243 244 245 246 247 248 249 250 251 252
253 254 255 256 257
258 259]
all classes 0 -> 259
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240  True
total: 10240
0.672

##### current_task: 4 #####
[output] current classes [260 261 262 263 264 265 266 267 268 269 270 271 272
273 274 275 276 277
278 279]
all classes 0 -> 279

```

```
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.707
```

```
##### current_task: 5 #####
[output] current classes [280 281 282 283 284 285 286 287 288 289 290 291 292
293 294 295 296 297
298 299]
all classes 0 -> 299
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.7165
```

```
##### current_task: 6 #####
[output] current classes [300 301 302 303 304 305 306 307 308 309 310 311 312
313 314 315 316 317
318 319]
all classes 0 -> 319
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.6385
```

```
##### current_task: 7 #####
[output] current classes [320 321 322 323 324 325 326 327 328 329 330 331 332
333 334 335 336 337
338 339]
all classes 0 -> 339
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.7325
```

```
##### current_task: 8 #####
[output] current classes [340 341 342 343 344 345 346 347 348 349 350 351 352
353 354 355 356 357
358 359]
all classes 0 -> 359
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.738
```

```
##### current_task: 9 #####
[output] current classes [360 361 362 363 364 365 366 367 368 369 370 371 372
373 374 375 376 377
```



```

378 379]
all classes 0 -> 379
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.7385

##### current_task: 10 #####
[output] current classes [380 381 382 383 384 385 386 387 388 389 390 391 392
393 394 395 396 397
398 399]
all classes 0 -> 399
> loaded base phase model from:
../checkpoints/CIFAR100_50_10x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.7515
all logistic locally:
0.7182  0.9408  0.9704  0.0    0.9736
0.701   0.972   1.0     0.0    0.994
0.841   0.984   0.994   0.0    1.0
0.672   0.964   0.982   0.0    0.986
0.707   0.96    0.956   0.0    0.974
0.7165  0.972   0.994   0.0    0.996
0.6385  0.986   0.994   0.0    0.996
0.7325  0.998   0.992   0.0    1.0
0.738   0.978   0.944   0.0    0.978
0.7385  0.998   0.974   0.0    1.0
0.7515  0.994   0.994   0.0    0.998

```

```

[252]: for i in range(task_num + 1):
        support_data, support_label, query_data, query_label, n_ways, n_shot, \
        classes = \
            get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                           local = True, brother = brother)
        pred_all = []
        for classes in classes_all:
            # load model:
            if brother:
                cls_01 = classes[-1]+1
                assert cls_01 % 4 == 0
                filename = path + '%d_model.pkl' % (int(cls_01/4))
            else:
                filename = path + '%d_model.pkl' % (classes[-1]+1)
            model = torch.load(filename)
            model.eval()
            print('> loaded base phase model from:', filename)

```

```

num_param(model)
# do prediction:
min_cls = min(classes)
if brother:
    pred = predict(model, query_data)
else:
    pred = predict(model, query_data)[:,:,:4]
pmax = torch.max(pred, dim=1)[1]
# pacc = np.mean(t2n(pmax) == query_label - min_cls)
# print(pacc)
if brother:
    labs_01 = query_label[:4]//4
    acc_, sc_pre = merge_sc(t2n(pred), labs_01,
                           mth='softmax', forLG=True, return_pre=True)
    min_cls = int(min_cls / 4)
    pred_all.append( (sc_pre + min_cls).tolist() )
else:
    pred_all.append( (t2n(pmax) + min_cls).tolist() )
pred_all = np.array(pred_all)
print(pred_all.shape)

if i == 0:
    pred_in_clique = copy.deepcopy(pred_all)
else:
    pred_in_clique = np.hstack((pred_in_clique, pred_all))

```

##### current\_task: 0 #####

```

[output] current classes [ 0  1  2  3  4  5  6  7  8  9 10 11 12
13 14 15 16 17
18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35
36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53
54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71
72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89
90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107
108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125
126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143
144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161
162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179
180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197
198 199]

```

all classes 0 -> 199

```

> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/50_model.pkl
module.classifier.weight      torch.Size([200, 512]) 102400 True
total: 102400
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])  10240  True
total: 10240

```

```

> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_50_10x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(11, 5000)

```

```
##### current_task: 1 #####
```

```

[output] current classes [200 201 202 203 204 205 206 207 208 209 210 211 212
213 214 215 216 217
218 219]

```

```
all classes 0 -> 219
```

```

> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/50_model.pkl
module.classifier.weight      torch.Size([200, 512])  102400    True
total: 102400
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/70_model.pkl

```

```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_50_10x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(11, 500)

```

##### current\_task: 2 #####

```

[output] current classes [220 221 222 223 224 225 226 227 228 229 230 231 232
233 234 235 236 237
238 239]
all classes 0 -> 239
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/50_model.pkl
module.classifier.weight      torch.Size([200, 512])  102400    True
total: 102400
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True

```

```

total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_50_10x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(11, 500)

```

```
##### current_task: 3 #####
```

```

[output] current classes [240 241 242 243 244 245 246 247 248 249 250 251 252
253 254 255 256 257
258 259]
all classes 0 -> 259
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/50_model.pkl
module.classifier.weight      torch.Size([200, 512])  102400   True
total: 102400
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240    True
total: 10240

```

```

> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_50_10x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(11, 500)

##### current_task: 4 #####
[output] current classes [260 261 262 263 264 265 266 267 268 269 270 271 272
273 274 275 276 277
278 279]
all classes 0 -> 279
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/50_model.pkl
module.classifier.weight      torch.Size([200, 512])  102400    True
total: 102400
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_50_10x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240

```

(11, 500)

##### current\_task: 5 #####

[output] current classes [280 281 282 283 284 285 286 287 288 289 290 291 292  
293 294 295 296 297  
298 299]

all classes 0 -> 299

> loaded base phase model from: ../checkpoints/CIFAR100\_50\_10x5voro/50\_model.pkl  
module.classifier.weight torch.Size([200, 512]) 102400 True  
total: 102400

> loaded base phase model from: ../checkpoints/CIFAR100\_50\_10x5voro/55\_model.pkl  
module.classifier.weight torch.Size([20, 512]) 10240 True  
total: 10240

> loaded base phase model from: ../checkpoints/CIFAR100\_50\_10x5voro/60\_model.pkl  
module.classifier.weight torch.Size([20, 512]) 10240 True  
total: 10240

> loaded base phase model from: ../checkpoints/CIFAR100\_50\_10x5voro/65\_model.pkl  
module.classifier.weight torch.Size([20, 512]) 10240 True  
total: 10240

> loaded base phase model from: ../checkpoints/CIFAR100\_50\_10x5voro/70\_model.pkl  
module.classifier.weight torch.Size([20, 512]) 10240 True  
total: 10240

> loaded base phase model from: ../checkpoints/CIFAR100\_50\_10x5voro/75\_model.pkl  
module.classifier.weight torch.Size([20, 512]) 10240 True  
total: 10240

> loaded base phase model from: ../checkpoints/CIFAR100\_50\_10x5voro/80\_model.pkl  
module.classifier.weight torch.Size([20, 512]) 10240 True  
total: 10240

> loaded base phase model from: ../checkpoints/CIFAR100\_50\_10x5voro/85\_model.pkl  
module.classifier.weight torch.Size([20, 512]) 10240 True  
total: 10240

> loaded base phase model from: ../checkpoints/CIFAR100\_50\_10x5voro/90\_model.pkl  
module.classifier.weight torch.Size([20, 512]) 10240 True  
total: 10240

> loaded base phase model from: ../checkpoints/CIFAR100\_50\_10x5voro/95\_model.pkl  
module.classifier.weight torch.Size([20, 512]) 10240 True  
total: 10240

> loaded base phase model from:  
../checkpoints/CIFAR100\_50\_10x5voro/100\_model.pkl  
module.classifier.weight torch.Size([20, 512]) 10240 True  
total: 10240

(11, 500)

##### current\_task: 6 #####

[output] current classes [300 301 302 303 304 305 306 307 308 309 310 311 312  
313 314 315 316 317  
318 319]

all classes 0 -> 319

```

> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/50_model.pkl
module.classifier.weight      torch.Size([200, 512])  102400  True
total: 102400
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_50_10x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
(11, 500)

```

```
##### current_task: 7 #####
```

```

[output] current classes [320 321 322 323 324 325 326 327 328 329 330 331 332
333 334 335 336 337
338 339]

```

```
all classes 0 -> 339
```

```

> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/50_model.pkl
module.classifier.weight      torch.Size([200, 512])  102400  True
total: 102400
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/60_model.pkl

```



```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_50_10x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(11, 500)

```

##### current\_task: 8 #####

```

[output] current classes [340 341 342 343 344 345 346 347 348 349 350 351 352
353 354 355 356 357
358 359]

```

all classes 0 -> 359

```

> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/50_model.pkl
module.classifier.weight      torch.Size([200, 512])  102400    True
total: 102400
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True

```

```

total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_50_10x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(11, 500)

```

##### current\_task: 9 #####

```

[output] current classes [360 361 362 363 364 365 366 367 368 369 370 371 372
373 374 375 376 377
378 379]
all classes 0 -> 379
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/50_model.pkl
module.classifier.weight      torch.Size([200, 512])  102400   True
total: 102400
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240    True
total: 10240

```

```

> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_50_10x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(11, 500)

##### current_task: 10 #####
[output] current classes [380 381 382 383 384 385 386 387 388 389 390 391 392
393 394 395 396 397
398 399]
all classes 0 -> 399
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/50_model.pkl
module.classifier.weight      torch.Size([200, 512])   102400   True
total: 102400
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_50_10x5voro/95_model.pkl

```

```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_50_10x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(11, 500)

```

```

[237]: print('cliques by test samples:', pred_in_clique.shape)

# compute prototypes
be      = 0.6 # 1.
l2      = True # False True
bias    = 0 # 0.05
protots = np.mean(feats_trans(support_data_, beta=be, l2=l2, bias=bias), axis=1)
query_pts = feats_trans(query_data_, beta=be, l2=l2, bias=bias)
# acenss = feats_trans(acens, beta=be, l2=l2, bias=bias)
if brother:
    dist = funbtch(query_pts, protots) # protots / acenss
else:
    dist = fun(query_pts, protots) # protots / acenss

test_splt = [sum(test_share[:t+1]) for t in range(len(test_share))]

```

cliques by test samples: (11, 10000)

```

[238]: dist_in_clique = np.zeros_like(pred_in_clique, dtype=np.float32)
for c_id, clique in enumerate(pred_in_clique):
    for s_id, samp in enumerate(clique):
        dist_in_clique[c_id][s_id] = dist[s_id][samp]

```

```

[253]: for i in range(task_num + 1):
        clique_dist = dist_in_clique[:i+1,:test_splt[i]]
        clique_pred = np.argmax(clique_dist, axis=0)
        merge_pred = [pred_in_clique[cli,s_id] for s_id, cli in
            ↪ enumerate(clique_pred)]
        merge_acc = np.mean(merge_pred == query_label_[:test_splt[i]])
        print(merge_acc)
print('DaC:', 'beta:', be, '| l2:', l2)

```

```

[28]: print('===== Experiment Done! =====')

```

===== Experiment Done! =====

## iVoro on CIFAR-100 Dataset (20 Phases)

```
[1]: import matplotlib.pyplot as plt
import os
import pickle
import numpy as np
import pandas as pd
import seaborn as sns
import time
import sys
sys.path.append('../')
sys.path.append('../analysis/')
import copy
import platform
import json
import pickle
import random

import torch
from scipy.stats import mode
```

```
[165]: from ResNet import resnet18_cbam

data_name      = 'CIFAR100' # 'Subset' # 'Tiny' # 'CIFAR100' # 'MNIST'
total_nc       = 100 # 200 # 100 # 10
fg_nc          = 40 # 100 # 40 # 50 # 4
task_num       = 20 # 20 # 5 # 10 # 2

# constant params
class_set      = list(range(total_nc))
ROTATION       = True
EMB2D          = False
DESIGN         = True
virtual_class  = 4*total_nc if ROTATION else total_nc
suffix         = 'voro' # 'prob' 'voro'
assert (total_nc - fg_nc)%task_num == 0
task_size      = int((total_nc - fg_nc)/task_num)
file_name      =
    ↳data_name+'_'+str(fg_nc)+'_'+str(task_num)+'x'+str(task_size)+suffix
```

```
print(file_name)

brother      = False # True False
```

CIFAR100\_40\_20x3voro

```
[166]: save_path = '../checkpoints/'
path    = save_path + file_name + '/'
filename = path + '%d_model.pkl' % (fg_nc+0) # +5
model    = torch.load(filename)
model.eval()
print('> loaded base phase model from:', filename)
```

> loaded base phase model from: ../checkpoints/CIFAR100\_40\_20x3voro/40\_model.pkl

```
[167]: from voro_helper import num_param, t2n, \
        load_feat, sanity_check, \
        id2emb_, num_samp, merge_sc, funbtch

num_param(model)

# voronoi centers:
vcenter = t2n(model.module.classifier.weight.data / 2.)
print(vcenter.shape)
```

```
module.classifier.weight      torch.Size([160, 512])  81920    True
total: 81920
(160, 512)
```

```
[168]: '''
CIFAR:
    'CIFAR100_50_5x10_test.pkl'
    'CIFAR100_50_5x10_train.pkl'
    'CIFAR100_40_20x3_test.pkl'
    'CIFAR100_40_20x3_train.pkl'
more CIFAR:
    'CIFAR100_40_12x5_test.pkl'
    'CIFAR100_40_12x5_train.pkl'
    'CIFAR100_30_14x5_test.pkl'
    'CIFAR100_30_14x5_train.pkl'
    'CIFAR100_20_16x5_test.pkl'
    'CIFAR100_20_16x5_train.pkl'
    'CIFAR100_10_18x5_test.pkl'
    'CIFAR100_10_18x5_train.pkl'
Tiny:
    'Tiny_100_20x5_test.pkl'
    'Tiny_100_20x5_train.pkl'
TinyL3:
    'Tiny_100_5x20_test.pkl'
```

```

        'Tiny_100_5x20_train.pkl'
Subset:
        'Subset_50_10x5_test.pkl'
        'Subset_50_10x5_train.pkl'
'''
ffile = '../embedding/prob/' + 'CIFAR100_40_20x3_test.pkl' # prob probL3
data_phas, last_tsk = load_feat(ffile)

labs, embeds, outputs = data_phas[last_tsk][last_tsk]
false_id, pred_ = sanity_check(labs, embeds, outputs)

```

```

feature file: ../embedding/prob/CIFAR100_40_20x3_test.pkl
> loaded tasks: dict_keys([20])
> classes: [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18,
19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38,
39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58,
59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78,
79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98,
99]
> samples: 10000
> embedding: 512
> classification: 400
~ acc (single): 61.07%
~ acc (quadruple): 51.41%

```

```

[169]: ffile = '../embedding/prob/' + 'CIFAR100_40_20x3_train.pkl' # prob probL3
data_phas, last_tsk = load_feat(ffile)

labst, embedst, outputst = data_phas[last_tsk][last_tsk]
false_id, pred_ = sanity_check(labst, embedst, outputst)

```

```

feature file: ../embedding/prob/CIFAR100_40_20x3_train.pkl
> loaded tasks: dict_keys([20])
> classes: [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18,
19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38,
39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58,
59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78,
79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98,
99]
> samples: 50000
> embedding: 512
> classification: 400
~ acc (single): 76.07%
~ acc (quadruple): 68.25%

```

```

[170]: embs = id2emb_(labs, embeds, brother=brother)
embst = id2emb_(labst, embedst, brother=brother)

```

```
sam_max, sam_min = num_samp(embst)
print('> loading data done!')
```

```
0 500,1 500,2 500,3 500,4 500,5 500,6 500,7 500,8 500,9 500,10 500,11 500,12
500,13 500,14 500,15 500,16 500,17 500,18 500,19 500,20 500,21 500,22 500,23
500,24 500,25 500,26 500,27 500,28 500,29 500,30 500,31 500,32 500,33 500,34
500,35 500,36 500,37 500,38 500,39 500,40 500,41 500,42 500,43 500,44 500,45
500,46 500,47 500,48 500,49 500,50 500,51 500,52 500,53 500,54 500,55 500,56
500,57 500,58 500,59 500,60 500,61 500,62 500,63 500,64 500,65 500,66 500,67
500,68 500,69 500,70 500,71 500,72 500,73 500,74 500,75 500,76 500,77 500,78
500,79 500,80 500,81 500,82 500,83 500,84 500,85 500,86 500,87 500,88 500,89
500,90 500,91 500,92 500,93 500,94 500,95 500,96 500,97 500,98 500,99 500,
max samples: 500
min samples: 500
> loading data done!
```

```
[171]: for k,v in embst.items():
        if v.shape[0] < sam_max:
            rid = np.random.choice(v.shape[0], sam_max-v.shape[0], replace=False)
            print('filling', sam_max-v.shape[0], 'samples')
            embst[k] = np.vstack((v, v[rid]))
```

```
[172]: from voro_helper import get_task_data, feat_trans, NC_o, tsk_cls, fun, \
        ↪acc_brother, forgetting

i = task_num
support_data_, support_label_, query_data_, query_label_, n_ways_, n_shot_, _ = \
    get_task_data(embst, embs, i, fg_nc, class_set, task_size, brother=brother)
```

```
##### current_task: 20 #####
current classes [97, 98, 99]
[output] all classes 0 -> 99
```

```
[173]: #%% =====
        ↪=====
be      = 1. # 1.
l2      = False # False True
protots = np.mean(feat_trans(support_data_, beta=be, l2=l2), axis=1)
```

```
[174]: i = 0
support_data, support_label, query_data, query_label, n_ways, n_shot, classes = \
    get_task_data(embst, embs, i, fg_nc, class_set, task_size, brother=brother)
acc, _, nn_pre = NC_o(support_data, support_label,
                      query_data, query_label,
                      n_ways, n_shot,
                      beta = be, l2 = l2,
                      given_cen = protots[classes], given_only = True,
```



```
brother = brother)
```

```
##### current_task: 0 #####
current classes [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17,
18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37,
38, 39]
[output] all classes 0 -> 39
0.7837
```

```
[175]: local      = False # True / False
nn_acc   = []
savefile = path+'NN' if brother else None # NN / NNp / NN3 / only saved NN
→results!
savefil2 = path+'NN3'
forget    = True # True False # calculate forgetting
class_ladder = []
a         = []
for i in range(task_num + 1):
    support_data, support_label, query_data, query_label, n_ways, n_shot,
→classes = \
        get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                        local = local, brother = brother) # False
    if forget:
        class_ladder.append(classes)
    acc, _, nn_pre = NC_o(support_data, support_label,
                           query_data, query_label,
                           n_ways, n_shot,
                           beta = be, l2 = l2,
                           given_cen = protots[classes] if local else protots[:
→classes[-1]+1],
                           given_only = True,
                           brother = brother,
                           savefile = savefile+'_'+str(i) if brother else None,
                           savefile2 = None, # savefil2+'_'+str(i), # None, #
                           weights = [0.7, 0.3],
                           class_ladder = class_ladder,
                           acc_all = a
                           )
    nn_acc.append(acc)
    # if all classes up2now: local = False, and protots[:classes[-1]+1]
print('local:', local, '| beta:', be, '| l2:', l2)
if brother:
    for accs in nn_acc:
        print('\t'.join([str(i) for i in accs]))
else:
    print('\n'.join([str(i) for i in nn_acc]))
```

```
if forget:
    avgf = forgetting(a, task_num)
    print(avgf)
```

```
##### current_task: 0 #####
current classes [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17,
18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37,
38, 39]
[output] all classes 0 -> 39
0.7837
```

```
##### current_task: 1 #####
current classes [40, 41, 42]
[output] all classes 0 -> 42
0.7567
```

```
##### current_task: 2 #####
current classes [43, 44, 45]
[output] all classes 0 -> 45
0.7226
```

```
##### current_task: 3 #####
current classes [46, 47, 48]
[output] all classes 0 -> 48
0.7059
```

```
##### current_task: 4 #####
current classes [49, 50, 51]
[output] all classes 0 -> 51
0.6873
```

```
##### current_task: 5 #####
current classes [52, 53, 54]
[output] all classes 0 -> 54
0.6816
```

```
##### current_task: 6 #####
current classes [55, 56, 57]
[output] all classes 0 -> 57
0.6645
```

```
##### current_task: 7 #####
current classes [58, 59, 60]
[output] all classes 0 -> 60
0.6530
```

```
##### current_task: 8 #####
```

current classes [61, 62, 63]  
[output] all classes 0 -> 63  
0.6420

##### current\_task: 9 #####  
current classes [64, 65, 66]  
[output] all classes 0 -> 66  
0.6197

##### current\_task: 10 #####  
current classes [67, 68, 69]  
[output] all classes 0 -> 69  
0.6147

##### current\_task: 11 #####  
current classes [70, 71, 72]  
[output] all classes 0 -> 72  
0.5975

##### current\_task: 12 #####  
current classes [73, 74, 75]  
[output] all classes 0 -> 75  
0.5825

##### current\_task: 13 #####  
current classes [76, 77, 78]  
[output] all classes 0 -> 78  
0.5730

##### current\_task: 14 #####  
current classes [79, 80, 81]  
[output] all classes 0 -> 81  
0.5613

##### current\_task: 15 #####  
current classes [82, 83, 84]  
[output] all classes 0 -> 84  
0.5546

##### current\_task: 16 #####  
current classes [85, 86, 87]  
[output] all classes 0 -> 87  
0.5513

##### current\_task: 17 #####  
current classes [88, 89, 90]  
[output] all classes 0 -> 90  
0.5464

```
##### current_task: 18 #####
current classes [91, 92, 93]
[output] all classes 0 -> 93
0.5355
```

```
##### current_task: 19 #####
current classes [94, 95, 96]
[output] all classes 0 -> 96
0.5309
```

```
##### current_task: 20 #####
current classes [97, 98, 99]
[output] all classes 0 -> 99
0.5238
```

```
local: False | beta: 1.0 | l2: False
0.78375
```

```
0.7567441860465116
0.7226086956521739
0.7059183673469388
0.6873076923076923
0.6816363636363636
0.6644827586206896
0.6529508196721312
0.64203125
0.6197014925373134
0.6147142857142858
0.5975342465753425
0.5825
0.5730379746835443
0.5613414634146342
0.5545882352941176
0.55125
0.5463736263736264
0.5355319148936171
0.5309278350515464
0.5238
```

```
[0.78375    0.        0.        0.        0.        0.
 0.        0.        0.        0.        0.        0.
 0.        0.        0.        0.        0.        0.
 0.        0.        0.        ]
[0.76325    0.67      0.        0.        0.        0.
 0.        0.        0.        0.        0.        0.
 0.        0.        0.        0.        0.        0.
 0.        0.        0.        ]
[0.7465     0.64      0.48666667 0.        0.        0.
 0.        0.        0.        0.        0.        0.
 0.        0.        0.        0.        0.        0.]
```

0.	0.	0.	]		
[0.7355	0.61666667	0.48	0.62666667	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	]		
[0.728	0.60333333	0.46	0.62666667	0.51666667	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	]		
[0.72075	0.6	0.46	0.52	0.51666667	0.79
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	]		
[0.71725	0.59666667	0.45666667	0.51333333	0.50333333	0.77333333
0.44	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	]		
[0.70925	0.59666667	0.45666667	0.49666667	0.47666667	0.76666667
0.43333333	0.59333333	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	]		
[0.699	0.59333333	0.45333333	0.49666667	0.46666667	0.76
0.42666667	0.59333333	0.58666667	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	]		
[0.697	0.58666667	0.43666667	0.49	0.44	0.75333333
0.42	0.59333333	0.58	0.24666667	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	]		
[0.693	0.57666667	0.43666667	0.49	0.43	0.75333333
0.41333333	0.58333333	0.57666667	0.24666667	0.59666667	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	]		
[0.69025	0.57666667	0.43333333	0.48666667	0.43	0.73666667
0.39666667	0.55666667	0.54	0.23666667	0.59666667	0.34666667
0.	0.	0.	0.	0.	0.
0.	0.	0.	]		
[0.68475	0.56333333	0.42333333	0.48666667	0.41	0.73666667
0.38666667	0.55333333	0.53	0.23333333	0.54666667	0.34666667
0.41	0.	0.	0.	0.	0.
0.	0.	0.	]		
[0.6825	0.56	0.41	0.48666667	0.39666667	0.73666667
0.38666667	0.55333333	0.52333333	0.22666667	0.53666667	0.34666667
0.41	0.41666667	0.	0.	0.	0.
0.	0.	0.	]		
[0.676	0.55	0.4	0.48666667	0.39666667	0.73333333
0.37666667	0.54333333	0.52333333	0.22333333	0.53666667	0.34666667
0.40333333	0.41333333	0.39666667	0.	0.	0.

```

0.      0.      0.      ]
[0.6715    0.54666667 0.39666667 0.48333333 0.39      0.71333333
 0.36333333 0.54333333 0.5      0.22      0.53666667 0.34333333
 0.40333333 0.41333333 0.38666667 0.52      0.      0.
 0.      0.      0.      ]
[0.6665    0.52      0.39666667 0.47666667 0.39      0.71333333
 0.36333333 0.54      0.49666667 0.22      0.53333333 0.34333333
 0.4      0.40333333 0.38666667 0.50666667 0.59333333 0.
 0.      0.      0.      ]
[0.663     0.51666667 0.38666667 0.47      0.38666667 0.71333333
 0.36333333 0.53666667 0.49666667 0.21666667 0.53333333 0.34333333
 0.4      0.40333333 0.37333333 0.5      0.58      0.51333333
 0.      0.      0.      ]
[0.659     0.51666667 0.37      0.47      0.37666667 0.69666667
 0.36333333 0.53666667 0.47666667 0.21666667 0.52333333 0.32666667
 0.39      0.40333333 0.37333333 0.48666667 0.58      0.51333333
 0.37333333 0.      0.      ]
[0.656     0.51666667 0.37      0.46666667 0.37666667 0.69666667
 0.36      0.53      0.47666667 0.21333333 0.51333333 0.32333333
 0.38333333 0.4      0.37333333 0.48      0.57666667 0.51333333
 0.37333333 0.47666667 0.      ]
[0.653     0.51666667 0.36666667 0.46333333 0.37666667 0.69666667
 0.36      0.53      0.47333333 0.16333333 0.51333333 0.32333333
 0.37666667 0.39333333 0.37      0.48      0.57333333 0.51333333
 0.37333333 0.47666667 0.41333333]]
[0, 2.0499999999999996, 3.3624999999999996, 3.6083333333333332,
3.7270833333333332, 5.326666666666667, 5.219444444444447, 5.397619047619048,
5.226041666666668, 5.5194444444444475, 5.407500000000002, 5.971212121212122,
6.519444444444446, 6.445512820512822, 6.436309523809525, 6.637222222222225,
6.691145833333334, 6.690686274509808, 6.970833333333334, 6.882894736842104,
6.953750000000001]

```

```

[176]: def predict(model, x, voro=True):
        x = torch.from_numpy(x.astype(np.float32)).cuda()
        with torch.no_grad():
            predi = model.module.classifier(x)
            if voro:
                predi += - torch.sum((model.module.classifier.weight/2.)**2, dim=1)
            return predi

classes_all = []
test_share = []
paccS = []
for i in range(task_num + 1):
    support_data, support_label, query_data, query_label, n_ways, n_shot, \
    classes = \
        get_task_data(embst, embs, i, fg_nc, class_set, task_size,

```

```

        local = True, brother = brother)

# load model:
if brother:
    cls_01 = classes[-1]+1
    assert cls_01 % 4 == 0
    filename = path + '%d_model.pkl' % (int(cls_01/4))
else:
    filename = path + '%d_model.pkl' % (classes[-1]+1)
model = torch.load(filename)
model.eval()
print('> loaded base phase model from:', filename)
num_param(model)
# do prediction:
min_cls = min(classes)
if brother:
    pred = predict(model, query_data)
else:
    pred = predict(model, query_data)[:,:,:4]
pmax = torch.max(pred, dim=1)[1]
pacc = np.mean(t2n(pmax) == query_label - min_cls)
print(pacc)
if brother:
    accs = acc_brother(t2n(pred), t2n(pmax), query_label - min_cls,
→forLG=True)
    pacc = [pacc] + accs
    paccS.append(pacc)
    classes_all.append(classes)
    test_share.append(len(query_label))
print('all logistic locally:')
if brother:
    for accs in paccS:
        print('\t'.join([str(i) for i in accs]))
else:
    print('\n'.join([str(i) for i in paccS]))

```

```

##### current_task: 0 #####
[output] current classes [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15,
16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35,
36, 37, 38, 39]
all classes 0 -> 39
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/40_model.pkl
module.classifier.weight      torch.Size([160, 512])  81920    True
total: 81920
0.81525

##### current_task: 1 #####
[output] current classes [40, 41, 42]

```

```

all classes 0 -> 42
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/43_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
0.9766666666666667

##### current_task: 2 #####
[output] current classes [43, 44, 45]
all classes 0 -> 45
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/46_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
0.9066666666666666

##### current_task: 3 #####
[output] current classes [46, 47, 48]
all classes 0 -> 48
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/49_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
0.9866666666666667

##### current_task: 4 #####
[output] current classes [49, 50, 51]
all classes 0 -> 51
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/52_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
0.96

##### current_task: 5 #####
[output] current classes [52, 53, 54]
all classes 0 -> 54
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/55_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
0.9866666666666667

##### current_task: 6 #####
[output] current classes [55, 56, 57]
all classes 0 -> 57
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/58_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
0.9866666666666667

##### current_task: 7 #####
[output] current classes [58, 59, 60]

```



```

all classes 0 -> 60
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/61_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
0.9866666666666667

##### current_task: 8 #####
[output] current classes [61, 62, 63]
all classes 0 -> 63
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/64_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
0.9766666666666667

##### current_task: 9 #####
[output] current classes [64, 65, 66]
all classes 0 -> 66
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/67_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
0.8066666666666666

##### current_task: 10 #####
[output] current classes [67, 68, 69]
all classes 0 -> 69
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/70_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
0.9833333333333333

##### current_task: 11 #####
[output] current classes [70, 71, 72]
all classes 0 -> 72
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/73_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
0.99

##### current_task: 12 #####
[output] current classes [73, 74, 75]
all classes 0 -> 75
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/76_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
0.93

##### current_task: 13 #####
[output] current classes [76, 77, 78]

```

```

all classes 0 -> 78
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/79_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
0.93

##### current_task: 14 #####
[output] current classes [79, 80, 81]
all classes 0 -> 81
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/82_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
0.9766666666666667

##### current_task: 15 #####
[output] current classes [82, 83, 84]
all classes 0 -> 84
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/85_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
0.97

##### current_task: 16 #####
[output] current classes [85, 86, 87]
all classes 0 -> 87
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/88_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
0.94

##### current_task: 17 #####
[output] current classes [88, 89, 90]
all classes 0 -> 90
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/91_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
0.94

##### current_task: 18 #####
[output] current classes [91, 92, 93]
all classes 0 -> 93
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/94_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
0.9233333333333333

##### current_task: 19 #####
[output] current classes [94, 95, 96]

```

```

all classes 0 -> 96
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/97_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
0.99

```

```

##### current_task: 20 #####
[output] current classes [97, 98, 99]
all classes 0 -> 99
> loaded base phase model from:
../checkpoints/CIFAR100_40_20x3voro/100_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
0.9733333333333334
all logistic locally:
0.81525
0.9766666666666667
0.9066666666666666
0.9866666666666667
0.96
0.9866666666666667
0.9866666666666667
0.9866666666666667
0.9766666666666667
0.8066666666666666
0.9833333333333333
0.99
0.93
0.93
0.9766666666666667
0.97
0.94
0.94
0.9233333333333333
0.99
0.9733333333333334

```

```

[177]: for i in range(task_num + 1):
        support_data, support_label, query_data, query_label, n_ways, n_shot, \
        classes = \
            get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                          local = True, brother = brother)
        pred_all = []
        for classes in classes_all:
            # load model:
            if brother:
                cls_01 = classes[-1]+1

```

```

        assert cls_01 % 4 == 0
        filename = path + '%d_model.pkl' % (int(cls_01/4))
    else:
        filename = path + '%d_model.pkl' % (classes[-1]+1)
    model = torch.load(filename)
    model.eval()
    print('> loaded base phase model from:', filename)
    num_param(model)
    # do prediction:
    min_cls = min(classes)
    if brother:
        pred = predict(model, query_data)
    else:
        pred = predict(model, query_data)[:,:,:4]
    pmax = torch.max(pred, dim=1)[1]
    # pacc = np.mean(t2n(pmax) == query_label - min_cls)
    # print(pacc)
    if brother:
        labs_01 = query_label[:4]//4
        acc_, sc_pre = merge_sc(t2n(pred), labs_01,
                                mth='softmax', forLG=True, return_pre=True)
        min_cls = int(min_cls / 4)
        pred_all.append( (sc_pre + min_cls).tolist() )
    else:
        pred_all.append( (t2n(pmax) + min_cls).tolist() )
    pred_all = np.array(pred_all)
    print(pred_all.shape)

    if i == 0:
        pred_in_clique = copy.deepcopy(pred_all)
    else:
        pred_in_clique = np.hstack((pred_in_clique, pred_all))

```

##### current\_task: 0 #####

[output] current classes [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39]

all classes 0 -> 39

> loaded base phase model from: ../checkpoints/CIFAR100\_40\_20x3voro/40\_model.pkl

module.classifier.weight torch.Size([160, 512]) 81920 True

total: 81920

> loaded base phase model from: ../checkpoints/CIFAR100\_40\_20x3voro/43\_model.pkl

module.classifier.weight torch.Size([12, 512]) 6144 True

total: 6144

> loaded base phase model from: ../checkpoints/CIFAR100\_40\_20x3voro/46\_model.pkl

module.classifier.weight torch.Size([12, 512]) 6144 True

total: 6144

```

> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/49_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/52_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/55_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/58_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/61_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/64_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/67_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/70_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/73_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/76_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/79_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/82_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/85_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/88_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/91_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/94_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144

```

```

> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/97_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from:
../checkpoints/CIFAR100_40_20x3voro/100_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
(21, 4000)

##### current_task: 1 #####
[output] current classes [40, 41, 42]
all classes 0 -> 42
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/40_model.pkl
module.classifier.weight      torch.Size([160, 512])   81920   True
total: 81920
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/43_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/46_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/49_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/52_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/55_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/58_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/61_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/64_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/67_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/70_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/73_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144

```

```

> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/76_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/79_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/82_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/85_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/88_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/91_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/94_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/97_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from:
../checkpoints/CIFAR100_40_20x3voro/100_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
(21, 300)

```

```
##### current_task: 2 #####
```

```
[output] current classes [43, 44, 45]
```

```
all classes 0 -> 45
```

```

> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/40_model.pkl
module.classifier.weight      torch.Size([160, 512])   81920   True
total: 81920
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/43_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/46_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/49_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/52_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144

```

```

> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/55_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/58_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/61_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/64_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/67_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/70_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/73_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/76_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/79_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/82_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/85_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/88_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/91_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/94_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/97_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from:
../checkpoints/CIFAR100_40_20x3voro/100_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True

```



```
total: 6144
(21, 300)
```

```
##### current_task: 3 #####
```

```
[output] current classes [46, 47, 48]
```

```
all classes 0 -> 48
```

```
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/40_model.pkl
module.classifier.weight      torch.Size([160, 512])  81920    True
total: 81920
```

```
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/43_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144     True
total: 6144
```

```
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/46_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144     True
total: 6144
```

```
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/49_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144     True
total: 6144
```

```
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/52_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144     True
total: 6144
```

```
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/55_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144     True
total: 6144
```

```
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/58_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144     True
total: 6144
```

```
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/61_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144     True
total: 6144
```

```
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/64_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144     True
total: 6144
```

```
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/67_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144     True
total: 6144
```

```
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/70_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144     True
total: 6144
```

```
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/73_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144     True
total: 6144
```

```
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/76_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144     True
total: 6144
```

```
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/79_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144     True
total: 6144
```

```

> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/82_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/85_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/88_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/91_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/94_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/97_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from:
../checkpoints/CIFAR100_40_20x3voro/100_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
(21, 300)

```

```
##### current_task: 4 #####
```

```
[output] current classes [49, 50, 51]
```

```
all classes 0 -> 51
```

```

> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/40_model.pkl
module.classifier.weight      torch.Size([160, 512])   81920   True
total: 81920
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/43_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/46_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/49_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/52_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/55_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/58_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144

```

```

> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/61_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/64_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/67_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/70_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/73_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/76_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/79_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/82_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/85_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/88_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/91_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/94_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/97_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from:
../checkpoints/CIFAR100_40_20x3voro/100_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
(21, 300)

##### current_task: 5 #####
[output] current classes [52, 53, 54]
all classes 0 -> 54

```

```

> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/40_model.pkl
module.classifier.weight      torch.Size([160, 512])  81920   True
total: 81920
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/43_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/46_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/49_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/52_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/55_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/58_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/61_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/64_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/67_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/70_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/73_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/76_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/79_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/82_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/85_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144    True
total: 6144

```

```

> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/88_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/91_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/94_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/97_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from:
../checkpoints/CIFAR100_40_20x3voro/100_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
(21, 300)

```

```
##### current_task: 6 #####
```

```
[output] current classes [55, 56, 57]
```

```
all classes 0 -> 57
```

```

> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/40_model.pkl
module.classifier.weight      torch.Size([160, 512])   81920   True
total: 81920
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/43_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/46_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/49_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/52_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/55_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/58_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/61_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/64_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144

```

```

> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/67_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/70_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/73_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/76_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/79_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/82_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/85_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/88_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/91_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/94_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/97_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from:
../checkpoints/CIFAR100_40_20x3voro/100_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
(21, 300)

```

```
##### current_task: 7 #####
```

```
[output] current classes [58, 59, 60]
```

```
all classes 0 -> 60
```

```

> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/40_model.pkl
module.classifier.weight      torch.Size([160, 512])   81920   True
total: 81920
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/43_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144

```

```

> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/46_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/49_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/52_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/55_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/58_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/61_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/64_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/67_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/70_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/73_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/76_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/79_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/82_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/85_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/88_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/91_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144

```

```

> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/94_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/97_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from:
../checkpoints/CIFAR100_40_20x3voro/100_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
(21, 300)

```

```
##### current_task: 8 #####
```

```
[output] current classes [61, 62, 63]
```

```
all classes 0 -> 63
```

```

> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/40_model.pkl
module.classifier.weight      torch.Size([160, 512])   81920   True
total: 81920
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/43_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/46_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/49_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/52_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/55_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/58_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/61_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/64_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/67_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/70_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144

```



```

> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/73_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/76_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/79_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/82_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/85_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/88_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/91_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/94_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/97_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from:
../checkpoints/CIFAR100_40_20x3voro/100_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
(21, 300)

```

```
##### current_task: 9 #####
```

```
[output] current classes [64, 65, 66]
```

```
all classes 0 -> 66
```

```

> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/40_model.pkl
module.classifier.weight      torch.Size([160, 512])   81920   True
total: 81920
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/43_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/46_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/49_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144

```

```

> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/52_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/55_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/58_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/61_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/64_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/67_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/70_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/73_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/76_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/79_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/82_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/85_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/88_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/91_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/94_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/97_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144

```

```

> loaded base phase model from:
../checkpoints/CIFAR100_40_20x3voro/100_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
(21, 300)

##### current_task: 10 #####
[output] current classes [67, 68, 69]
all classes 0 -> 69
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/40_model.pkl
module.classifier.weight      torch.Size([160, 512])   81920    True
total: 81920
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/43_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/46_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/49_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/52_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/55_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/58_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/61_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/64_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/67_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/70_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/73_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/76_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144

```

```

> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/79_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/82_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/85_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/88_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/91_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/94_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/97_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from:
../checkpoints/CIFAR100_40_20x3voro/100_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
(21, 300)

```

```
##### current_task: 11 #####
```

```
[output] current classes [70, 71, 72]
```

```
all classes 0 -> 72
```

```

> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/40_model.pkl
module.classifier.weight      torch.Size([160, 512])   81920   True
total: 81920
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/43_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/46_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/49_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/52_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/55_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144

```

```

> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/58_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/61_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/64_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/67_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/70_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/73_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/76_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/79_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/82_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/85_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/88_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/91_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/94_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/97_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from:
../checkpoints/CIFAR100_40_20x3voro/100_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
(21, 300)

```

```

##### current_task: 12 #####
[output] current classes [73, 74, 75]
all classes 0 -> 75
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/40_model.pkl
module.classifier.weight      torch.Size([160, 512])  81920   True
total: 81920
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/43_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/46_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/49_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/52_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/55_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/58_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/61_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/64_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/67_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/70_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/73_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/76_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/79_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/82_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144    True
total: 6144

```

```

> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/85_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/88_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/91_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/94_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/97_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from:
../checkpoints/CIFAR100_40_20x3voro/100_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
(21, 300)

```

```
##### current_task: 13 #####
```

```
[output] current classes [76, 77, 78]
```

```
all classes 0 -> 78
```

```

> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/40_model.pkl
module.classifier.weight      torch.Size([160, 512])   81920   True
total: 81920
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/43_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/46_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/49_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/52_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/55_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/58_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/61_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144

```

```

> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/64_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/67_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/70_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/73_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/76_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/79_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/82_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/85_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/88_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/91_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/94_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/97_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from:
../checkpoints/CIFAR100_40_20x3voro/100_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
(21, 300)

##### current_task: 14 #####
[output] current classes [79, 80, 81]
all classes 0 -> 81
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/40_model.pkl
module.classifier.weight      torch.Size([160, 512])   81920   True
total: 81920

```



```

> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/43_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/46_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/49_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/52_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/55_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/58_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/61_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/64_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/67_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/70_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/73_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/76_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/79_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/82_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/85_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/88_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144

```

```

> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/91_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/94_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/97_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from:
../checkpoints/CIFAR100_40_20x3voro/100_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
(21, 300)

```

```
##### current_task: 15 #####
```

```
[output] current classes [82, 83, 84]
```

```
all classes 0 -> 84
```

```

> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/40_model.pkl
module.classifier.weight      torch.Size([160, 512])   81920   True
total: 81920
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/43_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/46_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/49_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/52_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/55_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/58_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/61_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/64_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/67_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144

```

```

> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/70_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/73_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/76_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/79_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/82_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/85_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/88_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/91_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/94_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/97_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from:
../checkpoints/CIFAR100_40_20x3voro/100_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
(21, 300)

```

```
##### current_task: 16 #####
```

```
[output] current classes [85, 86, 87]
```

```
all classes 0 -> 87
```

```

> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/40_model.pkl
module.classifier.weight      torch.Size([160, 512])   81920   True
total: 81920
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/43_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/46_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144

```

```

> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/49_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/52_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/55_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/58_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/61_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/64_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/67_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/70_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/73_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/76_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/79_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/82_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/85_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/88_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/91_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/94_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144

```

```

> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/97_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from:
../checkpoints/CIFAR100_40_20x3voro/100_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
(21, 300)

##### current_task: 17 #####
[output] current classes [88, 89, 90]
all classes 0 -> 90
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/40_model.pkl
module.classifier.weight      torch.Size([160, 512])   81920   True
total: 81920
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/43_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/46_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/49_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/52_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/55_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/58_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/61_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/64_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/67_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/70_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/73_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144

```

```

> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/76_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/79_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/82_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/85_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/88_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/91_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/94_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/97_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from:
../checkpoints/CIFAR100_40_20x3voro/100_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
(21, 300)

```

```
##### current_task: 18 #####
```

```
[output] current classes [91, 92, 93]
```

```
all classes 0 -> 93
```

```

> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/40_model.pkl
module.classifier.weight      torch.Size([160, 512])   81920   True
total: 81920
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/43_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/46_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/49_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/52_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144

```

```

> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/55_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/58_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/61_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/64_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/67_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/70_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/73_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/76_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/79_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/82_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/85_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/88_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/91_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/94_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/97_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from:
../checkpoints/CIFAR100_40_20x3voro/100_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True

```

total: 6144  
(21, 300)

##### current\_task: 19 #####

[output] current classes [94, 95, 96]

all classes 0 -> 96

> loaded base phase model from: ../checkpoints/CIFAR100\_40\_20x3voro/40\_model.pkl  
module.classifier.weight torch.Size([160, 512]) 81920 True  
total: 81920

> loaded base phase model from: ../checkpoints/CIFAR100\_40\_20x3voro/43\_model.pkl  
module.classifier.weight torch.Size([12, 512]) 6144 True  
total: 6144

> loaded base phase model from: ../checkpoints/CIFAR100\_40\_20x3voro/46\_model.pkl  
module.classifier.weight torch.Size([12, 512]) 6144 True  
total: 6144

> loaded base phase model from: ../checkpoints/CIFAR100\_40\_20x3voro/49\_model.pkl  
module.classifier.weight torch.Size([12, 512]) 6144 True  
total: 6144

> loaded base phase model from: ../checkpoints/CIFAR100\_40\_20x3voro/52\_model.pkl  
module.classifier.weight torch.Size([12, 512]) 6144 True  
total: 6144

> loaded base phase model from: ../checkpoints/CIFAR100\_40\_20x3voro/55\_model.pkl  
module.classifier.weight torch.Size([12, 512]) 6144 True  
total: 6144

> loaded base phase model from: ../checkpoints/CIFAR100\_40\_20x3voro/58\_model.pkl  
module.classifier.weight torch.Size([12, 512]) 6144 True  
total: 6144

> loaded base phase model from: ../checkpoints/CIFAR100\_40\_20x3voro/61\_model.pkl  
module.classifier.weight torch.Size([12, 512]) 6144 True  
total: 6144

> loaded base phase model from: ../checkpoints/CIFAR100\_40\_20x3voro/64\_model.pkl  
module.classifier.weight torch.Size([12, 512]) 6144 True  
total: 6144

> loaded base phase model from: ../checkpoints/CIFAR100\_40\_20x3voro/67\_model.pkl  
module.classifier.weight torch.Size([12, 512]) 6144 True  
total: 6144

> loaded base phase model from: ../checkpoints/CIFAR100\_40\_20x3voro/70\_model.pkl  
module.classifier.weight torch.Size([12, 512]) 6144 True  
total: 6144

> loaded base phase model from: ../checkpoints/CIFAR100\_40\_20x3voro/73\_model.pkl  
module.classifier.weight torch.Size([12, 512]) 6144 True  
total: 6144

> loaded base phase model from: ../checkpoints/CIFAR100\_40\_20x3voro/76\_model.pkl  
module.classifier.weight torch.Size([12, 512]) 6144 True  
total: 6144

> loaded base phase model from: ../checkpoints/CIFAR100\_40\_20x3voro/79\_model.pkl  
module.classifier.weight torch.Size([12, 512]) 6144 True  
total: 6144



```

> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/82_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/85_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/88_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/91_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/94_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/97_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from:
../checkpoints/CIFAR100_40_20x3voro/100_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
(21, 300)

```

```
##### current_task: 20 #####
```

```
[output] current classes [97, 98, 99]
```

```
all classes 0 -> 99
```

```

> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/40_model.pkl
module.classifier.weight      torch.Size([160, 512])   81920   True
total: 81920
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/43_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/46_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/49_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/52_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/55_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/58_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144

```

```

> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/61_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/64_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/67_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/70_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/73_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/76_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/79_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/82_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/85_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/88_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/91_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/94_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/97_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from:
../checkpoints/CIFAR100_40_20x3voro/100_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
(21, 300)

```

```
[178]: print('cliques by test samples:', pred_in_clique.shape)
```

```

# compute prototypes
be      = 0.6 # 1.
l2      = True # False True
bias    = 0 # 0.05
protots = np.mean(feats_trans(support_data_, beta=be, l2=l2, bias=bias), axis=1)
query_pts = feats_trans(query_data_, beta=be, l2=l2, bias=bias)
# acenss  = feats_trans(acens, beta=be, l2=l2, bias=bias)
if brother:
    dist    = funbtch(query_pts, protots) # protots / acenss
else:
    dist    = fun(query_pts, protots) # protots / acenss

test_splt = [sum(test_share[:t+1]) for t in range(len(test_share))]

```

cliques by test samples: (21, 10000)

```

[179]: dist_in_clique = np.zeros_like(pred_in_clique, dtype=np.float32)
for c_id, clique in enumerate(pred_in_clique):
    for s_id, samp in enumerate(clique):
        dist_in_clique[c_id][s_id] = dist[s_id][samp]

```

```

[180]: for i in range(task_num + 1):
        clique_dist = dist_in_clique[:i+1,:test_splt[i]]
        clique_pred = np.argmax(clique_dist, axis=0)
        merge_pred = [pred_in_clique[cli,s_id] for s_id, cli in
            ↪enumerate(clique_pred)]
        merge_acc = np.mean(merge_pred == query_label_[:test_splt[i]])
        print(merge_acc)
print('DaC:', 'beta:', be, '| l2:', l2)

```

```

0.81525
0.7848837209302325
0.7465217391304347
0.7291836734693877
0.7088461538461538
0.7032727272727273
0.6837931034482758
0.6742622950819672
0.66203125
0.6417910447761194
0.637
0.6208219178082192
0.6052631578947368
0.5963291139240506
0.584390243902439
0.5764705882352941
0.5740909090909091
0.5695604395604396

```

```
0.5582978723404255
0.5530927835051547
0.5454
DaC: beta: 0.6 | 12: True
```

```
[28]: print('===== Experiment Done! =====')
```

```
===== Experiment Done! =====
```

## iVoro-AC/AI on CIFAR-100 Dataset (20 Phases)

```
[1]: import matplotlib.pyplot as plt
import os
import pickle
import numpy as np
import pandas as pd
import seaborn as sns
import time
import sys
sys.path.append('../')
sys.path.append('../analysis/')
import copy
import platform
import json
import pickle
import random

import torch
from scipy.stats import mode
```

```
[181]: from ResNet import resnet18_cbam

data_name      = 'CIFAR100' # 'Subset' # 'Tiny' # 'CIFAR100' # 'MNIST'
total_nc       = 100 # 200 # 100 # 10
fg_nc          = 40 # 100 # 40 # 50 # 4
task_num       = 20 # 20 # 5 # 10 # 2

# constant params
class_set      = list(range(total_nc))
ROTATION       = True
EMB2D          = False
DESIGN         = True
virtual_class  = 4*total_nc if ROTATION else total_nc
suffix         = 'voro' # 'prob' 'voro'
assert (total_nc - fg_nc)%task_num == 0
task_size      = int((total_nc - fg_nc)/task_num)
file_name      = _
    ↳data_name+'_'+str(fg_nc)+'_'+str(task_num)+'x'+str(task_size)+suffix
```

```
print(file_name)

brother      = True # True False
```

CIFAR100\_40\_20x3voro

```
[182]: save_path = '../checkpoints/'
path    = save_path + file_name + '/'
filename = path + '%d_model.pkl' % (fg_nc+0) # +5
model   = torch.load(filename)
model.eval()
print('> loaded base phase model from:', filename)
```

> loaded base phase model from: ../checkpoints/CIFAR100\_40\_20x3voro/40\_model.pkl

```
[183]: from voro_helper import num_param, t2n, \
        load_feat, sanity_check, \
        id2emb_, num_samp, merge_sc, funbtch

num_param(model)

# voronoi centers:
vcenter = t2n(model.module.classifier.weight.data / 2.)
print(vcenter.shape)
```

```
module.classifier.weight      torch.Size([160, 512])  81920    True
total: 81920
(160, 512)
```

```
[184]: '''
CIFAR:
    'CIFAR100_50_5x10_test.pkl'
    'CIFAR100_50_5x10_train.pkl'
    'CIFAR100_40_20x3_test.pkl'
    'CIFAR100_40_20x3_train.pkl'
more CIFAR:
    'CIFAR100_40_12x5_test.pkl'
    'CIFAR100_40_12x5_train.pkl'
    'CIFAR100_30_14x5_test.pkl'
    'CIFAR100_30_14x5_train.pkl'
    'CIFAR100_20_16x5_test.pkl'
    'CIFAR100_20_16x5_train.pkl'
    'CIFAR100_10_18x5_test.pkl'
    'CIFAR100_10_18x5_train.pkl'
Tiny:
    'Tiny_100_20x5_test.pkl'
    'Tiny_100_20x5_train.pkl'
TinyL3:
    'Tiny_100_5x20_test.pkl'
```

```

    'Tiny_100_5x20_train.pkl'
Subset:
    'Subset_50_10x5_test.pkl'
    'Subset_50_10x5_train.pkl'
'''
ffile = '../embedding/prob/' + 'CIFAR100_40_20x3_test.pkl' # prob probL3
data_phas, last_tsk = load_feat(ffile)

labs, embeds, outputs = data_phas[last_tsk][last_tsk]
false_id, pred_ = sanity_check(labs, embeds, outputs)

```

```

feature file: ../embedding/prob/CIFAR100_40_20x3_test.pkl
> loaded tasks: dict_keys([20])
> classes: [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18,
19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38,
39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58,
59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78,
79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98,
99]
> samples: 10000
> embedding: 512
> classification: 400
~ acc (single): 61.07%
~ acc (quadruple): 51.41%

```

```

[185]: ffile = '../embedding/prob/' + 'CIFAR100_40_20x3_train.pkl' # prob probL3
data_phas, last_tsk = load_feat(ffile)

labst, embedst, outputst = data_phas[last_tsk][last_tsk]
false_id, pred_ = sanity_check(labst, embedst, outputst)

```

```

feature file: ../embedding/prob/CIFAR100_40_20x3_train.pkl
> loaded tasks: dict_keys([20])
> classes: [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18,
19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38,
39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58,
59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78,
79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98,
99]
> samples: 50000
> embedding: 512
> classification: 400
~ acc (single): 76.07%
~ acc (quadruple): 68.25%

```

```

[186]: embs = id2emb_(labs, embeds, brother=brother)
embst = id2emb_(labst, embedst, brother=brother)

```

```
sam_max, sam_min = num_samp(embst)
print('> loading data done!')
```

```
0 500,1 500,2 500,3 500,4 500,5 500,6 500,7 500,8 500,9 500,10 500,11 500,12
500,13 500,14 500,15 500,16 500,17 500,18 500,19 500,20 500,21 500,22 500,23
500,24 500,25 500,26 500,27 500,28 500,29 500,30 500,31 500,32 500,33 500,34
500,35 500,36 500,37 500,38 500,39 500,40 500,41 500,42 500,43 500,44 500,45
500,46 500,47 500,48 500,49 500,50 500,51 500,52 500,53 500,54 500,55 500,56
500,57 500,58 500,59 500,60 500,61 500,62 500,63 500,64 500,65 500,66 500,67
500,68 500,69 500,70 500,71 500,72 500,73 500,74 500,75 500,76 500,77 500,78
500,79 500,80 500,81 500,82 500,83 500,84 500,85 500,86 500,87 500,88 500,89
500,90 500,91 500,92 500,93 500,94 500,95 500,96 500,97 500,98 500,99 500,100
500,101 500,102 500,103 500,104 500,105 500,106 500,107 500,108 500,109 500,110
500,111 500,112 500,113 500,114 500,115 500,116 500,117 500,118 500,119 500,120
500,121 500,122 500,123 500,124 500,125 500,126 500,127 500,128 500,129 500,130
500,131 500,132 500,133 500,134 500,135 500,136 500,137 500,138 500,139 500,140
500,141 500,142 500,143 500,144 500,145 500,146 500,147 500,148 500,149 500,150
500,151 500,152 500,153 500,154 500,155 500,156 500,157 500,158 500,159 500,160
500,161 500,162 500,163 500,164 500,165 500,166 500,167 500,168 500,169 500,170
500,171 500,172 500,173 500,174 500,175 500,176 500,177 500,178 500,179 500,180
500,181 500,182 500,183 500,184 500,185 500,186 500,187 500,188 500,189 500,190
500,191 500,192 500,193 500,194 500,195 500,196 500,197 500,198 500,199 500,200
500,201 500,202 500,203 500,204 500,205 500,206 500,207 500,208 500,209 500,210
500,211 500,212 500,213 500,214 500,215 500,216 500,217 500,218 500,219 500,220
500,221 500,222 500,223 500,224 500,225 500,226 500,227 500,228 500,229 500,230
500,231 500,232 500,233 500,234 500,235 500,236 500,237 500,238 500,239 500,240
500,241 500,242 500,243 500,244 500,245 500,246 500,247 500,248 500,249 500,250
500,251 500,252 500,253 500,254 500,255 500,256 500,257 500,258 500,259 500,260
500,261 500,262 500,263 500,264 500,265 500,266 500,267 500,268 500,269 500,270
500,271 500,272 500,273 500,274 500,275 500,276 500,277 500,278 500,279 500,280
500,281 500,282 500,283 500,284 500,285 500,286 500,287 500,288 500,289 500,290
500,291 500,292 500,293 500,294 500,295 500,296 500,297 500,298 500,299 500,300
500,301 500,302 500,303 500,304 500,305 500,306 500,307 500,308 500,309 500,310
500,311 500,312 500,313 500,314 500,315 500,316 500,317 500,318 500,319 500,320
500,321 500,322 500,323 500,324 500,325 500,326 500,327 500,328 500,329 500,330
500,331 500,332 500,333 500,334 500,335 500,336 500,337 500,338 500,339 500,340
500,341 500,342 500,343 500,344 500,345 500,346 500,347 500,348 500,349 500,350
500,351 500,352 500,353 500,354 500,355 500,356 500,357 500,358 500,359 500,360
500,361 500,362 500,363 500,364 500,365 500,366 500,367 500,368 500,369 500,370
500,371 500,372 500,373 500,374 500,375 500,376 500,377 500,378 500,379 500,380
500,381 500,382 500,383 500,384 500,385 500,386 500,387 500,388 500,389 500,390
500,391 500,392 500,393 500,394 500,395 500,396 500,397 500,398 500,399 500,
max samples: 500
min samples: 500
> loading data done!
```



```
[187]: for k,v in embst.items():
        if v.shape[0] < sam_max:
            rid = np.random.choice(v.shape[0], sam_max-v.shape[0], replace=False)
            print('filling', sam_max-v.shape[0], 'samples')
            embst[k] = np.vstack((v, v[rid]))
```

```
[188]: from voro_helper import get_task_data, feat_trans, NC_o, tsk_cls, fun,
        ↪acc_brother, forgetting

i = task_num
support_data_, support_label_, query_data_, query_label_, n_ways_, n_shot_, _ = \
    get_task_data(embst, embs, i, fg_nc, class_set, task_size, brother=brother)
```

```
##### current_task: 20 #####
current classes [388 389 390 391 392 393 394 395 396 397 398 399]
[output] all classes 0 -> 399
```

```
[189]: ### =====
        ↪=====
be      = 1. # 1.
l2      = False # False True
protots = np.mean(feat_trans(support_data_, beta=be, l2=l2), axis=1)
```

```
[174]: i = 0
support_data, support_label, query_data, query_label, n_ways, n_shot, classes = \
    get_task_data(embst, embs, i, fg_nc, class_set, task_size, brother=brother)
acc, _, nn_pre = NC_o(support_data, support_label,
                      query_data, query_label,
                      n_ways, n_shot,
                      beta = be, l2 = l2,
                      given_cen = protots[classes], given_only = True,
                      brother = brother)
```

```
##### current_task: 0 #####
current classes [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17,
18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37,
38, 39]
[output] all classes 0 -> 39
0.7837
```

```
[190]: local      = False # True / False
nn_acc      = []
savefile = path+'NN' if brother else None # NN / NNp / NN3 / only saved NN
        ↪results!
savefil12 = path+'NN3'
forget     = True # True False # calculate forgetting
```

```

class_ladder = []
a = []
for i in range(task_num + 1):
    support_data, support_label, query_data, query_label, n_ways, n_shot, \
    →classes = \
        get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                        local = local, brother = brother) # False
    if forget:
        class_ladder.append(classes)
    acc, _, nn_pre = NC_o(support_data, support_label,
                          query_data, query_label,
                          n_ways, n_shot,
                          beta = be, l2 = l2,
                          given_cen = protots[classes] if local else protots[:
    →classes[-1]+1],

                          given_only = True,
                          brother = brother,
                          savefile = savefile+'_'+str(i) if brother else None,
                          savefile2 = None, # savefile2+'_'+str(i), # None, #
                          weights = [0.7, 0.3],
                          class_ladder = class_ladder,
                          acc_all = a
                          )

    nn_acc.append(acc)
    # if all classes up2now: local = False, and protots[:classes[-1]+1]
print('local:', local, '| beta:', be, '| l2:', l2)
if brother:
    for accs in nn_acc:
        print('\t'.join([str(i) for i in accs]))
else:
    print('\n'.join([str(i) for i in nn_acc]))
if forget:
    avgf = forgetting(a, task_num)
    print(avgf)

```

##### current\_task: 0 #####

```

current classes [ 0  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15
16 17
18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35
36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53
54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71
72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89
90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107
108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125
126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143
144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159]

```

```

[output] all classes 0 -> 159
<<< loaded from: ../checkpoints/CIFAR100_40_20x3voro/NN_0.npy
0.6863

##### current_task: 1 #####
current classes [160 161 162 163 164 165 166 167 168 169 170 171]
[output] all classes 0 -> 171
<<< loaded from: ../checkpoints/CIFAR100_40_20x3voro/NN_1.npy
0.6630

##### current_task: 2 #####
current classes [172 173 174 175 176 177 178 179 180 181 182 183]
[output] all classes 0 -> 183
<<< loaded from: ../checkpoints/CIFAR100_40_20x3voro/NN_2.npy
0.6297

##### current_task: 3 #####
current classes [184 185 186 187 188 189 190 191 192 193 194 195]
[output] all classes 0 -> 195
<<< loaded from: ../checkpoints/CIFAR100_40_20x3voro/NN_3.npy
0.6212

##### current_task: 4 #####
current classes [196 197 198 199 200 201 202 203 204 205 206 207]
[output] all classes 0 -> 207
<<< loaded from: ../checkpoints/CIFAR100_40_20x3voro/NN_4.npy
0.6039

##### current_task: 5 #####
current classes [208 209 210 211 212 213 214 215 216 217 218 219]
[output] all classes 0 -> 219
<<< loaded from: ../checkpoints/CIFAR100_40_20x3voro/NN_5.npy
0.5951

##### current_task: 6 #####
current classes [220 221 222 223 224 225 226 227 228 229 230 231]
[output] all classes 0 -> 231
<<< loaded from: ../checkpoints/CIFAR100_40_20x3voro/NN_6.npy
0.5800

##### current_task: 7 #####
current classes [232 233 234 235 236 237 238 239 240 241 242 243]
[output] all classes 0 -> 243
<<< loaded from: ../checkpoints/CIFAR100_40_20x3voro/NN_7.npy
0.5735

##### current_task: 8 #####
current classes [244 245 246 247 248 249 250 251 252 253 254 255]

```

```

[output] all classes 0 -> 255
<<< loaded from: ../checkpoints/CIFAR100_40_20x3voro/NN_8.npy
0.5576

##### current_task: 9 #####
current classes [256 257 258 259 260 261 262 263 264 265 266 267]
[output] all classes 0 -> 267
<<< loaded from: ../checkpoints/CIFAR100_40_20x3voro/NN_9.npy
0.5368

##### current_task: 10 #####
current classes [268 269 270 271 272 273 274 275 276 277 278 279]
[output] all classes 0 -> 279
<<< loaded from: ../checkpoints/CIFAR100_40_20x3voro/NN_10.npy
0.5325

##### current_task: 11 #####
current classes [280 281 282 283 284 285 286 287 288 289 290 291]
[output] all classes 0 -> 291
<<< loaded from: ../checkpoints/CIFAR100_40_20x3voro/NN_11.npy
0.5198

##### current_task: 12 #####
current classes [292 293 294 295 296 297 298 299 300 301 302 303]
[output] all classes 0 -> 303
<<< loaded from: ../checkpoints/CIFAR100_40_20x3voro/NN_12.npy
0.5059

##### current_task: 13 #####
current classes [304 305 306 307 308 309 310 311 312 313 314 315]
[output] all classes 0 -> 315
<<< loaded from: ../checkpoints/CIFAR100_40_20x3voro/NN_13.npy
0.4978

##### current_task: 14 #####
current classes [316 317 318 319 320 321 322 323 324 325 326 327]
[output] all classes 0 -> 327
<<< loaded from: ../checkpoints/CIFAR100_40_20x3voro/NN_14.npy
0.4873

##### current_task: 15 #####
current classes [328 329 330 331 332 333 334 335 336 337 338 339]
[output] all classes 0 -> 339
<<< loaded from: ../checkpoints/CIFAR100_40_20x3voro/NN_15.npy
0.4778

##### current_task: 16 #####
current classes [340 341 342 343 344 345 346 347 348 349 350 351]

```

```

[output] all classes 0 -> 351
<<< loaded from: ../checkpoints/CIFAR100_40_20x3voro/NN_16.npy
0.4727

##### current_task: 17 #####
current classes [352 353 354 355 356 357 358 359 360 361 362 363]
[output] all classes 0 -> 363
<<< loaded from: ../checkpoints/CIFAR100_40_20x3voro/NN_17.npy
0.4687

##### current_task: 18 #####
current classes [364 365 366 367 368 369 370 371 372 373 374 375]
[output] all classes 0 -> 375
<<< loaded from: ../checkpoints/CIFAR100_40_20x3voro/NN_18.npy
0.4586

##### current_task: 19 #####
current classes [376 377 378 379 380 381 382 383 384 385 386 387]
[output] all classes 0 -> 387
<<< loaded from: ../checkpoints/CIFAR100_40_20x3voro/NN_19.npy
0.4541

##### current_task: 20 #####
current classes [388 389 390 391 392 393 394 395 396 397 398 399]
[output] all classes 0 -> 399
<<< loaded from: ../checkpoints/CIFAR100_40_20x3voro/NN_20.npy
0.4446
local: False | beta: 1.0 | l2: False
0.68625 0.93725 0.8825 0.88125 0.8375
0.6629651162790697 0.9293023255813954 0.7202325581395349
0.7158139534883721 0.6572093023255814
0.6297282608695652 0.9080434782608696 0.6971739130434783
0.6939130434782609 0.6415217391304348
0.6211734693877551 0.8946938775510204 0.6851020408163265
0.6822448979591836 0.636734693877551
0.6038942307692308 0.8775 0.6526923076923077 0.6501923076923077
0.6019230769230769
0.5950909090909091 0.8710909090909091 0.6485454545454545
0.6465454545454545 0.5985454545454545
0.58 0.8522413793103448 0.6451724137931034 0.6429310344827586
0.5956896551724138
0.5734836065573771 0.840327868852459 0.6198360655737705
0.6178688524590163 0.570983606557377
0.557578125 0.829375 0.620625 0.61859375 0.5746875
0.5368283582089552 0.802089552238806 0.6 0.5967164179104477
0.5571641791044776
0.5325 0.7985714285714286 0.5975714285714285 0.5945714285714285
0.5542857142857143

```

0.5197602739726027		0.783013698630137		0.5884931506849315	
0.5857534246575342		0.5446575342465754			
0.5058552631578948		0.7656578947368421		0.5798684210526316	
0.5776315789473684		0.5375			
0.4978481012658228		0.7544303797468355		0.5855696202531645	
0.5832911392405064		0.5456962025316455			
0.4873475609756098		0.7410975609756097		0.5752439024390243	
0.5732926829268292		0.541829268292683			
0.4777941176470588		0.7331764705882353		0.5730588235294117	
0.5709411764705883		0.5452941176470588			
0.47267045454545453		0.7346590909090909		0.5730681818181819	
0.5713636363636364		0.5446590909090909			
0.46865384615384614		0.7307692307692307		0.5723076923076923	
0.5703296703296703		0.5416483516483517			
0.45859042553191487		0.7167021276595744		0.5641489361702128	
0.5618085106382978		0.5323404255319149			
0.4540979381443299		0.7109278350515464		0.5629896907216495	
0.5608247422680412		0.5305154639175258			
0.444575	0.7001	0.5654	0.5633	0.5329	
[0.68625	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	]		
[0.67425	0.5125	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	]		
[0.6594375	0.4875	0.37583333	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	]		
[0.6479375	0.47166667	0.37416667	0.66083333	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	]		
[0.64	0.46833333	0.355	0.655	0.45583333	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	]		
[0.6350625	0.46583333	0.355	0.56083333	0.45	0.61083333
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	]		
[0.6296875	0.46166667	0.34416667	0.55166667	0.43666667	0.6
0.42333333	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	]		
[0.622625	0.45916667	0.34333333	0.53416667	0.415	0.58666667

0.41	0.61083333	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	]		
[0.6171875	0.45583333	0.34166667	0.53333333	0.405	0.57333333
0.4075	0.61083333	0.33833333	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	]		
[0.6143125	0.44583333	0.33083333	0.53166667	0.385	0.57
0.39416667	0.61083333	0.33583333	0.19416667	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	]		
[0.610625	0.4325	0.32916667	0.53166667	0.375	0.56916667
0.38	0.60083333	0.335	0.19416667	0.53583333	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	]		
[0.606625	0.4325	0.32583333	0.53	0.37166667	0.5625
0.36333333	0.5675	0.32666667	0.19083333	0.53166667	0.35666667
0.	0.	0.	0.	0.	0.
0.	0.	0.	]		
[0.6005625	0.42666667	0.32333333	0.53	0.35833333	0.5625
0.35416667	0.5675	0.31	0.18666667	0.49833333	0.3525
0.3375	0.	0.	0.	0.	0.
0.	0.	0.	]		
[0.59825	0.42583333	0.31416667	0.53	0.34666667	0.5625
0.35166667	0.5675	0.3025	0.18416667	0.4925	0.35
0.3375	0.36833333	0.	0.	0.	0.
0.	0.	0.	]		
[0.59175	0.41916667	0.31083333	0.52916667	0.34583333	0.56
0.34083333	0.55916667	0.3025	0.1775	0.49166667	0.34916667
0.33583333	0.36666667	0.3425	0.	0.	0.
0.	0.	0.	]		
[0.58825	0.41083333	0.30916667	0.52666667	0.34333333	0.54833333
0.3275	0.55833333	0.2925	0.17666667	0.49166667	0.34333333
0.33583333	0.3625	0.34	0.3275	0.	0.
0.	0.	0.	]		
[0.5831875	0.395	0.30833333	0.52333333	0.3425	0.54833333
0.3275	0.55166667	0.29166667	0.17666667	0.4875	0.34083333
0.33583333	0.35833333	0.33166667	0.32333333	0.44666667	0.
0.	0.	0.	]		
[0.58	0.38916667	0.30166667	0.51666667	0.34	0.54833333
0.3275	0.53666667	0.29166667	0.17416667	0.48583333	0.34083333
0.33333333	0.3575	0.30833333	0.3175	0.4275	0.48583333
0.	0.	0.	]		
[0.577	0.38833333	0.28833333	0.515	0.32916667	0.53416667
0.3275	0.53583333	0.26666667	0.17333333	0.47416667	0.32583333
0.32833333	0.35583333	0.30833333	0.3	0.4275	0.48583333
0.31166667	0.	0.	]		
[0.5716875	0.38833333	0.28833333	0.5025	0.325	0.52416667

```

0.32416667 0.52916667 0.26666667 0.17333333 0.46833333 0.32166667
0.32416667 0.35416667 0.30833333 0.29583333 0.42416667 0.48583333
0.31166667 0.44416667 0.          ]
[0.566875  0.38416667 0.28666667 0.49          0.325          0.52416667
0.3225      0.52916667 0.26416667 0.14833333 0.46833333 0.32166667
0.32166667 0.35          0.30833333 0.29583333 0.42333333 0.48583333
0.31166667 0.44333333 0.25666667]]
[0, 1.2000000000000001, 2.5906249999999993, 2.693749999999998,
2.9270833333333344, 4.490416666666669, 4.637152777777778, 5.0636904761904775,
4.89453125, 5.067824074074076, 5.1062499999999999, 5.4132575757575765,
5.755729166666666, 5.657692307692309, 5.621428571428571, 5.697777777777779,
5.696223958333335, 5.924019607843139, 6.268981481481482, 6.282785087719299,
6.271875000000001]

```

```

[191]: def predict(model, x, voro=True):
        x = torch.from_numpy(x.astype(np.float32)).cuda()
        with torch.no_grad():
            predi = model.module.classifier(x)
        if voro:
            predi += - torch.sum((model.module.classifier.weight/2.）**2, dim=1)
        return predi

classes_all = []
test_share = []
paccS = []
for i in range(task_num + 1):
    support_data, support_label, query_data, query_label, n_ways, n_shot, \
    →classes = \
        get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                        local = True, brother = brother)

    # load model:
    if brother:
        cls_01 = classes[-1]+1
        assert cls_01 % 4 == 0
        filename = path + '%d_model.pkl' % (int(cls_01/4))
    else:
        filename = path + '%d_model.pkl' % (classes[-1]+1)
    model = torch.load(filename)
    model.eval()
    print('> loaded base phase model from:', filename)
    num_param(model)
    # do prediction:
    min_cls = min(classes)
    if brother:
        pred = predict(model, query_data)
    else:
        pred = predict(model, query_data)[:,:,:4]

```



```

pmax = torch.max(pred, dim=1)[1]
pacc = np.mean(t2n(pmax) == query_label - min_cls)
print(pacc)
if brother:
    accs = acc_brother(t2n(pred), t2n(pmax), query_label - min_cls,
→forLG=True)
    pacc = [pacc] + accs
    paccS.append(pacc)
    classes_all.append(classes)
    test_share.append(len(query_label))
print('all logistic locally:')
if brother:
    for accs in paccS:
        print('\t'.join([str(i) for i in accs]))
else:
    print('\n'.join([str(i) for i in paccS]))

```

##### current\_task: 0 #####

[output] current classes [ 0 1 2 3 4 5 6 7 8 9 10 11 12  
13 14 15 16 17

18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35  
36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53  
54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71  
72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89  
90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107  
108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125  
126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143  
144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159]

all classes 0 -> 159

> loaded base phase model from: ../checkpoints/CIFAR100\_40\_20x3voro/40\_model.pkl  
module.classifier.weight torch.Size([160, 512]) 81920 True  
total: 81920  
0.7163125

##### current\_task: 1 #####

[output] current classes [160 161 162 163 164 165 166 167 168 169 170 171]

all classes 0 -> 171

> loaded base phase model from: ../checkpoints/CIFAR100\_40\_20x3voro/43\_model.pkl  
module.classifier.weight torch.Size([12, 512]) 6144 True  
total: 6144  
0.8016666666666666

##### current\_task: 2 #####

[output] current classes [172 173 174 175 176 177 178 179 180 181 182 183]

all classes 0 -> 183

> loaded base phase model from: ../checkpoints/CIFAR100\_40\_20x3voro/46\_model.pkl  
module.classifier.weight torch.Size([12, 512]) 6144 True

```
total: 6144
0.67
```

```
##### current_task: 3 #####
[output] current classes [184 185 186 187 188 189 190 191 192 193 194 195]
all classes 0 -> 195
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/49_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
0.9375
```

```
##### current_task: 4 #####
[output] current classes [196 197 198 199 200 201 202 203 204 205 206 207]
all classes 0 -> 207
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/52_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
0.7916666666666666
```

```
##### current_task: 5 #####
[output] current classes [208 209 210 211 212 213 214 215 216 217 218 219]
all classes 0 -> 219
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/55_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
0.7575
```

```
##### current_task: 6 #####
[output] current classes [220 221 222 223 224 225 226 227 228 229 230 231]
all classes 0 -> 231
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/58_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
0.8541666666666666
```

```
##### current_task: 7 #####
[output] current classes [232 233 234 235 236 237 238 239 240 241 242 243]
all classes 0 -> 243
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/61_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
0.9533333333333334
```

```
##### current_task: 8 #####
[output] current classes [244 245 246 247 248 249 250 251 252 253 254 255]
all classes 0 -> 255
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/64_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
```

```

total: 6144
0.6183333333333333

##### current_task: 9 #####
[output] current classes [256 257 258 259 260 261 262 263 264 265 266 267]
all classes 0 -> 267
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/67_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
0.6091666666666666

##### current_task: 10 #####
[output] current classes [268 269 270 271 272 273 274 275 276 277 278 279]
all classes 0 -> 279
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/70_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
0.8258333333333333

##### current_task: 11 #####
[output] current classes [280 281 282 283 284 285 286 287 288 289 290 291]
all classes 0 -> 291
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/73_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
0.8175

##### current_task: 12 #####
[output] current classes [292 293 294 295 296 297 298 299 300 301 302 303]
all classes 0 -> 303
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/76_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
0.7091666666666666

##### current_task: 13 #####
[output] current classes [304 305 306 307 308 309 310 311 312 313 314 315]
all classes 0 -> 315
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/79_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
0.7158333333333333

##### current_task: 14 #####
[output] current classes [316 317 318 319 320 321 322 323 324 325 326 327]
all classes 0 -> 327
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/82_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True

```

```

total: 6144
0.7491666666666666

##### current_task: 15 #####
[output] current classes [328 329 330 331 332 333 334 335 336 337 338 339]
all classes 0 -> 339
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/85_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
0.715

##### current_task: 16 #####
[output] current classes [340 341 342 343 344 345 346 347 348 349 350 351]
all classes 0 -> 351
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/88_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
0.6941666666666667

##### current_task: 17 #####
[output] current classes [352 353 354 355 356 357 358 359 360 361 362 363]
all classes 0 -> 363
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/91_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
0.8566666666666667

##### current_task: 18 #####
[output] current classes [364 365 366 367 368 369 370 371 372 373 374 375]
all classes 0 -> 375
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/94_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
0.6991666666666667

##### current_task: 19 #####
[output] current classes [376 377 378 379 380 381 382 383 384 385 386 387]
all classes 0 -> 387
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/97_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
0.7533333333333333

##### current_task: 20 #####
[output] current classes [388 389 390 391 392 393 394 395 396 397 398 399]
all classes 0 -> 399
> loaded base phase model from:
../checkpoints/CIFAR100_40_20x3voro/100_model.pkl

```

```

module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
0.6891666666666667
all logistic locally:
0.7163125      0.95625 0.9635 0.0      0.98325
0.8016666666666666      1.0      1.0      0.0      1.0
0.67      0.97      0.9933333333333333      0.0      0.9933333333333333
0.9375  1.0      1.0      0.0      1.0
0.7916666666666666      0.9933333333333333      0.9833333333333333
0.003333333333333335  0.9966666666666667
0.7575  0.9933333333333333      1.0      0.0      1.0
0.8541666666666666      1.0      1.0      0.0      1.0
0.9533333333333334      1.0      0.9533333333333334      0.0      1.0
0.6183333333333333      1.0      1.0      0.0      1.0
0.6091666666666666      0.88      0.86      0.006666666666666667
0.8966666666666666
0.8258333333333333      1.0      0.9933333333333333      0.0
0.9966666666666667
0.8175  1.0      1.0      0.0      1.0
0.7091666666666666      0.9966666666666667      1.0      0.0      1.0
0.7158333333333333      0.9833333333333333      1.0      0.0      1.0
0.7491666666666666      1.0      1.0      0.0      1.0
0.715      1.0      1.0      0.0      1.0
0.6941666666666667      0.9733333333333334      0.98      0.0
0.9866666666666667
0.8566666666666667      0.9833333333333333      0.9866666666666667      0.0
0.99
0.6991666666666667      0.9766666666666667      0.9833333333333333      0.0
0.99
0.7533333333333333      1.0      1.0      0.0      1.0
0.6891666666666667      0.9966666666666667      0.9966666666666667      0.0
1.0

```

```

[192]: for i in range(task_num + 1):
        support_data, support_label, query_data, query_label, n_ways, n_shot, \
        classes = \
            get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                           local = True, brother = brother)
        pred_all = []
        for classes in classes_all:
            # load model:
            if brother:
                cls_01 = classes[-1]+1
                assert cls_01 % 4 == 0
                filename = path + '%d_model.pkl' % (int(cls_01/4))
            else:
                filename = path + '%d_model.pkl' % (classes[-1]+1)

```

```

model      = torch.load(filename)
model.eval()
print('> loaded base phase model from:', filename)
num_param(model)
# do prediction:
min_cls = min(classes)
if brother:
    pred = predict(model, query_data)
else:
    pred = predict(model, query_data)[:,:,:4]
pmax = torch.max(pred, dim=1)[1]
# pacc = np.mean(t2n(pmax) == query_label - min_cls)
# print(pacc)
if brother:
    labs_01 = query_label[:4]//4
    acc_, sc_pre = merge_sc(t2n(pred), labs_01,
                           mth='softmax', forLG=True, return_pre=True)
    min_cls = int(min_cls / 4)
    pred_all.append( (sc_pre + min_cls).tolist() )
else:
    pred_all.append( (t2n(pmax) + min_cls).tolist() )
pred_all = np.array(pred_all)
print(pred_all.shape)

if i == 0:
    pred_in_clique = copy.deepcopy(pred_all)
else:
    pred_in_clique = np.hstack((pred_in_clique, pred_all))

```

##### current\_task: 0 #####

[output] current classes [ 0 1 2 3 4 5 6 7 8 9 10 11 12  
13 14 15 16 17

18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35  
36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53  
54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71  
72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89  
90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107  
108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125  
126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143  
144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159]

all classes 0 -> 159

> loaded base phase model from: ../checkpoints/CIFAR100\_40\_20x3voro/40\_model.pkl  
module.classifier.weight torch.Size([160, 512]) 81920 True  
total: 81920

> loaded base phase model from: ../checkpoints/CIFAR100\_40\_20x3voro/43\_model.pkl  
module.classifier.weight torch.Size([12, 512]) 6144 True  
total: 6144

```

> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/46_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/49_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/52_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/55_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/58_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/61_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/64_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/67_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/70_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/73_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/76_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/79_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/82_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/85_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/88_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/91_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144

```

```

> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/94_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/97_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from:
../checkpoints/CIFAR100_40_20x3voro/100_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
(21, 4000)

```

```
##### current_task: 1 #####
```

```

[output] current classes [160 161 162 163 164 165 166 167 168 169 170 171]
all classes 0 -> 171
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/40_model.pkl
module.classifier.weight      torch.Size([160, 512])   81920   True
total: 81920
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/43_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/46_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/49_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/52_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/55_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/58_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/61_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/64_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/67_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/70_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144

```



```

> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/73_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/76_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/79_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/82_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/85_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/88_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/91_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/94_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/97_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from:
../checkpoints/CIFAR100_40_20x3voro/100_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
(21, 300)

```

```
##### current_task: 2 #####
```

```

[output] current classes [172 173 174 175 176 177 178 179 180 181 182 183]
all classes 0 -> 183
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/40_model.pkl
module.classifier.weight      torch.Size([160, 512])   81920   True
total: 81920
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/43_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/46_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/49_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144

```

```

> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/52_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/55_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/58_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/61_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/64_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/67_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/70_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/73_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/76_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/79_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/82_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/85_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/88_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/91_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/94_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/97_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144

```

```

> loaded base phase model from:
../checkpoints/CIFAR100_40_20x3voro/100_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
(21, 300)

##### current_task: 3 #####
[output] current classes [184 185 186 187 188 189 190 191 192 193 194 195]
all classes 0 -> 195
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/40_model.pkl
module.classifier.weight      torch.Size([160, 512])   81920    True
total: 81920
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/43_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/46_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/49_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/52_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/55_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/58_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/61_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/64_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/67_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/70_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/73_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/76_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144

```

```

> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/79_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/82_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/85_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/88_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/91_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/94_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/97_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from:
../checkpoints/CIFAR100_40_20x3voro/100_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
(21, 300)

```

```
##### current_task: 4 #####
```

```

[output] current classes [196 197 198 199 200 201 202 203 204 205 206 207]
all classes 0 -> 207
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/40_model.pkl
module.classifier.weight      torch.Size([160, 512])   81920   True
total: 81920
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/43_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/46_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/49_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/52_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/55_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144

```

```

> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/58_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/61_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/64_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/67_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/70_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/73_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/76_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/79_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/82_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/85_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/88_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/91_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/94_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/97_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from:
../checkpoints/CIFAR100_40_20x3voro/100_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
(21, 300)

```

```

##### current_task: 5 #####
[output] current classes [208 209 210 211 212 213 214 215 216 217 218 219]
all classes 0 -> 219
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/40_model.pkl
module.classifier.weight      torch.Size([160, 512])  81920    True
total: 81920
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/43_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144     True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/46_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144     True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/49_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144     True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/52_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144     True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/55_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144     True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/58_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144     True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/61_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144     True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/64_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144     True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/67_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144     True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/70_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144     True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/73_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144     True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/76_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144     True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/79_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144     True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/82_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144     True
total: 6144

```

```

> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/85_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/88_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/91_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/94_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/97_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from:
../checkpoints/CIFAR100_40_20x3voro/100_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
(21, 300)

```

```
##### current_task: 6 #####
```

```

[output] current classes [220 221 222 223 224 225 226 227 228 229 230 231]
all classes 0 -> 231
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/40_model.pkl
module.classifier.weight      torch.Size([160, 512])   81920   True
total: 81920
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/43_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/46_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/49_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/52_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/55_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/58_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/61_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144

```

```

> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/64_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/67_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/70_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/73_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/76_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/79_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/82_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/85_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/88_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/91_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/94_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/97_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from:
../checkpoints/CIFAR100_40_20x3voro/100_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
(21, 300)

##### current_task: 7 #####
[output] current classes [232 233 234 235 236 237 238 239 240 241 242 243]
all classes 0 -> 243
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/40_model.pkl
module.classifier.weight      torch.Size([160, 512])   81920   True
total: 81920

```



```

> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/43_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/46_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/49_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/52_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/55_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/58_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/61_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/64_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/67_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/70_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/73_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/76_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/79_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/82_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/85_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/88_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144

```

```

> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/91_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/94_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/97_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from:
../checkpoints/CIFAR100_40_20x3voro/100_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
(21, 300)

```

```
##### current_task: 8 #####
```

```
[output] current classes [244 245 246 247 248 249 250 251 252 253 254 255]
```

```
all classes 0 -> 255
```

```

> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/40_model.pkl
module.classifier.weight      torch.Size([160, 512])   81920   True
total: 81920
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/43_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/46_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/49_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/52_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/55_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/58_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/61_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/64_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/67_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144

```

```

> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/70_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/73_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/76_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/79_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/82_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/85_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/88_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/91_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/94_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/97_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from:
../checkpoints/CIFAR100_40_20x3voro/100_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
(21, 300)

```

```
##### current_task: 9 #####
```

```
[output] current classes [256 257 258 259 260 261 262 263 264 265 266 267]
```

```
all classes 0 -> 267
```

```

> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/40_model.pkl
module.classifier.weight      torch.Size([160, 512])   81920   True
total: 81920
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/43_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/46_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144

```

```

> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/49_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/52_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/55_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/58_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/61_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/64_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/67_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/70_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/73_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/76_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/79_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/82_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/85_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/88_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/91_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/94_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144

```

```

> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/97_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from:
../checkpoints/CIFAR100_40_20x3voro/100_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
(21, 300)

##### current_task: 10 #####
[output] current classes [268 269 270 271 272 273 274 275 276 277 278 279]
all classes 0 -> 279
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/40_model.pkl
module.classifier.weight      torch.Size([160, 512])   81920   True
total: 81920
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/43_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/46_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/49_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/52_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/55_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/58_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/61_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/64_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/67_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/70_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/73_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144

```

```

> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/76_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/79_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/82_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/85_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/88_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/91_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/94_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/97_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from:
../checkpoints/CIFAR100_40_20x3voro/100_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
(21, 300)

```

```
##### current_task: 11 #####
```

```
[output] current classes [280 281 282 283 284 285 286 287 288 289 290 291]
```

```
all classes 0 -> 291
```

```

> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/40_model.pkl
module.classifier.weight      torch.Size([160, 512])   81920   True
total: 81920
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/43_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/46_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/49_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/52_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144

```

```

> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/55_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/58_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/61_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/64_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/67_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/70_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/73_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/76_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/79_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/82_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/85_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/88_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/91_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/94_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/97_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from:
../checkpoints/CIFAR100_40_20x3voro/100_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True

```

```
total: 6144
(21, 300)
```

```
##### current_task: 12 #####
```

```
[output] current classes [292 293 294 295 296 297 298 299 300 301 302 303]
```

```
all classes 0 -> 303
```

```
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/40_model.pkl
module.classifier.weight      torch.Size([160, 512])  81920    True
total: 81920
```

```
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/43_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144     True
total: 6144
```

```
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/46_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144     True
total: 6144
```

```
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/49_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144     True
total: 6144
```

```
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/52_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144     True
total: 6144
```

```
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/55_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144     True
total: 6144
```

```
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/58_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144     True
total: 6144
```

```
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/61_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144     True
total: 6144
```

```
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/64_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144     True
total: 6144
```

```
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/67_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144     True
total: 6144
```

```
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/70_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144     True
total: 6144
```

```
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/73_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144     True
total: 6144
```

```
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/76_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144     True
total: 6144
```

```
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/79_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144     True
total: 6144
```



```

> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/82_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/85_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/88_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/91_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/94_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/97_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from:
../checkpoints/CIFAR100_40_20x3voro/100_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
(21, 300)

```

```
##### current_task: 13 #####
```

```

[output] current classes [304 305 306 307 308 309 310 311 312 313 314 315]
all classes 0 -> 315
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/40_model.pkl
module.classifier.weight      torch.Size([160, 512])   81920   True
total: 81920
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/43_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/46_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/49_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/52_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/55_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/58_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144

```

```

> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/61_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/64_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/67_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/70_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/73_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/76_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/79_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/82_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/85_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/88_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/91_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/94_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/97_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from:
../checkpoints/CIFAR100_40_20x3voro/100_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
(21, 300)

##### current_task: 14 #####
[output] current classes [316 317 318 319 320 321 322 323 324 325 326 327]
all classes 0 -> 327

```

```

> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/40_model.pkl
module.classifier.weight      torch.Size([160, 512])  81920   True
total: 81920
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/43_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/46_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/49_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/52_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/55_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/58_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/61_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/64_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/67_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/70_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/73_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/76_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/79_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/82_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/85_model.pkl
module.classifier.weight      torch.Size([12, 512])   6144    True
total: 6144

```

```

> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/88_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/91_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/94_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/97_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from:
../checkpoints/CIFAR100_40_20x3voro/100_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
(21, 300)

```

```
##### current_task: 15 #####
```

```
[output] current classes [328 329 330 331 332 333 334 335 336 337 338 339]
```

```
all classes 0 -> 339
```

```

> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/40_model.pkl
module.classifier.weight      torch.Size([160, 512])   81920   True
total: 81920
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/43_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/46_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/49_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/52_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/55_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/58_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/61_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/64_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144

```

```

> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/67_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/70_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/73_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/76_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/79_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/82_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/85_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/88_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/91_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/94_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/97_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from:
../checkpoints/CIFAR100_40_20x3voro/100_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
(21, 300)

```

```
##### current_task: 16 #####
```

```
[output] current classes [340 341 342 343 344 345 346 347 348 349 350 351]
```

```
all classes 0 -> 351
```

```

> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/40_model.pkl
module.classifier.weight      torch.Size([160, 512])   81920   True
total: 81920
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/43_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144

```

```

> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/46_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/49_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/52_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/55_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/58_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/61_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/64_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/67_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/70_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/73_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/76_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/79_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/82_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/85_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/88_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/91_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144

```

```

> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/94_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/97_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from:
../checkpoints/CIFAR100_40_20x3voro/100_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
(21, 300)

```

```
##### current_task: 17 #####
```

```

[output] current classes [352 353 354 355 356 357 358 359 360 361 362 363]
all classes 0 -> 363
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/40_model.pkl
module.classifier.weight      torch.Size([160, 512])   81920   True
total: 81920
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/43_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/46_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/49_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/52_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/55_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/58_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/61_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/64_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/67_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/70_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144

```

```

> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/73_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/76_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/79_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/82_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/85_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/88_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/91_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/94_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/97_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from:
../checkpoints/CIFAR100_40_20x3voro/100_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
(21, 300)

```

```
##### current_task: 18 #####
```

```

[output] current classes [364 365 366 367 368 369 370 371 372 373 374 375]
all classes 0 -> 375
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/40_model.pkl
module.classifier.weight      torch.Size([160, 512])   81920   True
total: 81920
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/43_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/46_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/49_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144

```



```

> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/52_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/55_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/58_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/61_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/64_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/67_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/70_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/73_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/76_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/79_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/82_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/85_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/88_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/91_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/94_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/97_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144

```

```

> loaded base phase model from:
../checkpoints/CIFAR100_40_20x3voro/100_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
(21, 300)

##### current_task: 19 #####
[output] current classes [376 377 378 379 380 381 382 383 384 385 386 387]
all classes 0 -> 387
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/40_model.pkl
module.classifier.weight      torch.Size([160, 512])   81920    True
total: 81920
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/43_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/46_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/49_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/52_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/55_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/58_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/61_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/64_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/67_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/70_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/73_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/76_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144

```

```

> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/79_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/82_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/85_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/88_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/91_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/94_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/97_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from:
../checkpoints/CIFAR100_40_20x3voro/100_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
(21, 300)

```

```
##### current_task: 20 #####
```

```

[output] current classes [388 389 390 391 392 393 394 395 396 397 398 399]
all classes 0 -> 399
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/40_model.pkl
module.classifier.weight      torch.Size([160, 512])   81920   True
total: 81920
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/43_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/46_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/49_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/52_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/55_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144

```

```

> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/58_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/61_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/64_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/67_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/70_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/73_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/76_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/79_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/82_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/85_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/88_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/91_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/94_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from: ../checkpoints/CIFAR100_40_20x3voro/97_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
> loaded base phase model from:
../checkpoints/CIFAR100_40_20x3voro/100_model.pkl
module.classifier.weight      torch.Size([12, 512])    6144    True
total: 6144
(21, 300)

```

```
[178]: print('cliques by test samples:', pred_in_clique.shape)

# compute prototypes
be      = 0.6 # 1.
l2      = True # False True
bias    = 0 # 0.05
protots  = np.mean(feats_trans(support_data_, beta=be, l2=l2, bias=bias), axis=1)
query_pts = feats_trans(query_data_, beta=be, l2=l2, bias=bias)
# acenss  = feats_trans(acens, beta=be, l2=l2, bias=bias)
if brother:
    dist    = funbtch(query_pts, protots) # protots / acenss
else:
    dist    = fun(query_pts, protots) # protots / acenss

test_splt = [sum(test_share[:t+1]) for t in range(len(test_share))]
```

cliques by test samples: (21, 10000)

```
[179]: dist_in_clique = np.zeros_like(pred_in_clique, dtype=np.float32)
for c_id, clique in enumerate(pred_in_clique):
    for s_id, samp in enumerate(clique):
        dist_in_clique[c_id][s_id] = dist[s_id][samp]
```

```
[193]: for i in range(task_num + 1):
        clique_dist = dist_in_clique[:i+1,:test_splt[i]]
        clique_pred = np.argmax(clique_dist, axis=0)
        merge_pred = [pred_in_clique[cli,s_id] for s_id, cli in
            →enumerate(clique_pred)]
        merge_acc = np.mean(merge_pred == query_label_[:test_splt[i]])
        print(merge_acc)
print('DaC:', 'beta:', be, '| l2:', l2)
```

```
[28]: print('===== Experiment Done! =====')
```

===== Experiment Done! =====

## iVoro on TinyImageNet Dataset (5 Phases)

```
[1]: import matplotlib.pyplot as plt
import os
import pickle
import numpy as np
import pandas as pd
import seaborn as sns
import time
import sys
sys.path.append('../')
sys.path.append('../analysis/')
import copy
import platform
import json
import pickle
import random

import torch
from scipy.stats import mode
```

```
[63]: from ResNet import resnet18_cbam

data_name      = 'Tiny' # 'Subset' # 'Tiny' # 'CIFAR100' # 'MNIST'
total_nc       = 200 # 200 # 100 # 10
fg_nc          = 100 # 100 # 40 # 50 # 4
task_num       = 5 # 20 # 5 # 10 # 2

# constant params
class_set      = list(range(total_nc))
ROTATION       = True
EMB2D          = False
DESIGN         = True
virtual_class  = 4*total_nc if ROTATION else total_nc
suffix         = 'voro' # 'prob' 'voro'
assert (total_nc - fg_nc)%task_num == 0
task_size      = int((total_nc - fg_nc)/task_num)
file_name      = _
    ↳data_name+'_'+str(fg_nc)+'_'+str(task_num)+'x'+str(task_size)+suffix
```

```
print(file_name)

brother      = False # True False
```

Tiny\_100\_5x20voro

```
[64]: save_path = '../checkpoints/'
      path      = save_path + file_name + '/'
      filename   = path + '%d_model.pkl' % (fg_nc+0) # +5
      model      = torch.load(filename)
      model.eval()
      print('> loaded base phase model from:', filename)
```

> loaded base phase model from: ../checkpoints/Tiny\_100\_5x20voro/100\_model.pkl

```
[65]: from voro_helper import num_param, t2n, \
      load_feat, sanity_check, \
      id2emb_, num_samp, merge_sc, funbtch

num_param(model)

# voronoi centers:
vcenter = t2n(model.module.classifier.weight.data / 2.)
print(vcenter.shape)
```

```
module.classifier.weight      torch.Size([400, 512])  204800  True
total: 204800
(400, 512)
```

```
[66]: '''
      CIFAR:
          'CIFAR100_50_5x10_test.pkl'
          'CIFAR100_50_5x10_train.pkl'
          'CIFAR100_40_20x3_test.pkl'
          'CIFAR100_40_20x3_train.pkl'
      more CIFAR:
          'CIFAR100_40_12x5_test.pkl'
          'CIFAR100_40_12x5_train.pkl'
          'CIFAR100_30_14x5_test.pkl'
          'CIFAR100_30_14x5_train.pkl'
          'CIFAR100_20_16x5_test.pkl'
          'CIFAR100_20_16x5_train.pkl'
          'CIFAR100_10_18x5_test.pkl'
          'CIFAR100_10_18x5_train.pkl'
      Tiny:
          'Tiny_100_20x5_test.pkl'
          'Tiny_100_20x5_train.pkl'
      TinyL3:
```

```

        'Tiny_100_5x20_test.pkl'
        'Tiny_100_5x20_train.pkl'
Subset:
        'Subset_50_10x5_test.pkl'
        'Subset_50_10x5_train.pkl'
'''
ffile = '../embedding/prob/' + 'Tiny_100_20x5_test.pkl' # prob probL3
data_phas, last_tsk = load_feat(ffile)

labs, embeds, outputs = data_phas[last_tsk][last_tsk]
false_id, pred_ = sanity_check(labs, embeds, outputs)

```

```

feature file: ../embedding/prob/Tiny_100_20x5_test.pkl
> loaded tasks: dict_keys([20])
> classes: [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18,
19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38,
39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58,
59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78,
79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98,
99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114,
115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130,
131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146,
147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162,
163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178,
179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194,
195, 196, 197, 198, 199]
> samples: 10000
> embedding: 512
> classification: 800
~ acc (single): 51.51%
~ acc (quadruple): 46.10%

```

```

[67]: ffile = '../embedding/prob/' + 'Tiny_100_20x5_train.pkl' # prob probL3
data_phas, last_tsk = load_feat(ffile)

labst, embedst, outputst = data_phas[last_tsk][last_tsk]
false_id, pred_ = sanity_check(labst, embedst, outputst)

```

```

feature file: ../embedding/prob/Tiny_100_20x5_train.pkl
> loaded tasks: dict_keys([20])
> classes: [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18,
19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38,
39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58,
59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78,
79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98,
99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114,
115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130,
131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146,

```



```

147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162,
163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178,
179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194,
195, 196, 197, 198, 199]
> samples: 99968
> embedding: 512
> classification: 800
~ acc (single): 71.57%
~ acc (quadruple): 67.88%

```

```

[68]: embs = id2emb_(labs, embeds, brother=brother)
      embst = id2emb_(labst, embedst, brother=brother)

```

```

      sam_max, sam_min = num_samp(embst)
      print('> loading data done!')

```

```

0 498,1 500,2 500,3 500,4 500,5 500,6 500,7 500,8 500,9 500,10 500,11 500,12
500,13 499,14 500,15 500,16 500,17 500,18 500,19 500,20 500,21 499,22 500,23
500,24 500,25 500,26 500,27 500,28 499,29 500,30 500,31 500,32 500,33 500,34
500,35 500,36 500,37 500,38 500,39 499,40 500,41 500,42 500,43 500,44 500,45
500,46 500,47 500,48 500,49 499,50 500,51 499,52 500,53 500,54 500,55 500,56
500,57 500,58 500,59 500,60 500,61 500,62 499,63 500,64 500,65 500,66 500,67
500,68 500,69 499,70 500,71 500,72 500,73 499,74 499,75 500,76 500,77 500,78
500,79 500,80 500,81 498,82 499,83 500,84 500,85 500,86 500,87 500,88 500,89
500,90 500,91 500,92 500,93 498,94 500,95 500,96 500,97 500,98 499,99 499,100
500,101 500,102 499,103 500,104 500,105 500,106 500,107 500,108 500,109 500,110
499,111 500,112 500,113 500,114 500,115 500,116 499,117 500,118 500,119 500,120
500,121 500,122 500,123 500,124 500,125 500,126 500,127 500,128 500,129 500,130
500,131 500,132 500,133 500,134 500,135 500,136 500,137 500,138 500,139 500,140
500,141 500,142 500,143 500,144 499,145 500,146 500,147 500,148 500,149 500,150
499,151 500,152 499,153 499,154 500,155 500,156 500,157 500,158 500,159 499,160
500,161 500,162 500,163 500,164 500,165 500,166 500,167 500,168 500,169 500,170
500,171 500,172 500,173 500,174 500,175 500,176 500,177 499,178 500,179 500,180
500,181 500,182 499,183 500,184 500,185 500,186 500,187 499,188 500,189 500,190
500,191 500,192 500,193 500,194 500,195 500,196 498,197 500,198 500,199 500,
max samples: 500
min samples: 498
> loading data done!

```

```

[69]: for k,v in embst.items():
      if v.shape[0] < sam_max:
          rid = np.random.choice(v.shape[0], sam_max-v.shape[0], replace=False)
          print('filling', sam_max-v.shape[0], 'samples')
          embst[k] = np.vstack((v, v[rid]))

```

```

filling 2 samples
filling 1 samples
filling 1 samples
filling 1 samples

```

[illegible]

```
[70]: from voro_helper import get_task_data, feat_trans, NC_o, tsk_cls, fun, \
      ↪ acc_brother, forgetting

      i = task_num
      support_data_, support_label_, query_data_, query_label_, n_ways_, n_shot_, _ = \
          get_task_data(embst, embs, i, fg_nc, class_set, task_size, brother=brother)
```

```
##### current_task: 5 #####
current classes [180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191,
192, 193, 194, 195, 196, 197, 198, 199]
[output] all classes 0 -> 199
```

```
[71]: %% =====
      ↪ =====
be      = 1. # 1.
l2      = False # False True
protots = np.mean(feats_trans(support_data_, beta=be, l2=l2), axis=1)
```

```
[72]: i = 0
support_data, support_label, query_data, query_label, n_ways, n_shot, classes = \
    get_task_data(embst, embs, i, fg_nc, class_set, task_size, brother=brother)
acc, _, nn_pre = NC_o(support_data, support_label,
```

```

query_data, query_label,
n_ways, n_shot,
beta = be, l2 = l2,
given_cen = protots[classes], given_only = True,
brother = brother)

```

```

##### current_task: 0 #####
current classes [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17,
18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37,
38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57,
58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77,
78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97,
98, 99]
[output] all classes 0 -> 99
0.5318

```

```

[73]: local      = False # True / False
nn_acc    = []
savefile  = path+'NN' if brother else None # NN / NNp / NN3 / only saved NN
→results!
savefil2  = path+'NN3'
forget    = True # True False # calculate forgetting
class_ladder = []
a         = []
for i in range(task_num + 1):
    support_data, support_label, query_data, query_label, n_ways, n_shot,
→classes = \
        get_task_data(embst, embs, i, fg_nc, class_set, task_size,
            local = local, brother = brother) # False
    if forget:
        class_ladder.append(classes)
    acc, _, nn_pre = NC_o(support_data, support_label,
        query_data, query_label,
        n_ways, n_shot,
        beta = be, l2 = l2,
        given_cen = protots[classes] if local else protots[:
→classes[-1]+1],
        given_only = True,
        brother = brother,
        savefile  = savefile+'_'+str(i) if brother else None,
        savefile2 = None, # savefil2+'_'+str(i), # None, #
        weights = [0.7, 0.3],
        class_ladder = class_ladder,
        acc_all = a
    )
nn_acc.append(acc)

```

```

    # if all classes up2now: local = False, and protots[:classes[-1]+1]
print('local:', local, '| beta:', be, '| l2:', l2)
if brother:
    for accs in nn_acc:
        print('\t'.join([str(i) for i in accs]))
else:
    print('\n'.join([str(i) for i in nn_acc]))
if forget:
    avgf = forgetting(a, task_num)
    print(avgf)

```

```

##### current_task: 0 #####
current classes [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17,
18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37,
38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57,
58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77,
78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97,
98, 99]
[output] all classes 0 -> 99
0.5318

```

```

##### current_task: 1 #####
current classes [100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111,
112, 113, 114, 115, 116, 117, 118, 119]
[output] all classes 0 -> 119
0.4885

```

```

##### current_task: 2 #####
current classes [120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131,
132, 133, 134, 135, 136, 137, 138, 139]
[output] all classes 0 -> 139
0.4604

```

```

##### current_task: 3 #####
current classes [140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151,
152, 153, 154, 155, 156, 157, 158, 159]
[output] all classes 0 -> 159
0.4349

```

```

##### current_task: 4 #####
current classes [160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171,
172, 173, 174, 175, 176, 177, 178, 179]
[output] all classes 0 -> 179
0.4088

```

```

##### current_task: 5 #####
current classes [180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191,

```

```

192, 193, 194, 195, 196, 197, 198, 199]
[output] all classes 0 -> 199
0.3827
local: False | beta: 1.0 | l2: False
0.5318
0.4885
0.4604285714285714
0.434875
0.4087777777777778
0.3827
[[0.5318 0.      0.      0.      0.      0.      ]
 [0.4976 0.443  0.      0.      0.      0.      ]
 [0.4736 0.421  0.434  0.      0.      0.      ]
 [0.4564 0.416  0.402  0.379  0.      0.      ]
 [0.4408 0.397  0.385  0.354  0.339  0.      ]
 [0.4282 0.38   0.371  0.336  0.331  0.268 ]]
[0, 3.4200000000000006, 4.01000000000000025, 4.4800000000000003, 5.275, 5.612]

```

```

[74]: def predict(model, x, voro=True):
        x = torch.from_numpy(x.astype(np.float32)).cuda()
        with torch.no_grad():
            predi = model.module.classifier(x)
        if voro:
            predi += - torch.sum((model.module.classifier.weight/2.)**2, dim=1)
        return predi

classes_all = []
test_share = []
paccS = []
for i in range(task_num + 1):
    support_data, support_label, query_data, query_label, n_ways, n_shot, \
    classes = \
        get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                        local = True, brother = brother)

    # load model:
    if brother:
        cls_01 = classes[-1]+1
        assert cls_01 % 4 == 0
        filename = path + '%d_model.pkl' % (int(cls_01/4))
    else:
        filename = path + '%d_model.pkl' % (classes[-1]+1)
    model = torch.load(filename)
    model.eval()
    print('> loaded base phase model from:', filename)
    num_param(model)
    # do prediction:
    min_cls = min(classes)

```

```

    if brother:
        pred = predict(model, query_data)
    else:
        pred = predict(model, query_data)[:,:,:4]
    pmax = torch.max(pred, dim=1)[1]
    pacc = np.mean(t2n(pmax) == query_label - min_cls)
    print(pacc)
    if brother:
        accs = acc_brother(t2n(pred), t2n(pmax), query_label - min_cls,
→forLG=True)
        pacc = [pacc] + accs
        paccS.append(pacc)
        classes_all.append(classes)
        test_share.append(len(query_label))
print('all logistic locally:')
if brother:
    for accs in paccS:
        print('\t'.join([str(i) for i in accs]))
else:
    print('\n'.join([str(i) for i in paccS]))

```

##### current\_task: 0 #####

[output] current classes [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99]

all classes 0 -> 99

> loaded base phase model from: ../checkpoints/Tiny\_100\_5x20voro/100\_model.pkl

module.classifier.weight torch.Size([400, 512]) 204800 True

total: 204800

0.6284

##### current\_task: 1 #####

[output] current classes [100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119]

all classes 0 -> 119

> loaded base phase model from: ../checkpoints/Tiny\_100\_5x20voro/120\_model.pkl

module.classifier.weight torch.Size([80, 512]) 40960 True

total: 40960

0.766

##### current\_task: 2 #####

[output] current classes [120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139]

all classes 0 -> 139

```

> loaded base phase model from: ../checkpoints/Tiny_100_5x20voro/140_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
0.801

##### current_task: 3 #####
[output] current classes [140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150,
151, 152, 153, 154, 155, 156, 157, 158, 159]
all classes 0 -> 159
> loaded base phase model from: ../checkpoints/Tiny_100_5x20voro/160_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
0.801

##### current_task: 4 #####
[output] current classes [160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170,
171, 172, 173, 174, 175, 176, 177, 178, 179]
all classes 0 -> 179
> loaded base phase model from: ../checkpoints/Tiny_100_5x20voro/180_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
0.752

##### current_task: 5 #####
[output] current classes [180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190,
191, 192, 193, 194, 195, 196, 197, 198, 199]
all classes 0 -> 199
> loaded base phase model from: ../checkpoints/Tiny_100_5x20voro/200_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
0.783
all logistic locally:
0.6284
0.766
0.801
0.801
0.752
0.783

```

```

[75]: for i in range(task_num + 1):
        support_data, support_label, query_data, query_label, n_ways, n_shot,
        classes = \
            get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                           local = True, brother = brother)
        pred_all = []
        for classes in classes_all:
            # load model:

```

```

if brother:
    cls_01 = classes[-1]+1
    assert cls_01 % 4 == 0
    filename = path + '%d_model.pkl' % (int(cls_01/4))
else:
    filename = path + '%d_model.pkl' % (classes[-1]+1)
model = torch.load(filename)
model.eval()
print('> loaded base phase model from:', filename)
num_param(model)
# do prediction:
min_cls = min(classes)
if brother:
    pred = predict(model, query_data)
else:
    pred = predict(model, query_data)[:,:,:4]
pmax = torch.max(pred, dim=1)[1]
# pacc = np.mean(t2n(pmax) == query_label - min_cls)
# print(pacc)
if brother:
    labs_01 = query_label[:4]//4
    acc_, sc_pre = merge_sc(t2n(pred), labs_01,
                           mth='softmax', forLG=True, return_pre=True)
    min_cls = int(min_cls / 4)
    pred_all.append( (sc_pre + min_cls).tolist() )
else:
    pred_all.append( (t2n(pmax) + min_cls).tolist() )
pred_all = np.array(pred_all)
print(pred_all.shape)

if i == 0:
    pred_in_clique = copy.deepcopy(pred_all)
else:
    pred_in_clique = np.hstack((pred_in_clique, pred_all))

```

##### current\_task: 0 #####

[output] current classes [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99]

all classes 0 -> 99

> loaded base phase model from: ../checkpoints/Tiny\_100\_5x20voro/100\_model.pkl

module.classifier.weight torch.Size([400, 512]) 204800 True

total: 204800

> loaded base phase model from: ../checkpoints/Tiny\_100\_5x20voro/120\_model.pkl



```

module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
> loaded base phase model from: ../checkpoints/Tiny_100_5x20voro/140_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
> loaded base phase model from: ../checkpoints/Tiny_100_5x20voro/160_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
> loaded base phase model from: ../checkpoints/Tiny_100_5x20voro/180_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
> loaded base phase model from: ../checkpoints/Tiny_100_5x20voro/200_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
(6, 5000)

##### current_task: 1 #####
[output] current classes [100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110,
111, 112, 113, 114, 115, 116, 117, 118, 119]
all classes 0 -> 119
> loaded base phase model from: ../checkpoints/Tiny_100_5x20voro/100_model.pkl
module.classifier.weight      torch.Size([400, 512])   204800   True
total: 204800
> loaded base phase model from: ../checkpoints/Tiny_100_5x20voro/120_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
> loaded base phase model from: ../checkpoints/Tiny_100_5x20voro/140_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
> loaded base phase model from: ../checkpoints/Tiny_100_5x20voro/160_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
> loaded base phase model from: ../checkpoints/Tiny_100_5x20voro/180_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
> loaded base phase model from: ../checkpoints/Tiny_100_5x20voro/200_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
(6, 1000)

##### current_task: 2 #####
[output] current classes [120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130,
131, 132, 133, 134, 135, 136, 137, 138, 139]
all classes 0 -> 139
> loaded base phase model from: ../checkpoints/Tiny_100_5x20voro/100_model.pkl
module.classifier.weight      torch.Size([400, 512])   204800   True
total: 204800
> loaded base phase model from: ../checkpoints/Tiny_100_5x20voro/120_model.pkl

```

```

module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
> loaded base phase model from: ../checkpoints/Tiny_100_5x20voro/140_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
> loaded base phase model from: ../checkpoints/Tiny_100_5x20voro/160_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
> loaded base phase model from: ../checkpoints/Tiny_100_5x20voro/180_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
> loaded base phase model from: ../checkpoints/Tiny_100_5x20voro/200_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
(6, 1000)

```

```

##### current_task: 3 #####
[output] current classes [140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150,
151, 152, 153, 154, 155, 156, 157, 158, 159]
all classes 0 -> 159
> loaded base phase model from: ../checkpoints/Tiny_100_5x20voro/100_model.pkl
module.classifier.weight      torch.Size([400, 512])   204800   True
total: 204800
> loaded base phase model from: ../checkpoints/Tiny_100_5x20voro/120_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
> loaded base phase model from: ../checkpoints/Tiny_100_5x20voro/140_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
> loaded base phase model from: ../checkpoints/Tiny_100_5x20voro/160_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
> loaded base phase model from: ../checkpoints/Tiny_100_5x20voro/180_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
> loaded base phase model from: ../checkpoints/Tiny_100_5x20voro/200_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
(6, 1000)

```

```

##### current_task: 4 #####
[output] current classes [160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170,
171, 172, 173, 174, 175, 176, 177, 178, 179]
all classes 0 -> 179
> loaded base phase model from: ../checkpoints/Tiny_100_5x20voro/100_model.pkl
module.classifier.weight      torch.Size([400, 512])   204800   True
total: 204800
> loaded base phase model from: ../checkpoints/Tiny_100_5x20voro/120_model.pkl

```

```

module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
> loaded base phase model from: ../checkpoints/Tiny_100_5x20voro/140_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
> loaded base phase model from: ../checkpoints/Tiny_100_5x20voro/160_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
> loaded base phase model from: ../checkpoints/Tiny_100_5x20voro/180_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
> loaded base phase model from: ../checkpoints/Tiny_100_5x20voro/200_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
(6, 1000)

##### current_task: 5 #####
[output] current classes [180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190,
191, 192, 193, 194, 195, 196, 197, 198, 199]
all classes 0 -> 199
> loaded base phase model from: ../checkpoints/Tiny_100_5x20voro/100_model.pkl
module.classifier.weight      torch.Size([400, 512])   204800   True
total: 204800
> loaded base phase model from: ../checkpoints/Tiny_100_5x20voro/120_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
> loaded base phase model from: ../checkpoints/Tiny_100_5x20voro/140_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
> loaded base phase model from: ../checkpoints/Tiny_100_5x20voro/160_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
> loaded base phase model from: ../checkpoints/Tiny_100_5x20voro/180_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
> loaded base phase model from: ../checkpoints/Tiny_100_5x20voro/200_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
(6, 1000)

```

```

[76]: print('cliques by test samples:', pred_in_clique.shape)

# compute prototypes
be      = 0.6 # 1.
l2      = True # False True
bias    = 0 # 0.05
protots = np.mean(feats_trans(support_data_, beta=be, l2=l2, bias=bias), axis=1)

```

```

query_pts = feat_trans(query_data_, beta=be, l2=l2, bias=bias)
# acenss    = feat_trans(acens, beta=be, l2=l2, bias=bias)
if brother:
    dist     = funbtch(query_pts, protots) # protots / acenss
else:
    dist     = fun(query_pts, protots) # protots / acenss

test_splt = [sum(test_share[:t+1]) for t in range(len(test_share))]

```

cliques by test samples: (6, 10000)

```

[77]: dist_in_clique = np.zeros_like(pred_in_clique, dtype=np.float32)
      for c_id, clique in enumerate(pred_in_clique):
          for s_id, samp in enumerate(clique):
              dist_in_clique[c_id][s_id] = dist[s_id][samp]

```

```

[78]: for i in range(task_num + 1):
      clique_dist = dist_in_clique[:i+1,:test_splt[i]]
      clique_pred = np.argmax(clique_dist, axis=0)
      merge_pred = [pred_in_clique[cli,s_id] for s_id, cli in
      → enumerate(clique_pred)]
      merge_acc   = np.mean(merge_pred == query_label_[:test_splt[i]])
      print(merge_acc)
      print('DaC:', 'beta:', be, '| l2:', l2)

```

```

0.6284
0.559
0.5267142857142857
0.494
0.4613333333333333
0.4341
DaC: beta: 0.6 | l2: True

```

```

[28]: print('==== Experiment Done! =====')

```

```

===== Experiment Done! =====

```

## iVoro-AC/AI on TinyImageNet Dataset (5 Phases)

```
[9]: import matplotlib.pyplot as plt
import os
import pickle
import numpy as np
import pandas as pd
import seaborn as sns
import time
import sys
sys.path.append('../')
sys.path.append('../analysis/')
import copy
import platform
import json
import pickle
import random

import torch
from scipy.stats import mode
```

```
[10]: from ResNet import resnet18_cbam

data_name      = 'Tiny' # 'Subset' # 'Tiny' # 'CIFAR100' # 'MNIST'
total_nc       = 200 # 200 # 100 # 10
fg_nc          = 100 # 100 # 40 # 50 # 4
task_num       = 5 # 20 # 5 # 10 # 2

# constant params
class_set      = list(range(total_nc))
ROTATION       = True
EMB2D          = False
DESIGN         = True
virtual_class  = 4*total_nc if ROTATION else total_nc
suffix         = 'voro' # 'prob' 'voro'
assert (total_nc - fg_nc)%task_num == 0
task_size      = int((total_nc - fg_nc)/task_num)
file_name      = _
    ↳data_name+'_'+str(fg_nc)+'_'+str(task_num)+'x'+str(task_size)+suffix
```

```
print(file_name)

brother      = True # True False
```

Tiny\_100\_5x20voro

```
[11]: save_path = '../checkpoints/'
      path      = save_path + file_name + '/'
      filename   = path + '%d_model.pkl' % (fg_nc+0) # +5
      model      = torch.load(filename)
      model.eval()
      print('> loaded base phase model from:', filename)
```

> loaded base phase model from: ../checkpoints/Tiny\_100\_5x20voro/100\_model.pkl

```
[13]: from voro_helper import num_param, t2n, \
      load_feat, sanity_check, \
      id2emb_, num_samp, merge_sc, funbtch

      num_param(model)

      # voronoi centers:
      vcenter = t2n(model.module.classifier.weight.data / 2.)
      print(vcenter.shape)
```

```
module.classifier.weight      torch.Size([400, 512])  204800  True
total: 204800
(400, 512)
```

```
[14]: '''
      CIFAR:
          'CIFAR100_50_5x10_test.pkl'
          'CIFAR100_50_5x10_train.pkl'
          'CIFAR100_40_20x3_test.pkl'
          'CIFAR100_40_20x3_train.pkl'
      more CIFAR:
          'CIFAR100_40_12x5_test.pkl'
          'CIFAR100_40_12x5_train.pkl'
          'CIFAR100_30_14x5_test.pkl'
          'CIFAR100_30_14x5_train.pkl'
          'CIFAR100_20_16x5_test.pkl'
          'CIFAR100_20_16x5_train.pkl'
          'CIFAR100_10_18x5_test.pkl'
          'CIFAR100_10_18x5_train.pkl'
      Tiny:
          'Tiny_100_20x5_test.pkl'
          'Tiny_100_20x5_train.pkl'
      TinyL3:
```

```

        'Tiny_100_5x20_test.pkl'
        'Tiny_100_5x20_train.pkl'
Subset:
        'Subset_50_10x5_test.pkl'
        'Subset_50_10x5_train.pkl'
'''
ffile = '../embedding/prob/' + 'Tiny_100_20x5_test.pkl' # prob probL3
data_phas, last_tsk = load_feat(ffile)

labs, embeds, outputs = data_phas[last_tsk][last_tsk]
false_id, pred_ = sanity_check(labs, embeds, outputs)

```

```

feature file: ../embedding/prob/Tiny_100_20x5_test.pkl
> loaded tasks: dict_keys([20])
> classes: [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18,
19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38,
39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58,
59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78,
79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98,
99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114,
115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130,
131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146,
147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162,
163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178,
179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194,
195, 196, 197, 198, 199]
> samples: 10000
> embedding: 512
> classification: 800
~ acc (single): 51.51%
~ acc (quadruple): 46.10%

```

```

[15]: ffile = '../embedding/prob/' + 'Tiny_100_20x5_train.pkl' # prob probL3
data_phas, last_tsk = load_feat(ffile)

labst, embedst, outputst = data_phas[last_tsk][last_tsk]
false_id, pred_ = sanity_check(labst, embedst, outputst)

```

```

feature file: ../embedding/prob/Tiny_100_20x5_train.pkl
> loaded tasks: dict_keys([20])
> classes: [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18,
19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38,
39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58,
59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78,
79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98,
99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114,
115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130,
131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146,

```

```

147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162,
163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178,
179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194,
195, 196, 197, 198, 199]
> samples: 99968
> embedding: 512
> classification: 800
~ acc (single): 71.57%
~ acc (quadruple): 67.88%

```

```

[16]: embs = id2emb_(labs, embeds, brother=brother)
      embst = id2emb_(labst, embedst, brother=brother)

      sam_max, sam_min = num_samp(embst)
      print('> loading data done!')

```

```

0 498,1 498,2 498,3 498,4 500,5 500,6 500,7 500,8 500,9 500,10 500,11 500,12
500,13 500,14 500,15 500,16 500,17 500,18 500,19 500,20 500,21 500,22 500,23
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500,35 500,36 500,37 500,38 500,39 500,40 500,41 500,42 500,43 500,44 500,45
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500,57 500,58 500,59 500,60 500,61 500,62 500,63 500,64 500,65 500,66 500,67
500,68 500,69 500,70 500,71 500,72 500,73 500,74 500,75 500,76 500,77 500,78
500,79 500,80 500,81 500,82 500,83 500,84 499,85 499,86 499,87 499,88 500,89
500,90 500,91 500,92 500,93 500,94 500,95 500,96 500,97 500,98 500,99 500,100
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500,121 500,122 500,123 500,124 500,125 500,126 500,127 500,128 500,129 500,130
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500,171 500,172 500,173 500,174 500,175 500,176 500,177 500,178 500,179 500,180
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500,241 500,242 500,243 500,244 500,245 500,246 500,247 500,248 499,249 499,250
499,251 499,252 500,253 500,254 500,255 500,256 500,257 500,258 500,259 500,260
500,261 500,262 500,263 500,264 500,265 500,266 500,267 500,268 500,269 500,270
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500,281 500,282 500,283 500,284 500,285 500,286 500,287 500,288 500,289 500,290
500,291 500,292 499,293 499,294 499,295 499,296 499,297 499,298 499,299 499,300
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```



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499,751 499,752 500,753 500,754 500,755 500,756 500,757 500,758 500,759 500,760  
500,761 500,762 500,763 500,764 500,765 500,766 500,767 500,768 500,769 500,770  
500,771 500,772 500,773 500,774 500,775 500,776 500,777 500,778 500,779 500,780  
500,781 500,782 500,783 500,784 498,785 498,786 498,787 498,788 500,789 500,790  
500,791 500,792 500,793 500,794 500,795 500,796 500,797 500,798 500,799 500,  
max samples: 500

```
min samples: 498
> loading data done!
```

```
[17]: for k,v in embst.items():
      if v.shape[0] < sam_max:
          rid = np.random.choice(v.shape[0], sam_max-v.shape[0], replace=False)
          print('filling', sam_max-v.shape[0], 'samples')
          embst[k] = np.vstack((v, v[rid]))
```

[illegible]

[illegible]

filling	1	samples
filling	1	samples
filling	1	samples
filling	1	samples
filling	1	samples
filling	1	samples
filling	1	samples
filling	1	samples
filling	1	samples
filling	1	samples
filling	1	samples
filling	1	samples
filling	1	samples
filling	1	samples
filling	1	samples
filling	1	samples
filling	1	samples
filling	1	samples
filling	1	samples
filling	1	samples
filling	1	samples
filling	1	samples
filling	2	samples
filling	2	samples
filling	2	samples
filling	2	samples

```
[18]: from voro_helper import get_task_data, feat_trans, NC_o, tsk_cls, fun, \
      ↪ acc_brother, forgetting

      i = task_num
      support_data_, support_label_, query_data_, query_label_, n_ways_, n_shot_, _ = \
          get_task_data(embst, embs, i, fg_nc, class_set, task_size, brother=brother)
```

```
##### current_task: 5 #####
current classes [720 721 722 723 724 725 726 727 728 729 730 731 732 733 734 735
736 737
738 739 740 741 742 743 744 745 746 747 748 749 750 751 752 753 754 755
756 757 758 759 760 761 762 763 764 765 766 767 768 769 770 771 772 773
774 775 776 777 778 779 780 781 782 783 784 785 786 787 788 789 790 791
792 793 794 795 796 797 798 799]
[output] all classes 0 -> 799
```

```
[23]: %% =====
      ↪ =====
be      = 1. # 1.
l2      = False # False True
protots = np.mean(feats_trans(support_data_, beta=be, l2=l2), axis=1)
```

```
[25]: i = 0
support_data, support_label, query_data, query_label, n_ways, n_shot, classes = \
    get_task_data(embst, embs, i, fg_nc, class_set, task_size, brother=brother)
acc, _, nn_pre = NC_o(support_data, support_label,
                      query_data, query_label,
                      n_ways, n_shot,
                      beta = be, l2 = l2,
                      given_cen = protots[classes], given_only = True,
                      brother = brother)
```

```
[26]: local      = False # True / False
nn_acc      = []
savefile = path+'NNp' if brother else None # NN / NNp / NN3 / only saved NN
→results!
savefil2 = path+'NN3'
forget      = True # True False # calculate forgetting
class_ladder = []
a           = []
for i in range(task_num + 1):
    support_data, support_label, query_data, query_label, n_ways, n_shot,
→classes = \
        get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                      local = local, brother = brother) # False
    if forget:
        class_ladder.append(classes)
    acc, _, nn_pre = NC_o(support_data, support_label,
                          query_data, query_label,
                          n_ways, n_shot,
                          beta = be, l2 = l2,
                          given_cen = protots[classes] if local else protots[:
→classes[-1]+1],
                          given_only = True,
                          brother = brother,
                          savefile = savefile+'_'+str(i) if brother else None,
                          savefile2 = None, # savefil2+'_'+str(i), # None, #
                          weights = [0.7, 0.3],
                          class_ladder = class_ladder,
                          acc_all = a
                          )
    nn_acc.append(acc)
    # if all classes up2now: local = False, and protots[:classes[-1]+1]
print('local:', local, '| beta:', be, '| l2:', l2)
if brother:
    for accs in nn_acc:
        print('\t'.join([str(i) for i in accs]))
else:
    print('\n'.join([str(i) for i in nn_acc]))
```

```

if forget:
    avgf = forgetting(a, task_num)
    print(avgf)

```

```

##### current_task: 0 #####
current classes [ 0  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15
16 17
 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35
 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53
 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71
 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89
 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107
108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125
126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143
144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161
162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179
180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197
198 199 200 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215
216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233
234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250 251
252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269
270 271 272 273 274 275 276 277 278 279 280 281 282 283 284 285 286 287
288 289 290 291 292 293 294 295 296 297 298 299 300 301 302 303 304 305
306 307 308 309 310 311 312 313 314 315 316 317 318 319 320 321 322 323
324 325 326 327 328 329 330 331 332 333 334 335 336 337 338 339 340 341
342 343 344 345 346 347 348 349 350 351 352 353 354 355 356 357 358 359
360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375 376 377
378 379 380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395
396 397 398 399]
[output] all classes 0 -> 399
<<< loaded from: ../checkpoints/Tiny_100_5x20voro/NNp_0.npy
0.4657

##### current_task: 1 #####
current classes [400 401 402 403 404 405 406 407 408 409 410 411 412 413 414 415
416 417
 418 419 420 421 422 423 424 425 426 427 428 429 430 431 432 433 434 435
 436 437 438 439 440 441 442 443 444 445 446 447 448 449 450 451 452 453
 454 455 456 457 458 459 460 461 462 463 464 465 466 467 468 469 470 471
 472 473 474 475 476 477 478 479]
[output] all classes 0 -> 479
<<< loaded from: ../checkpoints/Tiny_100_5x20voro/NNp_1.npy
0.4298

##### current_task: 2 #####
current classes [480 481 482 483 484 485 486 487 488 489 490 491 492 493 494 495
496 497

```

```

498 499 500 501 502 503 504 505 506 507 508 509 510 511 512 513 514 515
516 517 518 519 520 521 522 523 524 525 526 527 528 529 530 531 532 533
534 535 536 537 538 539 540 541 542 543 544 545 546 547 548 549 550 551
552 553 554 555 556 557 558 559]
[output] all classes 0 -> 559
<<< loaded from: ../checkpoints/Tiny_100_5x20voro/NNp_2.npy
0.4045

##### current_task: 3 #####
current classes [560 561 562 563 564 565 566 567 568 569 570 571 572 573 574 575
576 577
578 579 580 581 582 583 584 585 586 587 588 589 590 591 592 593 594 595
596 597 598 599 600 601 602 603 604 605 606 607 608 609 610 611 612 613
614 615 616 617 618 619 620 621 622 623 624 625 626 627 628 629 630 631
632 633 634 635 636 637 638 639]
[output] all classes 0 -> 639
<<< loaded from: ../checkpoints/Tiny_100_5x20voro/NNp_3.npy
0.3754

##### current_task: 4 #####
current classes [640 641 642 643 644 645 646 647 648 649 650 651 652 653 654 655
656 657
658 659 660 661 662 663 664 665 666 667 668 669 670 671 672 673 674 675
676 677 678 679 680 681 682 683 684 685 686 687 688 689 690 691 692 693
694 695 696 697 698 699 700 701 702 703 704 705 706 707 708 709 710 711
712 713 714 715 716 717 718 719]
[output] all classes 0 -> 719
<<< loaded from: ../checkpoints/Tiny_100_5x20voro/NNp_4.npy
0.3501

##### current_task: 5 #####
current classes [720 721 722 723 724 725 726 727 728 729 730 731 732 733 734 735
736 737
738 739 740 741 742 743 744 745 746 747 748 749 750 751 752 753 754 755
756 757 758 759 760 761 762 763 764 765 766 767 768 769 770 771 772 773
774 775 776 777 778 779 780 781 782 783 784 785 786 787 788 789 790 791
792 793 794 795 796 797 798 799]
[output] all classes 0 -> 799
<<< loaded from: ../checkpoints/Tiny_100_5x20voro/NNp_5.npy
0.3285
local: False | beta: 1.0 | l2: False
0.46575 0.7036 0.8204 0.8116 0.7684
0.4298333333333333 0.6545 0.7825 0.7735 0.7261666666666666
0.4045 0.6201428571428571 0.7334285714285714 0.7251428571428571
0.6661428571428571
0.3754375 0.573375 0.712875 0.70575 0.646375
0.3500833333333333 0.5355555555555555 0.685 0.6755555555555555
0.6181111111111111

```

```

0.3285  0.4978  0.6584  0.6506  0.5907
[[0.46575 0.      0.      0.      0.      0.      ]
 [0.4465  0.3465  0.      0.      0.      0.      ]
 [0.43105 0.33175 0.3445  0.      0.      0.      ]
 [0.42315 0.33    0.32575 0.232  0.      0.      ]
 [0.4134  0.3155  0.30975 0.21875 0.23975 0.      ]
 [0.40565 0.30875 0.29725 0.213  0.2355  0.20225]]
[0, 1.9249999999999999, 2.4724999999999997, 2.5949999999999997,
3.2837499999999998, 3.3669999999999998]

```

```

[27]: def predict(model, x, voro=True):
        x = torch.from_numpy(x.astype(np.float32)).cuda()
        with torch.no_grad():
            predi = model.module.classifier(x)
        if voro:
            predi += - torch.sum((model.module.classifier.weight/2.)**2, dim=1)
        return predi

classes_all = []
test_share = []
paccS = []
for i in range(task_num + 1):
    support_data, support_label, query_data, query_label, n_ways, n_shot, \
    →classes = \
        get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                        local = True, brother = brother)

    # load model:
    if brother:
        cls_01 = classes[-1]+1
        assert cls_01 % 4 == 0
        filename = path + '%d_model.pkl' % (int(cls_01/4))
    else:
        filename = path + '%d_model.pkl' % (classes[-1]+1)
    model = torch.load(filename)
    model.eval()
    print('> loaded base phase model from:', filename)
    num_param(model)
    # do prediction:
    min_cls = min(classes)
    if brother:
        pred = predict(model, query_data)
    else:
        pred = predict(model, query_data)[:,:,:4]
    pmax = torch.max(pred, dim=1)[1]
    pacc = np.mean(t2n(pmax) == query_label - min_cls)
    print(pacc)
    if brother:

```



```

        accs = acc_brother(t2n(pred), t2n(pmax), query_label - min_cls,
→forLG=True)
        pacc = [pacc] + accs
        paccS.append(pacc)
        classes_all.append(classes)
        test_share.append(len(query_label))
print('all logistic locally:')
if brother:
    for accs in paccS:
        print('\t'.join([str(i) for i in accs]))
else:
    print('\n'.join([str(i) for i in paccS]))

```

##### current\_task: 0 #####

[output] current classes [ 0 1 2 3 4 5 6 7 8 9 10 11 12  
13 14 15 16 17

18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35  
36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53  
54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71  
72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89  
90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107  
108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125  
126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143  
144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161  
162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179  
180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197  
198 199 200 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215  
216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233  
234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250 251  
252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269  
270 271 272 273 274 275 276 277 278 279 280 281 282 283 284 285 286 287  
288 289 290 291 292 293 294 295 296 297 298 299 300 301 302 303 304 305  
306 307 308 309 310 311 312 313 314 315 316 317 318 319 320 321 322 323  
324 325 326 327 328 329 330 331 332 333 334 335 336 337 338 339 340 341  
342 343 344 345 346 347 348 349 350 351 352 353 354 355 356 357 358 359  
360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375 376 377  
378 379 380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395  
396 397 398 399]

all classes 0 -> 399

> loaded base phase model from: ../checkpoints/Tiny\_100\_5x20voro/100\_model.pkl  
module.classifier.weight torch.Size([400, 512]) 204800 True  
total: 204800  
0.5617

##### current\_task: 1 #####

[output] current classes [400 401 402 403 404 405 406 407 408 409 410 411 412  
413 414 415 416 417

```

418 419 420 421 422 423 424 425 426 427 428 429 430 431 432 433 434 435
436 437 438 439 440 441 442 443 444 445 446 447 448 449 450 451 452 453
454 455 456 457 458 459 460 461 462 463 464 465 466 467 468 469 470 471
472 473 474 475 476 477 478 479]
all classes 0 -> 479
> loaded base phase model from: ../checkpoints/Tiny_100_5x20voro/120_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
0.69325

##### current_task: 2 #####
[output] current classes [480 481 482 483 484 485 486 487 488 489 490 491 492
493 494 495 496 497
498 499 500 501 502 503 504 505 506 507 508 509 510 511 512 513 514 515
516 517 518 519 520 521 522 523 524 525 526 527 528 529 530 531 532 533
534 535 536 537 538 539 540 541 542 543 544 545 546 547 548 549 550 551
552 553 554 555 556 557 558 559]
all classes 0 -> 559
> loaded base phase model from: ../checkpoints/Tiny_100_5x20voro/140_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
0.71275

##### current_task: 3 #####
[output] current classes [560 561 562 563 564 565 566 567 568 569 570 571 572
573 574 575 576 577
578 579 580 581 582 583 584 585 586 587 588 589 590 591 592 593 594 595
596 597 598 599 600 601 602 603 604 605 606 607 608 609 610 611 612 613
614 615 616 617 618 619 620 621 622 623 624 625 626 627 628 629 630 631
632 633 634 635 636 637 638 639]
all classes 0 -> 639
> loaded base phase model from: ../checkpoints/Tiny_100_5x20voro/160_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
0.709

##### current_task: 4 #####
[output] current classes [640 641 642 643 644 645 646 647 648 649 650 651 652
653 654 655 656 657
658 659 660 661 662 663 664 665 666 667 668 669 670 671 672 673 674 675
676 677 678 679 680 681 682 683 684 685 686 687 688 689 690 691 692 693
694 695 696 697 698 699 700 701 702 703 704 705 706 707 708 709 710 711
712 713 714 715 716 717 718 719]
all classes 0 -> 719
> loaded base phase model from: ../checkpoints/Tiny_100_5x20voro/180_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
0.64425

```

```
##### current_task: 5 #####
[output] current classes [720 721 722 723 724 725 726 727 728 729 730 731 732
733 734 735 736 737
738 739 740 741 742 743 744 745 746 747 748 749 750 751 752 753 754 755
756 757 758 759 760 761 762 763 764 765 766 767 768 769 770 771 772 773
774 775 776 777 778 779 780 781 782 783 784 785 786 787 788 789 790 791
792 793 794 795 796 797 798 799]
all classes 0 -> 799
> loaded base phase model from: ../checkpoints/Tiny_100_5x20voro/200_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
0.703
all logistic locally:
0.5617  0.843   0.91    0.0    0.9362
0.69325 0.933   0.939   0.0    0.966
0.71275 0.966   0.958   0.0    0.986
0.709   0.951   0.932   0.0    0.976
0.64425 0.908   0.887   0.0    0.958
0.703   0.932   0.906   0.0    0.969
```

```
[28]: for i in range(task_num + 1):
        support_data, support_label, query_data, query_label, n_ways, n_shot, \
        classes = \
            get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                           local = True, brother = brother)
        pred_all = []
        for classes in classes_all:
            # load model:
            if brother:
                cls_01 = classes[-1]+1
                assert cls_01 % 4 == 0
                filename = path + '%d_model.pkl' % (int(cls_01/4))
            else:
                filename = path + '%d_model.pkl' % (classes[-1]+1)
            model = torch.load(filename)
            model.eval()
            print('> loaded base phase model from:', filename)
            num_param(model)
            # do prediction:
            min_cls = min(classes)
            if brother:
                pred = predict(model, query_data)
            else:
                pred = predict(model, query_data)[:,:,:4]
            pmax = torch.max(pred, dim=1)[1]
            # pacc = np.mean(t2n(pmax) == query_label - min_cls)
```

```

# print(pacc)
if brother:
    labs_01 = query_label[:,4]//4
    acc_, sc_pre = merge_sc(t2n(pred), labs_01,
                           mth='softmax', forLG=True, return_pre=True)
    min_cls = int(min_cls / 4)
    pred_all.append( (sc_pre + min_cls).tolist() )
else:
    pred_all.append( (t2n(pmax) + min_cls).tolist() )
pred_all = np.array(pred_all)
print(pred_all.shape)

if i == 0:
    pred_in_clique = copy.deepcopy(pred_all)
else:
    pred_in_clique = np.hstack((pred_in_clique, pred_all))

```

##### current\_task: 0 #####

[output] current classes [ 0 1 2 3 4 5 6 7 8 9 10 11 12  
13 14 15 16 17

18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35  
36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53  
54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71  
72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89  
90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107  
108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125  
126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143  
144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161  
162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179  
180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197  
198 199 200 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215  
216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233  
234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250 251  
252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269  
270 271 272 273 274 275 276 277 278 279 280 281 282 283 284 285 286 287  
288 289 290 291 292 293 294 295 296 297 298 299 300 301 302 303 304 305  
306 307 308 309 310 311 312 313 314 315 316 317 318 319 320 321 322 323  
324 325 326 327 328 329 330 331 332 333 334 335 336 337 338 339 340 341  
342 343 344 345 346 347 348 349 350 351 352 353 354 355 356 357 358 359  
360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375 376 377  
378 379 380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395  
396 397 398 399]

all classes 0 -> 399

> loaded base phase model from: ../checkpoints/Tiny\_100\_5x20voro/100\_model.pkl  
module.classifier.weight torch.Size([400, 512]) 204800 True  
total: 204800

> loaded base phase model from: ../checkpoints/Tiny\_100\_5x20voro/120\_model.pkl

```

module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
> loaded base phase model from: ../checkpoints/Tiny_100_5x20voro/140_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
> loaded base phase model from: ../checkpoints/Tiny_100_5x20voro/160_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
> loaded base phase model from: ../checkpoints/Tiny_100_5x20voro/180_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
> loaded base phase model from: ../checkpoints/Tiny_100_5x20voro/200_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
(6, 5000)

```

##### current\_task: 1 #####

```

[output] current classes [400 401 402 403 404 405 406 407 408 409 410 411 412
413 414 415 416 417
 418 419 420 421 422 423 424 425 426 427 428 429 430 431 432 433 434 435
 436 437 438 439 440 441 442 443 444 445 446 447 448 449 450 451 452 453
 454 455 456 457 458 459 460 461 462 463 464 465 466 467 468 469 470 471
 472 473 474 475 476 477 478 479]
all classes 0 -> 479
> loaded base phase model from: ../checkpoints/Tiny_100_5x20voro/100_model.pkl
module.classifier.weight      torch.Size([400, 512])  204800   True
total: 204800
> loaded base phase model from: ../checkpoints/Tiny_100_5x20voro/120_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960   True
total: 40960
> loaded base phase model from: ../checkpoints/Tiny_100_5x20voro/140_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960   True
total: 40960
> loaded base phase model from: ../checkpoints/Tiny_100_5x20voro/160_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960   True
total: 40960
> loaded base phase model from: ../checkpoints/Tiny_100_5x20voro/180_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960   True
total: 40960
> loaded base phase model from: ../checkpoints/Tiny_100_5x20voro/200_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960   True
total: 40960
(6, 1000)

```

##### current\_task: 2 #####

```

[output] current classes [480 481 482 483 484 485 486 487 488 489 490 491 492
493 494 495 496 497
 498 499 500 501 502 503 504 505 506 507 508 509 510 511 512 513 514 515

```

```

516 517 518 519 520 521 522 523 524 525 526 527 528 529 530 531 532 533
534 535 536 537 538 539 540 541 542 543 544 545 546 547 548 549 550 551
552 553 554 555 556 557 558 559]
all classes 0 -> 559
> loaded base phase model from: ../checkpoints/Tiny_100_5x20voro/100_model.pkl
module.classifier.weight      torch.Size([400, 512])  204800  True
total: 204800
> loaded base phase model from: ../checkpoints/Tiny_100_5x20voro/120_model.pkl
module.classifier.weight      torch.Size([80, 512])   40960   True
total: 40960
> loaded base phase model from: ../checkpoints/Tiny_100_5x20voro/140_model.pkl
module.classifier.weight      torch.Size([80, 512])   40960   True
total: 40960
> loaded base phase model from: ../checkpoints/Tiny_100_5x20voro/160_model.pkl
module.classifier.weight      torch.Size([80, 512])   40960   True
total: 40960
> loaded base phase model from: ../checkpoints/Tiny_100_5x20voro/180_model.pkl
module.classifier.weight      torch.Size([80, 512])   40960   True
total: 40960
> loaded base phase model from: ../checkpoints/Tiny_100_5x20voro/200_model.pkl
module.classifier.weight      torch.Size([80, 512])   40960   True
total: 40960
(6, 1000)

```

##### current\_task: 3 #####

```

[output] current classes [560 561 562 563 564 565 566 567 568 569 570 571 572
573 574 575 576 577
578 579 580 581 582 583 584 585 586 587 588 589 590 591 592 593 594 595
596 597 598 599 600 601 602 603 604 605 606 607 608 609 610 611 612 613
614 615 616 617 618 619 620 621 622 623 624 625 626 627 628 629 630 631
632 633 634 635 636 637 638 639]
all classes 0 -> 639
> loaded base phase model from: ../checkpoints/Tiny_100_5x20voro/100_model.pkl
module.classifier.weight      torch.Size([400, 512])  204800  True
total: 204800
> loaded base phase model from: ../checkpoints/Tiny_100_5x20voro/120_model.pkl
module.classifier.weight      torch.Size([80, 512])   40960   True
total: 40960
> loaded base phase model from: ../checkpoints/Tiny_100_5x20voro/140_model.pkl
module.classifier.weight      torch.Size([80, 512])   40960   True
total: 40960
> loaded base phase model from: ../checkpoints/Tiny_100_5x20voro/160_model.pkl
module.classifier.weight      torch.Size([80, 512])   40960   True
total: 40960
> loaded base phase model from: ../checkpoints/Tiny_100_5x20voro/180_model.pkl
module.classifier.weight      torch.Size([80, 512])   40960   True
total: 40960
> loaded base phase model from: ../checkpoints/Tiny_100_5x20voro/200_model.pkl

```

```

module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
(6, 1000)

##### current_task: 4 #####
[output] current classes [640 641 642 643 644 645 646 647 648 649 650 651 652
653 654 655 656 657
 658 659 660 661 662 663 664 665 666 667 668 669 670 671 672 673 674 675
 676 677 678 679 680 681 682 683 684 685 686 687 688 689 690 691 692 693
 694 695 696 697 698 699 700 701 702 703 704 705 706 707 708 709 710 711
 712 713 714 715 716 717 718 719]
all classes 0 -> 719
> loaded base phase model from: ../checkpoints/Tiny_100_5x20voro/100_model.pkl
module.classifier.weight      torch.Size([400, 512])    204800    True
total: 204800
> loaded base phase model from: ../checkpoints/Tiny_100_5x20voro/120_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
> loaded base phase model from: ../checkpoints/Tiny_100_5x20voro/140_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
> loaded base phase model from: ../checkpoints/Tiny_100_5x20voro/160_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
> loaded base phase model from: ../checkpoints/Tiny_100_5x20voro/180_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
> loaded base phase model from: ../checkpoints/Tiny_100_5x20voro/200_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
(6, 1000)

##### current_task: 5 #####
[output] current classes [720 721 722 723 724 725 726 727 728 729 730 731 732
733 734 735 736 737
 738 739 740 741 742 743 744 745 746 747 748 749 750 751 752 753 754 755
 756 757 758 759 760 761 762 763 764 765 766 767 768 769 770 771 772 773
 774 775 776 777 778 779 780 781 782 783 784 785 786 787 788 789 790 791
 792 793 794 795 796 797 798 799]
all classes 0 -> 799
> loaded base phase model from: ../checkpoints/Tiny_100_5x20voro/100_model.pkl
module.classifier.weight      torch.Size([400, 512])    204800    True
total: 204800
> loaded base phase model from: ../checkpoints/Tiny_100_5x20voro/120_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
> loaded base phase model from: ../checkpoints/Tiny_100_5x20voro/140_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960    True

```

```

total: 40960
> loaded base phase model from: ../checkpoints/Tiny_100_5x20voro/160_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
> loaded base phase model from: ../checkpoints/Tiny_100_5x20voro/180_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
> loaded base phase model from: ../checkpoints/Tiny_100_5x20voro/200_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
(6, 1000)

```

```

[29]: print('cliques by test samples:', pred_in_clique.shape)

# compute prototypes
be      = 0.6 # 1.
l2      = True # False True
bias    = 0 # 0.05
protots = np.mean(feats_trans(support_data_, beta=be, l2=l2, bias=bias), axis=1)
query_pts = feats_trans(query_data_, beta=be, l2=l2, bias=bias)
# acenss  = feats_trans(acens, beta=be, l2=l2, bias=bias)
if brother:
    dist      = funbtch(query_pts, protots) # protots / acenss
else:
    dist      = fun(query_pts, protots) # protots / acenss

test_splt = [sum(test_share[:t+1]) for t in range(len(test_share))]

```

```

cliques by test samples: (6, 10000)
100%|| 200/200 [00:40<00:00, 4.98it/s]

```

```

[238]: dist_in_clique = np.zeros_like(pred_in_clique, dtype=np.float32)
for c_id, clique in enumerate(pred_in_clique):
    for s_id, samp in enumerate(clique):
        dist_in_clique[c_id][s_id] = dist[s_id][samp]

```

```

[253]: for i in range(task_num + 1):
        clique_dist = dist_in_clique[:i+1,:test_splt[i]]
        clique_pred = np.argmax(clique_dist, axis=0)
        merge_pred = [pred_in_clique[cli,s_id] for s_id, cli in
            enumerate(clique_pred)]
        merge_acc = np.mean(merge_pred == query_label_[:test_splt[i]])
        print(merge_acc)
        print('DaC:', 'beta:', be, '| l2:', l2)

```

```

[28]: print('===== Experiment Done! =====')

```

```

===== Experiment Done! =====

```



## iVoro on TinyImageNet Dataset (10 Phases)

```
[1]: import matplotlib.pyplot as plt
import os
import pickle
import numpy as np
import pandas as pd
import seaborn as sns
import time
import sys
sys.path.append('../')
sys.path.append('../analysis/')
import copy
import platform
import json
import pickle
import random

import torch
from scipy.stats import mode
```

```
[97]: from ResNet import resnet18_cbam

data_name      = 'Tiny' # 'Subset' # 'Tiny' # 'CIFAR100' # 'MNIST'
total_nc       = 200 # 200 # 100 # 10
fg_nc          = 100 # 100 # 40 # 50 # 4
task_num       = 10 # 20 # 5 # 10 # 2

# constant params
class_set      = list(range(total_nc))
ROTATION       = True
EMB2D          = False
DESIGN         = True
virtual_class  = 4*total_nc if ROTATION else total_nc
suffix         = 'voro' # 'prob' 'voro'
assert (total_nc - fg_nc)%task_num == 0
task_size      = int((total_nc - fg_nc)/task_num)
file_name      = _
    ↳data_name+'_'+str(fg_nc)+'_'+str(task_num)+'x'+str(task_size)+suffix
```

```
print(file_name)

brother      = False # True False
```

Tiny\_100\_10x10voro

```
[98]: save_path = '../checkpoints/'
      path      = save_path + file_name + '/'
      filename   = path + '%d_model.pkl' % (fg_nc+0) # +5
      model      = torch.load(filename)
      model.eval()
      print('> loaded base phase model from:', filename)
```

> loaded base phase model from: ../checkpoints/Tiny\_100\_10x10voro/100\_model.pkl

```
[99]: from voro_helper import num_param, t2n, \
      load_feat, sanity_check, \
      id2emb_, num_samp, merge_sc, funbtch

num_param(model)

# voronoi centers:
vcenter = t2n(model.module.classifier.weight.data / 2.)
print(vcenter.shape)
```

```
module.classifier.weight      torch.Size([400, 512])  204800  True
total: 204800
(400, 512)
```

```
[100]: '''
CIFAR:
    'CIFAR100_50_5x10_test.pkl'
    'CIFAR100_50_5x10_train.pkl'
    'CIFAR100_40_20x3_test.pkl'
    'CIFAR100_40_20x3_train.pkl'
more CIFAR:
    'CIFAR100_40_12x5_test.pkl'
    'CIFAR100_40_12x5_train.pkl'
    'CIFAR100_30_14x5_test.pkl'
    'CIFAR100_30_14x5_train.pkl'
    'CIFAR100_20_16x5_test.pkl'
    'CIFAR100_20_16x5_train.pkl'
    'CIFAR100_10_18x5_test.pkl'
    'CIFAR100_10_18x5_train.pkl'
Tiny:
    'Tiny_100_20x5_test.pkl'
    'Tiny_100_20x5_train.pkl'
TinyL3:
```

```

        'Tiny_100_5x20_test.pkl'
        'Tiny_100_5x20_train.pkl'
Subset:
        'Subset_50_10x5_test.pkl'
        'Subset_50_10x5_train.pkl'
'''
ffile = '../embedding/prob/' + 'Tiny_100_20x5_test.pkl' # prob probL3
data_phas, last_tsk = load_feat(ffile)

labs, embeds, outputs = data_phas[last_tsk][last_tsk]
false_id, pred_ = sanity_check(labs, embeds, outputs)

```

```

feature file: ../embedding/prob/Tiny_100_20x5_test.pkl
> loaded tasks: dict_keys([20])
> classes: [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18,
19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38,
39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58,
59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78,
79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98,
99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114,
115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130,
131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146,
147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162,
163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178,
179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194,
195, 196, 197, 198, 199]
> samples: 10000
> embedding: 512
> classification: 800
~ acc (single): 51.51%
~ acc (quadruple): 46.10%

```

```

[101]: ffile = '../embedding/prob/' + 'Tiny_100_20x5_train.pkl' # prob probL3
data_phas, last_tsk = load_feat(ffile)

labst, embedst, outputst = data_phas[last_tsk][last_tsk]
false_id, pred_ = sanity_check(labst, embedst, outputst)

```

```

feature file: ../embedding/prob/Tiny_100_20x5_train.pkl
> loaded tasks: dict_keys([20])
> classes: [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18,
19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38,
39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58,
59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78,
79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98,
99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114,
115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130,
131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146,

```

```

147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162,
163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178,
179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194,
195, 196, 197, 198, 199]
> samples: 99968
> embedding: 512
> classification: 800
~ acc (single): 71.57%
~ acc (quadruple): 67.88%

```

```

[102]: embs = id2emb_(labs, embeds, brother=brother)
        embst = id2emb_(labst, embedst, brother=brother)

```

```

        sam_max, sam_min = num_samp(embst)
        print('> loading data done!')

```

```

0 498,1 500,2 500,3 500,4 500,5 500,6 500,7 500,8 500,9 500,10 500,11 500,12
500,13 499,14 500,15 500,16 500,17 500,18 500,19 500,20 500,21 499,22 500,23
500,24 500,25 500,26 500,27 500,28 499,29 500,30 500,31 500,32 500,33 500,34
500,35 500,36 500,37 500,38 500,39 499,40 500,41 500,42 500,43 500,44 500,45
500,46 500,47 500,48 500,49 499,50 500,51 499,52 500,53 500,54 500,55 500,56
500,57 500,58 500,59 500,60 500,61 500,62 499,63 500,64 500,65 500,66 500,67
500,68 500,69 499,70 500,71 500,72 500,73 499,74 499,75 500,76 500,77 500,78
500,79 500,80 500,81 498,82 499,83 500,84 500,85 500,86 500,87 500,88 500,89
500,90 500,91 500,92 500,93 498,94 500,95 500,96 500,97 500,98 499,99 499,100
500,101 500,102 499,103 500,104 500,105 500,106 500,107 500,108 500,109 500,110
499,111 500,112 500,113 500,114 500,115 500,116 499,117 500,118 500,119 500,120
500,121 500,122 500,123 500,124 500,125 500,126 500,127 500,128 500,129 500,130
500,131 500,132 500,133 500,134 500,135 500,136 500,137 500,138 500,139 500,140
500,141 500,142 500,143 500,144 499,145 500,146 500,147 500,148 500,149 500,150
499,151 500,152 499,153 499,154 500,155 500,156 500,157 500,158 500,159 499,160
500,161 500,162 500,163 500,164 500,165 500,166 500,167 500,168 500,169 500,170
500,171 500,172 500,173 500,174 500,175 500,176 500,177 499,178 500,179 500,180
500,181 500,182 499,183 500,184 500,185 500,186 500,187 499,188 500,189 500,190
500,191 500,192 500,193 500,194 500,195 500,196 498,197 500,198 500,199 500,
max samples: 500
min samples: 498
> loading data done!

```

```

[103]: for k,v in embst.items():
        if v.shape[0] < sam_max:
            rid = np.random.choice(v.shape[0], sam_max-v.shape[0], replace=False)
            print('filling', sam_max-v.shape[0], 'samples')
            embst[k] = np.vstack((v, v[rid]))

```

```

filling 2 samples
filling 1 samples
filling 1 samples
filling 1 samples

```

[illegible]

```
[104]: from voro_helper import get_task_data, feat_trans, NC_o, tsk_cls, fun, \
        ↪ acc_brother, forgetting

i = task_num
support_data_, support_label_, query_data_, query_label_, n_ways_, n_shot_, _ = \
    get_task_data(embst, embs, i, fg_nc, class_set, task_size, brother=brother)
```

```
##### current_task: 10 #####
current classes [190, 191, 192, 193, 194, 195, 196, 197, 198, 199]
[output] all classes 0 -> 199
```

```
[105]: #####  

       ↪=====  

be      = 1. # 1.  

l2      = False # False True  

protots = np.mean(feats_trans(support_data_, beta=be, l2=l2), axis=1)
```

```
[106]: i = 0
support_data, support_label, query_data, query_label, n_ways, n_shot, classes = \
    get_task_data(embst, embs, i, fg_nc, class_set, task_size, brother=brother)
acc, _, nn_pre = NC_o(support_data, support_label,
                      query_data, query_label,
```

```

n_ways, n_shot,
beta = be, l2 = l2,
given_cen = protots[classes], given_only = True,
brother = brother)

```

```

##### current_task: 0 #####
current classes [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17,
18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37,
38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57,
58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77,
78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97,
98, 99]
[output] all classes 0 -> 99
0.5318

```

```

[107]: local      = False # True / False
nn_acc   = []
savefile = path+'NN' if brother else None # NN / NNp / NN3 / only saved NN
→results!
savefil2 = path+'NN3'
forget    = True # True False # calculate forgetting
class_ladder = []
a         = []
for i in range(task_num + 1):
    support_data, support_label, query_data, query_label, n_ways, n_shot,
→classes = \
        get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                        local = local, brother = brother) # False
    if forget:
        class_ladder.append(classes)
    acc, _, nn_pre = NC_o(support_data, support_label,
                           query_data, query_label,
                           n_ways, n_shot,
                           beta = be, l2 = l2,
                           given_cen = protots[classes] if local else protots[:
→classes[-1]+1],
                           given_only = True,
                           brother = brother,
                           savefile = savefile+'_'+str(i) if brother else None,
                           savefile2 = None, # savefil2+'_'+str(i), # None, #
                           weights = [0.7, 0.3],
                           class_ladder = class_ladder,
                           acc_all = a
                           )
    nn_acc.append(acc)
    # if all classes up2now: local = False, and protots[:classes[-1]+1]

```

```

print('local:', local, '| beta:', be, '| l2:', l2)
if brother:
    for accs in nn_acc:
        print('\t'.join([str(i) for i in accs]))
else:
    print('\n'.join([str(i) for i in nn_acc]))
if forget:
    avgf = forgetting(a, task_num)
    print(avgf)

```

```

##### current_task: 0 #####
current classes [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17,
18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37,
38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57,
58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77,
78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97,
98, 99]
[output] all classes 0 -> 99
0.5318

##### current_task: 1 #####
current classes [100, 101, 102, 103, 104, 105, 106, 107, 108, 109]
[output] all classes 0 -> 109
0.5131

##### current_task: 2 #####
current classes [110, 111, 112, 113, 114, 115, 116, 117, 118, 119]
[output] all classes 0 -> 119
0.4885

##### current_task: 3 #####
current classes [120, 121, 122, 123, 124, 125, 126, 127, 128, 129]
[output] all classes 0 -> 129
0.4686

##### current_task: 4 #####
current classes [130, 131, 132, 133, 134, 135, 136, 137, 138, 139]
[output] all classes 0 -> 139
0.4607

##### current_task: 5 #####
current classes [140, 141, 142, 143, 144, 145, 146, 147, 148, 149]
[output] all classes 0 -> 149
0.4469

##### current_task: 6 #####
current classes [150, 151, 152, 153, 154, 155, 156, 157, 158, 159]

```

[output] all classes 0 -> 159  
0.4349

##### current\_task: 7 #####  
current classes [160, 161, 162, 163, 164, 165, 166, 167, 168, 169]  
[output] all classes 0 -> 169  
0.4247

##### current\_task: 8 #####  
current classes [170, 171, 172, 173, 174, 175, 176, 177, 178, 179]  
[output] all classes 0 -> 179  
0.4087

##### current\_task: 9 #####  
current classes [180, 181, 182, 183, 184, 185, 186, 187, 188, 189]  
[output] all classes 0 -> 189  
0.3974

##### current\_task: 10 #####  
current classes [190, 191, 192, 193, 194, 195, 196, 197, 198, 199]  
[output] all classes 0 -> 199  
0.3826

local: False | beta: 1.0 | l2: False

0.5318

0.513090909090909

0.4885

0.4686153846153846

0.4607142857142857

0.44693333333333335

0.434875

0.42470588235294116

0.4086666666666667

0.3973684210526316

0.3826

[0.5318	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	]								
[0.5126	0.518	0.	0.	0.	0.	0.	0.	0.	0.
0.	]								
[0.4976	0.476	0.41	0.	0.	0.	0.	0.	0.	0.
0.	]								
[0.4856	0.468	0.4	0.368	0.	0.	0.	0.	0.	0.
0.	]								
[0.4736	0.46	0.382	0.354	0.518	0.	0.	0.	0.	0.
0.	]								
[0.4642	0.456	0.38	0.336	0.506	0.384	0.	0.	0.	0.
0.	]								
[0.4562	0.454	0.378	0.314	0.492	0.358	0.4	0.	0.	0.
0.	]								



```

[0.448  0.444  0.374  0.31   0.474  0.352  0.388  0.398  0.    0.
 0.    ]
[0.4406 0.424  0.37   0.3    0.472  0.338  0.37   0.394  0.282  0.
 0.    ]
[0.4344 0.414  0.368  0.286  0.466  0.32   0.368  0.394  0.274  0.316
 0.    ]
[0.428  0.4    0.36   0.278  0.466  0.312  0.36   0.392  0.268  0.308
 0.228 ]]
[0, 1.920000000000000106, 3.8100000000000005, 3.5400000000000001, 3.955, 4.072,
4.6266666666666668, 4.854285714285716, 5.2400000000000002, 5.393333333333334,
5.538]

```

```

[108]: def predict(model, x, voro=True):
        x = torch.from_numpy(x.astype(np.float32)).cuda()
        with torch.no_grad():
            predi = model.module.classifier(x)
            if voro:
                predi += - torch.sum((model.module.classifier.weight/2.)**2, dim=1)
        return predi

classes_all = []
test_share = []
paccS = []
for i in range(task_num + 1):
    support_data, support_label, query_data, query_label, n_ways, n_shot, \
    →classes = \
        get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                      local = True, brother = brother)

    # load model:
    if brother:
        cls_01 = classes[-1]+1
        assert cls_01 % 4 == 0
        filename = path + '%d_model.pkl' % (int(cls_01/4))
    else:
        filename = path + '%d_model.pkl' % (classes[-1]+1)
    model = torch.load(filename)
    model.eval()
    print('> loaded base phase model from:', filename)
    num_param(model)
    # do prediction:
    min_cls = min(classes)
    if brother:
        pred = predict(model, query_data)
    else:
        pred = predict(model, query_data)[:,:,:4]
    pmax = torch.max(pred, dim=1)[1]
    pacc = np.mean(t2n(pmax) == query_label - min_cls)

```

```

print(pacc)
if brother:
    accs = acc_brother(t2n(pred), t2n(pmax), query_label - min_cls,
→forLG=True)
    pacc = [pacc] + accs
    paccS.append(pacc)
    classes_all.append(classes)
    test_share.append(len(query_label))
print('all logistic locally:')
if brother:
    for accs in paccS:
        print('\t'.join([str(i) for i in accs]))
else:
    print('\n'.join([str(i) for i in paccS]))

```

```

##### current_task: 0 #####
[output] current classes [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15,
16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35,
36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55,
56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75,
76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95,
96, 97, 98, 99]
all classes 0 -> 99
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/100_model.pkl
module.classifier.weight      torch.Size([400, 512])  204800  True
total: 204800
0.6278

```

```

##### current_task: 1 #####
[output] current classes [100, 101, 102, 103, 104, 105, 106, 107, 108, 109]
all classes 0 -> 109
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/110_model.pkl
module.classifier.weight      torch.Size([40, 512])   20480  True
total: 20480
0.846

```

```

##### current_task: 2 #####
[output] current classes [110, 111, 112, 113, 114, 115, 116, 117, 118, 119]
all classes 0 -> 119
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/120_model.pkl
module.classifier.weight      torch.Size([40, 512])   20480  True
total: 20480
0.826

```

```

##### current_task: 3 #####
[output] current classes [120, 121, 122, 123, 124, 125, 126, 127, 128, 129]
all classes 0 -> 129

```

```
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/130_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
0.838
```

```
##### current_task: 4 #####
```

```
[output] current classes [130, 131, 132, 133, 134, 135, 136, 137, 138, 139]
all classes 0 -> 139
```

```
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/140_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
0.888
```

```
##### current_task: 5 #####
```

```
[output] current classes [140, 141, 142, 143, 144, 145, 146, 147, 148, 149]
all classes 0 -> 149
```

```
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/150_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
0.878
```

```
##### current_task: 6 #####
```

```
[output] current classes [150, 151, 152, 153, 154, 155, 156, 157, 158, 159]
all classes 0 -> 159
```

```
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/160_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
0.882
```

```
##### current_task: 7 #####
```

```
[output] current classes [160, 161, 162, 163, 164, 165, 166, 167, 168, 169]
all classes 0 -> 169
```

```
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/170_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
0.85
```

```
##### current_task: 8 #####
```

```
[output] current classes [170, 171, 172, 173, 174, 175, 176, 177, 178, 179]
all classes 0 -> 179
```

```
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/180_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
0.808
```

```
##### current_task: 9 #####
```

```
[output] current classes [180, 181, 182, 183, 184, 185, 186, 187, 188, 189]
all classes 0 -> 189
```

```
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/190_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
0.848
```

```
##### current_task: 10 #####
```

```
[output] current classes [190, 191, 192, 193, 194, 195, 196, 197, 198, 199]
```

```
all classes 0 -> 199
```

```
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/200_model.pkl
```

```
module.classifier.weight      torch.Size([40, 512])    20480    True
```

```
total: 20480
```

```
0.868
```

```
all logistic locally:
```

```
0.6278
```

```
0.846
```

```
0.826
```

```
0.838
```

```
0.888
```

```
0.878
```

```
0.882
```

```
0.85
```

```
0.808
```

```
0.848
```

```
0.868
```

```
[109]: for i in range(task_num + 1):
        support_data, support_label, query_data, query_label, n_ways, n_shot, \
        classes = \
            get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                           local = True, brother = brother)
        pred_all = []
        for classes in classes_all:
            # load model:
            if brother:
                cls_01 = classes[-1]+1
                assert cls_01 % 4 == 0
                filename = path + '%d_model.pkl' % (int(cls_01/4))
            else:
                filename = path + '%d_model.pkl' % (classes[-1]+1)
            model = torch.load(filename)
            model.eval()
            print('> loaded base phase model from:', filename)
            num_param(model)
            # do prediction:
            min_cls = min(classes)
            if brother:
                pred = predict(model, query_data)
```

```

else:
    pred = predict(model, query_data)[:,:,:4]
    pmax = torch.max(pred, dim=1)[1]
    # pacc = np.mean(t2n(pmax) == query_label - min_cls)
    # print(pacc)
    if brother:
        labs_01 = query_label[:4]//4
        acc_, sc_pre = merge_sc(t2n(pred), labs_01,
                                mth='softmax', forLG=True, return_pre=True)
        min_cls = int(min_cls / 4)
        pred_all.append( (sc_pre + min_cls).tolist() )
    else:
        pred_all.append( (t2n(pmax) + min_cls).tolist() )
pred_all = np.array(pred_all)
print(pred_all.shape)

if i == 0:
    pred_in_clique = copy.deepcopy(pred_all)
else:
    pred_in_clique = np.hstack((pred_in_clique, pred_all))

```

```

##### current_task: 0 #####
[output] current classes [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15,
16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35,
36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55,
56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75,
76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95,
96, 97, 98, 99]
all classes 0 -> 99
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/100_model.pkl
module.classifier.weight      torch.Size([400, 512])  204800  True
total: 204800
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/110_model.pkl
module.classifier.weight      torch.Size([40, 512])   20480   True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/120_model.pkl
module.classifier.weight      torch.Size([40, 512])   20480   True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/130_model.pkl
module.classifier.weight      torch.Size([40, 512])   20480   True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/140_model.pkl
module.classifier.weight      torch.Size([40, 512])   20480   True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/150_model.pkl
module.classifier.weight      torch.Size([40, 512])   20480   True
total: 20480

```

```

> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/160_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/170_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/180_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/190_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/200_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
(11, 5000)

```

```
##### current_task: 1 #####
```

```
[output] current classes [100, 101, 102, 103, 104, 105, 106, 107, 108, 109]
```

```
all classes 0 -> 109
```

```

> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/100_model.pkl
module.classifier.weight      torch.Size([400, 512])   204800   True
total: 204800
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/110_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/120_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/130_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/140_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/150_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/160_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/170_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/180_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/190_model.pkl

```

```

module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/200_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
(11, 500)

```

##### current\_task: 2 #####

```

[output] current classes [110, 111, 112, 113, 114, 115, 116, 117, 118, 119]
all classes 0 -> 119
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/100_model.pkl
module.classifier.weight      torch.Size([400, 512])  204800   True
total: 204800
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/110_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/120_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/130_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/140_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/150_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/160_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/170_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/180_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/190_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/200_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
(11, 500)

```

##### current\_task: 3 #####

```

[output] current classes [120, 121, 122, 123, 124, 125, 126, 127, 128, 129]
all classes 0 -> 129

```

```

> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/100_model.pkl
module.classifier.weight      torch.Size([400, 512])  204800  True
total: 204800
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/110_model.pkl
module.classifier.weight      torch.Size([40, 512])   20480   True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/120_model.pkl
module.classifier.weight      torch.Size([40, 512])   20480   True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/130_model.pkl
module.classifier.weight      torch.Size([40, 512])   20480   True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/140_model.pkl
module.classifier.weight      torch.Size([40, 512])   20480   True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/150_model.pkl
module.classifier.weight      torch.Size([40, 512])   20480   True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/160_model.pkl
module.classifier.weight      torch.Size([40, 512])   20480   True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/170_model.pkl
module.classifier.weight      torch.Size([40, 512])   20480   True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/180_model.pkl
module.classifier.weight      torch.Size([40, 512])   20480   True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/190_model.pkl
module.classifier.weight      torch.Size([40, 512])   20480   True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/200_model.pkl
module.classifier.weight      torch.Size([40, 512])   20480   True
total: 20480
(11, 500)

```

```
##### current_task: 4 #####
```

```
[output] current classes [130, 131, 132, 133, 134, 135, 136, 137, 138, 139]
```

```
all classes 0 -> 139
```

```

> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/100_model.pkl
module.classifier.weight      torch.Size([400, 512])  204800  True
total: 204800
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/110_model.pkl
module.classifier.weight      torch.Size([40, 512])   20480   True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/120_model.pkl
module.classifier.weight      torch.Size([40, 512])   20480   True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/130_model.pkl

```



```

module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/140_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/150_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/160_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/170_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/180_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/190_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/200_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
(11, 500)

```

```
##### current_task: 5 #####
```

```

[output] current classes [140, 141, 142, 143, 144, 145, 146, 147, 148, 149]
all classes 0 -> 149
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/100_model.pkl
module.classifier.weight      torch.Size([400, 512])  204800    True
total: 204800
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/110_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/120_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/130_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/140_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/150_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/160_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True

```

```

total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/170_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/180_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/190_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/200_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
(11, 500)

```

```
##### current_task: 6 #####
```

```

[output] current classes [150, 151, 152, 153, 154, 155, 156, 157, 158, 159]
all classes 0 -> 159
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/100_model.pkl
module.classifier.weight      torch.Size([400, 512])  204800   True
total: 204800
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/110_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/120_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/130_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/140_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/150_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/160_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/170_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/180_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/190_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480

```

```
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/200_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
(11, 500)
```

```
##### current_task: 7 #####
```

```
[output] current classes [160, 161, 162, 163, 164, 165, 166, 167, 168, 169]
```

```
all classes 0 -> 169
```

```
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/100_model.pkl
module.classifier.weight      torch.Size([400, 512])  204800    True
total: 204800
```

```
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/110_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
```

```
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/120_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
```

```
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/130_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
```

```
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/140_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
```

```
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/150_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
```

```
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/160_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
```

```
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/170_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
```

```
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/180_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
```

```
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/190_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
```

```
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/200_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
(11, 500)
```

```
##### current_task: 8 #####
```

```
[output] current classes [170, 171, 172, 173, 174, 175, 176, 177, 178, 179]
```

```
all classes 0 -> 179
```

```
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/100_model.pkl
module.classifier.weight      torch.Size([400, 512])  204800    True
```

```

total: 204800
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/110_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/120_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/130_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/140_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/150_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/160_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/170_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/180_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/190_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/200_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
(11, 500)

```

```
##### current_task: 9 #####
```

```

[output] current classes [180, 181, 182, 183, 184, 185, 186, 187, 188, 189]
all classes 0 -> 189
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/100_model.pkl
module.classifier.weight      torch.Size([400, 512])   204800   True
total: 204800
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/110_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/120_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/130_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480

```

```

> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/140_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/150_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/160_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/170_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/180_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/190_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/200_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
(11, 500)

```

```
##### current_task: 10 #####
```

```
[output] current classes [190, 191, 192, 193, 194, 195, 196, 197, 198, 199]
```

```
all classes 0 -> 199
```

```

> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/100_model.pkl
module.classifier.weight      torch.Size([400, 512])  204800    True
total: 204800
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/110_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/120_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/130_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/140_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/150_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/160_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/170_model.pkl

```

```

module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/180_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/190_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/200_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
(11, 500)

```

```

[110]: print('cliques by test samples:', pred_in_clique.shape)

# compute prototypes
be      = 0.6 # 1.
l2      = True # False True
bias    = 0 # 0.05
protots = np.mean(feats_trans(support_data_, beta=be, l2=l2, bias=bias), axis=1)
query_pts = feats_trans(query_data_, beta=be, l2=l2, bias=bias)
# acenss = feats_trans(acens, beta=be, l2=l2, bias=bias)
if brother:
    dist = funbtch(query_pts, protots) # protots / acenss
else:
    dist = fun(query_pts, protots) # protots / acenss

test_splt = [sum(test_share[:t+1]) for t in range(len(test_share))]

```

cliques by test samples: (11, 10000)

```

[111]: dist_in_clique = np.zeros_like(pred_in_clique, dtype=np.float32)
for c_id, clique in enumerate(pred_in_clique):
    for s_id, samp in enumerate(clique):
        dist_in_clique[c_id][s_id] = dist[s_id][samp]

```

```

[112]: for i in range(task_num + 1):
        clique_dist = dist_in_clique[:i+1,:test_splt[i]]
        clique_pred = np.argmax(clique_dist, axis=0)
        merge_pred = [pred_in_clique[cli,s_id] for s_id, cli in
            →enumerate(clique_pred)]
        merge_acc = np.mean(merge_pred == query_label_[:test_splt[i]])
        print(merge_acc)
print('DaC:', 'beta:', be, '| l2:', l2)

```

```

0.6278
0.582
0.5458333333333333
0.5226153846153846

```

```
0.5144285714285715
0.49893333333333334
0.48425
0.46905882352941175
0.45322222222222225
0.43873684210526315
0.4245
DaC: beta: 0.6 | 12: True
```

```
[28]: print('===== Experiment Done! =====')
```

```
===== Experiment Done! =====
```

## iVoro-AC/AI on TinyImageNet Dataset (10 Phases)

```
[9]: import matplotlib.pyplot as plt
import os
import pickle
import numpy as np
import pandas as pd
import seaborn as sns
import time
import sys
sys.path.append('../')
sys.path.append('../analysis/')
import copy
import platform
import json
import pickle
import random

import torch
from scipy.stats import mode
```

```
[30]: from ResNet import resnet18_cbam

data_name      = 'Tiny' # 'Subset' # 'Tiny' # 'CIFAR100' # 'MNIST'
total_nc       = 200 # 200 # 100 # 10
fg_nc          = 100 # 100 # 40 # 50 # 4
task_num       = 10 # 20 # 5 # 10 # 2

# constant params
class_set      = list(range(total_nc))
ROTATION       = True
EMB2D         = False
DESIGN         = True
virtual_class  = 4*total_nc if ROTATION else total_nc
suffix         = 'voro' # 'prob' 'voro'
assert (total_nc - fg_nc)%task_num == 0
task_size      = int((total_nc - fg_nc)/task_num)
file_name      = _
    ↳data_name+'_'+str(fg_nc)+'_'+str(task_num)+'x'+str(task_size)+suffix
```



```
print(file_name)

brother      = True # True False
```

Tiny\_100\_10x10voro

```
[31]: save_path = '../checkpoints/'
      path      = save_path + file_name + '/'
      filename   = path + '%d_model.pkl' % (fg_nc+0) # +5
      model      = torch.load(filename)
      model.eval()
      print('> loaded base phase model from:', filename)
```

> loaded base phase model from: ../checkpoints/Tiny\_100\_10x10voro/100\_model.pkl

```
[32]: from voro_helper import num_param, t2n, \
      load_feat, sanity_check, \
      id2emb_, num_samp, merge_sc, funbtch

num_param(model)

# voronoi centers:
vcenter = t2n(model.module.classifier.weight.data / 2.)
print(vcenter.shape)
```

```
module.classifier.weight      torch.Size([400, 512])  204800  True
total: 204800
(400, 512)
```

```
[33]: '''
      CIFAR:
          'CIFAR100_50_5x10_test.pkl'
          'CIFAR100_50_5x10_train.pkl'
          'CIFAR100_40_20x3_test.pkl'
          'CIFAR100_40_20x3_train.pkl'
      more CIFAR:
          'CIFAR100_40_12x5_test.pkl'
          'CIFAR100_40_12x5_train.pkl'
          'CIFAR100_30_14x5_test.pkl'
          'CIFAR100_30_14x5_train.pkl'
          'CIFAR100_20_16x5_test.pkl'
          'CIFAR100_20_16x5_train.pkl'
          'CIFAR100_10_18x5_test.pkl'
          'CIFAR100_10_18x5_train.pkl'
      Tiny:
          'Tiny_100_20x5_test.pkl'
          'Tiny_100_20x5_train.pkl'
      TinyL3:
```

```

        'Tiny_100_5x20_test.pkl'
        'Tiny_100_5x20_train.pkl'
Subset:
        'Subset_50_10x5_test.pkl'
        'Subset_50_10x5_train.pkl'
'''
ffile = '../embedding/prob/' + 'Tiny_100_20x5_test.pkl' # prob probL3
data_phas, last_tsk = load_feat(ffile)

labs, embeds, outputs = data_phas[last_tsk][last_tsk]
false_id, pred_ = sanity_check(labs, embeds, outputs)

```

```

feature file: ../embedding/prob/Tiny_100_20x5_test.pkl
> loaded tasks: dict_keys([20])
> classes: [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18,
19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38,
39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58,
59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78,
79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98,
99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114,
115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130,
131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146,
147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162,
163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178,
179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194,
195, 196, 197, 198, 199]
> samples: 10000
> embedding: 512
> classification: 800
~ acc (single): 51.51%
~ acc (quadruple): 46.10%

```

```

[34]: ffile = '../embedding/prob/' + 'Tiny_100_20x5_train.pkl' # prob probL3
data_phas, last_tsk = load_feat(ffile)

labst, embedst, outputst = data_phas[last_tsk][last_tsk]
false_id, pred_ = sanity_check(labst, embedst, outputst)

```

```

feature file: ../embedding/prob/Tiny_100_20x5_train.pkl
> loaded tasks: dict_keys([20])
> classes: [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18,
19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38,
39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58,
59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78,
79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98,
99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114,
115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130,
131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146,

```

```

147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162,
163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178,
179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194,
195, 196, 197, 198, 199]
> samples: 99968
> embedding: 512
> classification: 800
~ acc (single): 71.57%
~ acc (quadruple): 67.88%

```

```

[35]: embs = id2emb_(labs, embeds, brother=brother)
      embst = id2emb_(labst, embedst, brother=brother)

      sam_max, sam_min = num_samp(embst)
      print('> loading data done!')

```

```

0 498,1 498,2 498,3 498,4 500,5 500,6 500,7 500,8 500,9 500,10 500,11 500,12
500,13 500,14 500,15 500,16 500,17 500,18 500,19 500,20 500,21 500,22 500,23
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500,57 500,58 500,59 500,60 500,61 500,62 500,63 500,64 500,65 500,66 500,67
500,68 500,69 500,70 500,71 500,72 500,73 500,74 500,75 500,76 500,77 500,78
500,79 500,80 500,81 500,82 500,83 500,84 499,85 499,86 499,87 499,88 500,89
500,90 500,91 500,92 500,93 500,94 500,95 500,96 500,97 500,98 500,99 500,100
500,101 500,102 500,103 500,104 500,105 500,106 500,107 500,108 500,109 500,110
500,111 500,112 499,113 499,114 499,115 499,116 500,117 500,118 500,119 500,120
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500,171 500,172 500,173 500,174 500,175 500,176 500,177 500,178 500,179 500,180
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500,231 500,232 500,233 500,234 500,235 500,236 500,237 500,238 500,239 500,240
500,241 500,242 500,243 500,244 500,245 500,246 500,247 500,248 499,249 499,250
499,251 499,252 500,253 500,254 500,255 500,256 500,257 500,258 500,259 500,260
500,261 500,262 500,263 500,264 500,265 500,266 500,267 500,268 500,269 500,270
500,271 500,272 500,273 500,274 500,275 500,276 499,277 499,278 499,279 499,280
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```

499,331 499,332 500,333 500,334 500,335 500,336 500,337 500,338 500,339 500,340  
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500,521 500,522 500,523 500,524 500,525 500,526 500,527 500,528 500,529 500,530  
500,531 500,532 500,533 500,534 500,535 500,536 500,537 500,538 500,539 500,540  
500,541 500,542 500,543 500,544 500,545 500,546 500,547 500,548 500,549 500,550  
500,551 500,552 500,553 500,554 500,555 500,556 500,557 500,558 500,559 500,560  
500,561 500,562 500,563 500,564 500,565 500,566 500,567 500,568 500,569 500,570  
500,571 500,572 500,573 500,574 500,575 500,576 499,577 499,578 499,579 499,580  
500,581 500,582 500,583 500,584 500,585 500,586 500,587 500,588 500,589 500,590  
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500,631 500,632 500,633 500,634 500,635 500,636 499,637 499,638 499,639 499,640  
500,641 500,642 500,643 500,644 500,645 500,646 500,647 500,648 500,649 500,650  
500,651 500,652 500,653 500,654 500,655 500,656 500,657 500,658 500,659 500,660  
500,661 500,662 500,663 500,664 500,665 500,666 500,667 500,668 500,669 500,670  
500,671 500,672 500,673 500,674 500,675 500,676 500,677 500,678 500,679 500,680  
500,681 500,682 500,683 500,684 500,685 500,686 500,687 500,688 500,689 500,690  
500,691 500,692 500,693 500,694 500,695 500,696 500,697 500,698 500,699 500,700  
500,701 500,702 500,703 500,704 500,705 500,706 500,707 500,708 499,709 499,710  
499,711 499,712 500,713 500,714 500,715 500,716 500,717 500,718 500,719 500,720  
500,721 500,722 500,723 500,724 500,725 500,726 500,727 500,728 499,729 499,730  
499,731 499,732 500,733 500,734 500,735 500,736 500,737 500,738 500,739 500,740  
500,741 500,742 500,743 500,744 500,745 500,746 500,747 500,748 499,749 499,750  
499,751 499,752 500,753 500,754 500,755 500,756 500,757 500,758 500,759 500,760  
500,761 500,762 500,763 500,764 500,765 500,766 500,767 500,768 500,769 500,770  
500,771 500,772 500,773 500,774 500,775 500,776 500,777 500,778 500,779 500,780  
500,781 500,782 500,783 500,784 498,785 498,786 498,787 498,788 500,789 500,790  
500,791 500,792 500,793 500,794 500,795 500,796 500,797 500,798 500,799 500,  
max samples: 500

```
min samples: 498
> loading data done!
```

```
[36]: for k,v in embst.items():
      if v.shape[0] < sam_max:
          rid = np.random.choice(v.shape[0], sam_max-v.shape[0], replace=False)
          print('filling', sam_max-v.shape[0], 'samples')
          embst[k] = np.vstack((v, v[rid]))
```

[illegible]

[illegible]

filling	1	samples
filling	1	samples
filling	1	samples
filling	1	samples
filling	1	samples
filling	1	samples
filling	1	samples
filling	1	samples
filling	1	samples
filling	1	samples
filling	1	samples
filling	1	samples
filling	1	samples
filling	1	samples
filling	1	samples
filling	1	samples
filling	1	samples
filling	1	samples
filling	1	samples
filling	1	samples
filling	1	samples
filling	1	samples
filling	2	samples
filling	2	samples
filling	2	samples
filling	2	samples

```
[37]: from voro_helper import get_task_data, feat_trans, NC_o, tsk_cls, fun, \
      ↪ acc_brother, forgetting

      i = task_num
      support_data_, support_label_, query_data_, query_label_, n_ways_, n_shot_, _ = \
          get_task_data(embst, embs, i, fg_nc, class_set, task_size, brother=brother)
```

```
##### current_task: 10 #####
current classes [760 761 762 763 764 765 766 767 768 769 770 771 772 773 774 775
776 777
778 779 780 781 782 783 784 785 786 787 788 789 790 791 792 793 794 795
796 797 798 799]
[output] all classes 0 -> 799
```

```
[38]: #####  
      ↪=====  
be      = 1. # 1.  
l2      = False # False True  
protots = np.mean(feats_trans(support_data_, beta=be, l2=l2), axis=1)
```

```
[25]: i = 0
support_data, support_label, query_data, query_label, n_ways, n_shot, classes = \
    get_task_data(embst, embs, i, fg_nc, class_set, task_size, brother=brother)
acc, _, nn_pre = NC_o(support_data, support_label,
                      query_data, query_label,
                      n_ways, n_shot,
                      beta = be, l2 = l2,
                      given_cen = protots[classes], given_only = True,
                      brother = brother)
```

```
[39]: local      = False # True / False
nn_acc   = []
savefile = path+'NNp' if brother else None # NN / NNp / NN3 / only saved NN
→results!
savefil2 = path+'NN3'
forget    = True # True False # calculate forgetting
class_ladder = []
a         = []
for i in range(task_num + 1):
    support_data, support_label, query_data, query_label, n_ways, n_shot,
→classes = \
        get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                      local = local, brother = brother) # False
    if forget:
        class_ladder.append(classes)
    acc, _, nn_pre = NC_o(support_data, support_label,
                          query_data, query_label,
                          n_ways, n_shot,
                          beta = be, l2 = l2,
                          given_cen = protots[classes] if local else protots[:
→classes[-1]+1],
                          given_only = True,
                          brother = brother,
                          savefile = savefile+'_'+str(i) if brother else None,
                          savefile2 = None, # savefil2+'_'+str(i), # None, #
                          weights = [0.7, 0.3],
                          class_ladder = class_ladder,
                          acc_all = a
                          )
    nn_acc.append(acc)
    # if all classes up2now: local = False, and protots[:classes[-1]+1]
print('local:', local, '| beta:', be, '| l2:', l2)
if brother:
    for accs in nn_acc:
        print('\t'.join([str(i) for i in accs]))
else:
    print('\n'.join([str(i) for i in nn_acc]))
```



```

if forget:
    avgf = forgetting(a, task_num)
    print(avgf)

```

```

##### current_task: 0 #####
current classes [ 0  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15
16 17
 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35
 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53
 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71
 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89
 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107
108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125
126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143
144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161
162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179
180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197
198 199 200 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215
216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233
234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250 251
252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269
270 271 272 273 274 275 276 277 278 279 280 281 282 283 284 285 286 287
288 289 290 291 292 293 294 295 296 297 298 299 300 301 302 303 304 305
306 307 308 309 310 311 312 313 314 315 316 317 318 319 320 321 322 323
324 325 326 327 328 329 330 331 332 333 334 335 336 337 338 339 340 341
342 343 344 345 346 347 348 349 350 351 352 353 354 355 356 357 358 359
360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375 376 377
378 379 380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395
396 397 398 399]
[output] all classes 0 -> 399
<<< loaded from: ../checkpoints/Tiny_100_10x10voro/NNp_0.npy
0.4657

##### current_task: 1 #####
current classes [400 401 402 403 404 405 406 407 408 409 410 411 412 413 414 415
416 417
 418 419 420 421 422 423 424 425 426 427 428 429 430 431 432 433 434 435
 436 437 438 439]
[output] all classes 0 -> 439
<<< loaded from: ../checkpoints/Tiny_100_10x10voro/NNp_1.npy
0.4492

##### current_task: 2 #####
current classes [440 441 442 443 444 445 446 447 448 449 450 451 452 453 454 455
456 457
 458 459 460 461 462 463 464 465 466 467 468 469 470 471 472 473 474 475
 476 477 478 479]

```

```

[output] all classes 0 -> 479
<<< loaded from: ../checkpoints/Tiny_100_10x10voro/NNp_2.npy
0.4299

##### current_task: 3 #####
current classes [480 481 482 483 484 485 486 487 488 489 490 491 492 493 494 495
496 497
  498 499 500 501 502 503 504 505 506 507 508 509 510 511 512 513 514 515
  516 517 518 519]
[output] all classes 0 -> 519
<<< loaded from: ../checkpoints/Tiny_100_10x10voro/NNp_3.npy
0.4120

##### current_task: 4 #####
current classes [520 521 522 523 524 525 526 527 528 529 530 531 532 533 534 535
536 537
  538 539 540 541 542 543 544 545 546 547 548 549 550 551 552 553 554 555
  556 557 558 559]
[output] all classes 0 -> 559
<<< loaded from: ../checkpoints/Tiny_100_10x10voro/NNp_4.npy
0.4045

##### current_task: 5 #####
current classes [560 561 562 563 564 565 566 567 568 569 570 571 572 573 574 575
576 577
  578 579 580 581 582 583 584 585 586 587 588 589 590 591 592 593 594 595
  596 597 598 599]
[output] all classes 0 -> 599
<<< loaded from: ../checkpoints/Tiny_100_10x10voro/NNp_5.npy
0.3907

##### current_task: 6 #####
current classes [600 601 602 603 604 605 606 607 608 609 610 611 612 613 614 615
616 617
  618 619 620 621 622 623 624 625 626 627 628 629 630 631 632 633 634 635
  636 637 638 639]
[output] all classes 0 -> 639
<<< loaded from: ../checkpoints/Tiny_100_10x10voro/NNp_6.npy
0.3755

##### current_task: 7 #####
current classes [640 641 642 643 644 645 646 647 648 649 650 651 652 653 654 655
656 657
  658 659 660 661 662 663 664 665 666 667 668 669 670 671 672 673 674 675
  676 677 678 679]
[output] all classes 0 -> 679
<<< loaded from: ../checkpoints/Tiny_100_10x10voro/NNp_7.npy
0.3631

```

```
##### current_task: 8 #####
current classes [680 681 682 683 684 685 686 687 688 689 690 691 692 693 694 695
696 697
698 699 700 701 702 703 704 705 706 707 708 709 710 711 712 713 714 715
716 717 718 719]
[output] all classes 0 -> 719
<<< loaded from: ../checkpoints/Tiny_100_10x10voro/NNp_8.npy
0.3500
```

```
##### current_task: 9 #####
current classes [720 721 722 723 724 725 726 727 728 729 730 731 732 733 734 735
736 737
738 739 740 741 742 743 744 745 746 747 748 749 750 751 752 753 754 755
756 757 758 759]
[output] all classes 0 -> 759
<<< loaded from: ../checkpoints/Tiny_100_10x10voro/NNp_9.npy
0.3412
```

```
##### current_task: 10 #####
current classes [760 761 762 763 764 765 766 767 768 769 770 771 772 773 774 775
776 777
778 779 780 781 782 783 784 785 786 787 788 789 790 791 792 793 794 795
796 797 798 799]
[output] all classes 0 -> 799
<<< loaded from: ../checkpoints/Tiny_100_10x10voro/NNp_10.npy
0.3285
local: False | beta: 1.0 | l2: False
0.46575 0.7036 0.8204 0.8118 0.7684
0.4491818181818182 0.6854545454545454 0.8054545454545454 0.796
0.7525454545454545
0.429875 0.6545 0.7826666666666666 0.7733333333333333 0.7265
0.4120384615384615 0.6292307692307693 0.75 0.7398461538461538
0.6906153846153846
0.4044642857142857 0.6198571428571429 0.7335714285714285
0.7251428571428571 0.6665714285714286
0.3906666666666666 0.5976 0.7269333333333333 0.7197333333333333
0.6601333333333333
0.3755 0.57325 0.712875 0.705625 0.646875
0.36314705882352943 0.5561176470588235 0.6983529411764706
0.6889411764705883 0.630235294117647
0.3500277777777777 0.5353333333333333 0.6851111111111111
0.6754444444444444 0.6187777777777778
0.3411578947368421 0.5198947368421053 0.6709473684210526
0.6613684210526316 0.6027368421052631
0.328475 0.4976 0.6585 0.6506 0.5913
[[0.46575 0. 0. 0. 0. 0. 0. 0.
0. 0. ]
```

```

[0.45315 0.4095 0.      0.      0.      0.      0.      0.      0.
 0.      0.      ]
[0.4465 0.3995 0.294 0.      0.      0.      0.      0.      0.
 0.      0.      ]
[0.4394 0.3935 0.291 0.278 0.      0.      0.      0.      0.
 0.      0.      ]
[0.43095 0.3855 0.2785 0.263 0.426 0.      0.      0.      0.
 0.      0.      ]
[0.42785 0.3845 0.277 0.2555 0.417 0.2475 0.      0.      0.
 0.      0.      ]
[0.4232 0.384 0.2765 0.2455 0.406 0.2355 0.2285 0.      0.
 0.      0.      ]
[0.41655 0.381 0.273 0.24 0.3915 0.23 0.2155 0.277 0.
 0.      0.      ]
[0.4134 0.3615 0.27 0.2325 0.3865 0.228 0.2085 0.275 0.2045
 0.      0.      ]
[0.40795 0.354 0.2695 0.224 0.3805 0.2185 0.2085 0.274 0.2025
 0.271 0.      ]
[0.40565 0.351 0.267 0.214 0.38 0.218 0.207 0.272 0.199
 0.266 0.139 ]]
[0, 1.26, 1.4624999999999972, 1.5116666666666647, 2.232499999999998,
2.2279999999999999, 2.5008333333333317, 2.881428571428571, 3.1356249999999997,
3.236666666666667, 3.2209999999999996]

```

```

[40]: def predict(model, x, voro=True):
        x = torch.from_numpy(x.astype(np.float32)).cuda()
        with torch.no_grad():
            predi = model.module.classifier(x)
            if voro:
                predi += - torch.sum((model.module.classifier.weight/2.)**2, dim=1)
            return predi

classes_all = []
test_share = []
paccS = []
for i in range(task_num + 1):
    support_data, support_label, query_data, query_label, n_ways, n_shot, \
    ↪ classes = \
        get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                        local = True, brother = brother)

    # load model:
    if brother:
        cls_01 = classes[-1]+1
        assert cls_01 % 4 == 0
        filename = path + '%d_model.pkl' % (int(cls_01/4))
    else:
        filename = path + '%d_model.pkl' % (classes[-1]+1)

```

```

model      = torch.load(filename)
model.eval()
print('> loaded base phase model from:', filename)
num_param(model)
# do prediction:
min_cls = min(classes)
if brother:
    pred = predict(model, query_data)
else:
    pred = predict(model, query_data)[:,:,:4]
pmax = torch.max(pred, dim=1)[1]
pacc = np.mean(t2n(pmax) == query_label - min_cls)
print(pacc)
if brother:
    accs = acc_brother(t2n(pred), t2n(pmax), query_label - min_cls,
→forLG=True)
    pacc = [pacc] + accs
    paccS.append(pacc)
    classes_all.append(classes)
    test_share.append(len(query_label))
print('all logistic locally:')
if brother:
    for accs in paccS:
        print('\t'.join([str(i) for i in accs]))
else:
    print('\n'.join([str(i) for i in paccS]))

```

##### current\_task: 0 #####

```

[output] current classes [ 0  1  2  3  4  5  6  7  8  9 10 11 12
13 14 15 16 17
 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35
 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53
 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71
 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89
 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107
108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125
126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143
144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161
162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179
180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197
198 199 200 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215
216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233
234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250 251
252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269
270 271 272 273 274 275 276 277 278 279 280 281 282 283 284 285 286 287
288 289 290 291 292 293 294 295 296 297 298 299 300 301 302 303 304 305
306 307 308 309 310 311 312 313 314 315 316 317 318 319 320 321 322 323

```

```

324 325 326 327 328 329 330 331 332 333 334 335 336 337 338 339 340 341
342 343 344 345 346 347 348 349 350 351 352 353 354 355 356 357 358 359
360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375 376 377
378 379 380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395
396 397 398 399]
all classes 0 -> 399
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/100_model.pkl
module.classifier.weight      torch.Size([400, 512])  204800  True
total: 204800
0.561

```

```

##### current_task: 1 #####
[output] current classes [400 401 402 403 404 405 406 407 408 409 410 411 412
413 414 415 416 417
  418 419 420 421 422 423 424 425 426 427 428 429 430 431 432 433 434 435
  436 437 438 439]
all classes 0 -> 439
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/110_model.pkl
module.classifier.weight      torch.Size([40, 512])   20480  True
total: 20480
0.7515

```

```

##### current_task: 2 #####
[output] current classes [440 441 442 443 444 445 446 447 448 449 450 451 452
453 454 455 456 457
  458 459 460 461 462 463 464 465 466 467 468 469 470 471 472 473 474 475
  476 477 478 479]
all classes 0 -> 479
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/120_model.pkl
module.classifier.weight      torch.Size([40, 512])   20480  True
total: 20480
0.7555

```

```

##### current_task: 3 #####
[output] current classes [480 481 482 483 484 485 486 487 488 489 490 491 492
493 494 495 496 497
  498 499 500 501 502 503 504 505 506 507 508 509 510 511 512 513 514 515
  516 517 518 519]
all classes 0 -> 519
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/130_model.pkl
module.classifier.weight      torch.Size([40, 512])   20480  True
total: 20480
0.7555

```

```

##### current_task: 4 #####
[output] current classes [520 521 522 523 524 525 526 527 528 529 530 531 532
533 534 535 536 537
  538 539 540 541 542 543 544 545 546 547 548 549 550 551 552 553 554 555

```

```

556 557 558 559]
all classes 0 -> 559
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/140_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
0.7655

```

```

##### current_task: 5 #####
[output] current classes [560 561 562 563 564 565 566 567 568 569 570 571 572
573 574 575 576 577
578 579 580 581 582 583 584 585 586 587 588 589 590 591 592 593 594 595
596 597 598 599]
all classes 0 -> 599
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/150_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
0.758

```

```

##### current_task: 6 #####
[output] current classes [600 601 602 603 604 605 606 607 608 609 610 611 612
613 614 615 616 617
618 619 620 621 622 623 624 625 626 627 628 629 630 631 632 633 634 635
636 637 638 639]
all classes 0 -> 639
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/160_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
0.787

```

```

##### current_task: 7 #####
[output] current classes [640 641 642 643 644 645 646 647 648 649 650 651 652
653 654 655 656 657
658 659 660 661 662 663 664 665 666 667 668 669 670 671 672 673 674 675
676 677 678 679]
all classes 0 -> 679
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/170_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
0.7115

```

```

##### current_task: 8 #####
[output] current classes [680 681 682 683 684 685 686 687 688 689 690 691 692
693 694 695 696 697
698 699 700 701 702 703 704 705 706 707 708 709 710 711 712 713 714 715
716 717 718 719]
all classes 0 -> 719
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/180_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True

```

```

total: 20480
0.706

##### current_task: 9 #####
[output] current classes [720 721 722 723 724 725 726 727 728 729 730 731 732
733 734 735 736 737
  738 739 740 741 742 743 744 745 746 747 748 749 750 751 752 753 754 755
  756 757 758 759]
all classes 0 -> 759
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/190_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
0.768

##### current_task: 10 #####
[output] current classes [760 761 762 763 764 765 766 767 768 769 770 771 772
773 774 775 776 777
  778 779 780 781 782 783 784 785 786 787 788 789 790 791 792 793 794 795
  796 797 798 799]
all classes 0 -> 799
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/200_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
0.773
all logistic locally:
0.561  0.8388  0.9044  0.0    0.9368
0.7515  0.972  0.988  0.0    0.986
0.7555  0.978  0.974  0.0    0.99
0.7555  0.972  0.982  0.0    0.982
0.7655  0.994  0.982  0.0    0.998
0.758   0.972  0.96   0.0    0.986
0.787   0.98   0.968  0.0    1.0
0.7115  0.938  0.962  0.0    0.976
0.706   0.948  0.948  0.0    0.966
0.768   0.952  0.954  0.0    0.974
0.773   0.96   0.974  0.0    0.984

```

```

[41]: for i in range(task_num + 1):
        support_data, support_label, query_data, query_label, n_ways, n_shot, \
        classes = \
            get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                           local = True, brother = brother)
        pred_all = []
        for classes in classes_all:
            # load model:
            if brother:
                cls_01 = classes[-1]+1

```



```

        assert cls_01 % 4 == 0
        filename = path + '%d_model.pkl' % (int(cls_01/4))
    else:
        filename = path + '%d_model.pkl' % (classes[-1]+1)
    model = torch.load(filename)
    model.eval()
    print('> loaded base phase model from:', filename)
    num_param(model)
    # do prediction:
    min_cls = min(classes)
    if brother:
        pred = predict(model, query_data)
    else:
        pred = predict(model, query_data)[:,:4]
    pmax = torch.max(pred, dim=1)[1]
    # pacc = np.mean(t2n(pmax) == query_label - min_cls)
    # print(pacc)
    if brother:
        labs_01 = query_label[:,:4]//4
        acc_, sc_pre = merge_sc(t2n(pred), labs_01,
                                mth='softmax', forLG=True, return_pre=True)
        min_cls = int(min_cls / 4)
        pred_all.append( (sc_pre + min_cls).tolist() )
    else:
        pred_all.append( (t2n(pmax) + min_cls).tolist() )
    pred_all = np.array(pred_all)
    print(pred_all.shape)

    if i == 0:
        pred_in_clique = copy.deepcopy(pred_all)
    else:
        pred_in_clique = np.hstack((pred_in_clique, pred_all))

```

##### current\_task: 0 #####

```

[output] current classes [ 0  1  2  3  4  5  6  7  8  9 10 11 12
13 14 15 16 17
18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35
36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53
54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71
72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89
90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107
108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125
126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143
144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161
162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179
180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197
198 199 200 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215

```

```

216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233
234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250 251
252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269
270 271 272 273 274 275 276 277 278 279 280 281 282 283 284 285 286 287
288 289 290 291 292 293 294 295 296 297 298 299 300 301 302 303 304 305
306 307 308 309 310 311 312 313 314 315 316 317 318 319 320 321 322 323
324 325 326 327 328 329 330 331 332 333 334 335 336 337 338 339 340 341
342 343 344 345 346 347 348 349 350 351 352 353 354 355 356 357 358 359
360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375 376 377
378 379 380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395
396 397 398 399]
all classes 0 -> 399
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/100_model.pkl
module.classifier.weight      torch.Size([400, 512])  204800  True
total: 204800
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/110_model.pkl
module.classifier.weight      torch.Size([40, 512])   20480   True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/120_model.pkl
module.classifier.weight      torch.Size([40, 512])   20480   True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/130_model.pkl
module.classifier.weight      torch.Size([40, 512])   20480   True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/140_model.pkl
module.classifier.weight      torch.Size([40, 512])   20480   True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/150_model.pkl
module.classifier.weight      torch.Size([40, 512])   20480   True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/160_model.pkl
module.classifier.weight      torch.Size([40, 512])   20480   True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/170_model.pkl
module.classifier.weight      torch.Size([40, 512])   20480   True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/180_model.pkl
module.classifier.weight      torch.Size([40, 512])   20480   True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/190_model.pkl
module.classifier.weight      torch.Size([40, 512])   20480   True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/200_model.pkl
module.classifier.weight      torch.Size([40, 512])   20480   True
total: 20480
(11, 5000)

##### current_task: 1 #####

```

```

[output] current classes [400 401 402 403 404 405 406 407 408 409 410 411 412
413 414 415 416 417
 418 419 420 421 422 423 424 425 426 427 428 429 430 431 432 433 434 435
 436 437 438 439]
all classes 0 -> 439
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/100_model.pkl
module.classifier.weight      torch.Size([400, 512])  204800  True
total: 204800
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/110_model.pkl
module.classifier.weight      torch.Size([40, 512])   20480   True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/120_model.pkl
module.classifier.weight      torch.Size([40, 512])   20480   True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/130_model.pkl
module.classifier.weight      torch.Size([40, 512])   20480   True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/140_model.pkl
module.classifier.weight      torch.Size([40, 512])   20480   True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/150_model.pkl
module.classifier.weight      torch.Size([40, 512])   20480   True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/160_model.pkl
module.classifier.weight      torch.Size([40, 512])   20480   True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/170_model.pkl
module.classifier.weight      torch.Size([40, 512])   20480   True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/180_model.pkl
module.classifier.weight      torch.Size([40, 512])   20480   True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/190_model.pkl
module.classifier.weight      torch.Size([40, 512])   20480   True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/200_model.pkl
module.classifier.weight      torch.Size([40, 512])   20480   True
total: 20480
(11, 500)

```

```
##### current_task: 2 #####
```

```

[output] current classes [440 441 442 443 444 445 446 447 448 449 450 451 452
453 454 455 456 457
 458 459 460 461 462 463 464 465 466 467 468 469 470 471 472 473 474 475
 476 477 478 479]
all classes 0 -> 479
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/100_model.pkl
module.classifier.weight      torch.Size([400, 512])  204800  True

```

```

total: 204800
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/110_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/120_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/130_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/140_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/150_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/160_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/170_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/180_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/190_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/200_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
(11, 500)

```

```
##### current_task: 3 #####
```

```

[output] current classes [480 481 482 483 484 485 486 487 488 489 490 491 492
493 494 495 496 497
498 499 500 501 502 503 504 505 506 507 508 509 510 511 512 513 514 515
516 517 518 519]
all classes 0 -> 519
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/100_model.pkl
module.classifier.weight      torch.Size([400, 512])   204800   True
total: 204800
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/110_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/120_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480

```

```

> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/130_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/140_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/150_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/160_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/170_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/180_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/190_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/200_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
(11, 500)

```

```
##### current_task: 4 #####
```

```
[output] current classes [520 521 522 523 524 525 526 527 528 529 530 531 532
533 534 535 536 537
```

```
538 539 540 541 542 543 544 545 546 547 548 549 550 551 552 553 554 555
556 557 558 559]
```

```
all classes 0 -> 559
```

```

> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/100_model.pkl
module.classifier.weight      torch.Size([400, 512])  204800    True
total: 204800
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/110_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/120_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/130_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/140_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/150_model.pkl

```

```

module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/160_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/170_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/180_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/190_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/200_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
(11, 500)

##### current_task: 5 #####
[output] current classes [560 561 562 563 564 565 566 567 568 569 570 571 572
573 574 575 576 577
 578 579 580 581 582 583 584 585 586 587 588 589 590 591 592 593 594 595
 596 597 598 599]
all classes 0 -> 599
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/100_model.pkl
module.classifier.weight      torch.Size([400, 512])  204800    True
total: 204800
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/110_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/120_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/130_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/140_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/150_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/160_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/170_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True

```

```

total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/180_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/190_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/200_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
(11, 500)

##### current_task: 6 #####
[output] current classes [600 601 602 603 604 605 606 607 608 609 610 611 612
613 614 615 616 617
 618 619 620 621 622 623 624 625 626 627 628 629 630 631 632 633 634 635
 636 637 638 639]
all classes 0 -> 639
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/100_model.pkl
module.classifier.weight      torch.Size([400, 512])  204800   True
total: 204800
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/110_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/120_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/130_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/140_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/150_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/160_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/170_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/180_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/190_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480

```

```
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/200_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
(11, 500)
```

```
##### current_task: 7 #####
```

```
[output] current classes [640 641 642 643 644 645 646 647 648 649 650 651 652
653 654 655 656 657
658 659 660 661 662 663 664 665 666 667 668 669 670 671 672 673 674 675
676 677 678 679]
```

```
all classes 0 -> 679
```

```
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/100_model.pkl
module.classifier.weight      torch.Size([400, 512])  204800    True
total: 204800
```

```
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/110_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
```

```
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/120_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
```

```
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/130_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
```

```
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/140_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
```

```
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/150_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
```

```
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/160_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
```

```
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/170_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
```

```
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/180_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
```

```
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/190_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
```

```
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/200_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
(11, 500)
```

```
##### current_task: 8 #####
```

```
[output] current classes [680 681 682 683 684 685 686 687 688 689 690 691 692
```



```

693 694 695 696 697
698 699 700 701 702 703 704 705 706 707 708 709 710 711 712 713 714 715
716 717 718 719]
all classes 0 -> 719
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/100_model.pkl
module.classifier.weight      torch.Size([400, 512])  204800  True
total: 204800
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/110_model.pkl
module.classifier.weight      torch.Size([40, 512])   20480   True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/120_model.pkl
module.classifier.weight      torch.Size([40, 512])   20480   True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/130_model.pkl
module.classifier.weight      torch.Size([40, 512])   20480   True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/140_model.pkl
module.classifier.weight      torch.Size([40, 512])   20480   True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/150_model.pkl
module.classifier.weight      torch.Size([40, 512])   20480   True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/160_model.pkl
module.classifier.weight      torch.Size([40, 512])   20480   True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/170_model.pkl
module.classifier.weight      torch.Size([40, 512])   20480   True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/180_model.pkl
module.classifier.weight      torch.Size([40, 512])   20480   True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/190_model.pkl
module.classifier.weight      torch.Size([40, 512])   20480   True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/200_model.pkl
module.classifier.weight      torch.Size([40, 512])   20480   True
total: 20480
(11, 500)

##### current_task: 9 #####
[output] current classes [720 721 722 723 724 725 726 727 728 729 730 731 732
733 734 735 736 737
738 739 740 741 742 743 744 745 746 747 748 749 750 751 752 753 754 755
756 757 758 759]
all classes 0 -> 759
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/100_model.pkl
module.classifier.weight      torch.Size([400, 512])  204800  True
total: 204800

```

```

> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/110_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/120_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/130_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/140_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/150_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/160_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/170_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/180_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/190_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/200_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
(11, 500)

```

```
##### current_task: 10 #####
```

```

[output] current classes [760 761 762 763 764 765 766 767 768 769 770 771 772
773 774 775 776 777
778 779 780 781 782 783 784 785 786 787 788 789 790 791 792 793 794 795
796 797 798 799]

```

```
all classes 0 -> 799
```

```

> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/100_model.pkl
module.classifier.weight      torch.Size([400, 512])  204800    True
total: 204800
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/110_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/120_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/130_model.pkl

```

```

module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/140_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/150_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/160_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/170_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/180_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/190_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/Tiny_100_10x10voro/200_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
(11, 500)

```

```

[42]: print('cliques by test samples:', pred_in_clique.shape)

# compute prototypes
be      = 0.6 # 1.
l2      = True # False True
bias    = 0 # 0.05
protots  = np.mean(feats_trans(support_data_, beta=be, l2=l2, bias=bias), axis=1)
query_pts = feats_trans(query_data_, beta=be, l2=l2, bias=bias)
# acenss  = feats_trans(acens, beta=be, l2=l2, bias=bias)
if brother:
    dist    = funbtch(query_pts, protots) # protots / acenss
else:
    dist    = fun(query_pts, protots) # protots / acenss

test_splt = [sum(test_share[:t+1]) for t in range(len(test_share))]

```

```

[238]: dist_in_clique = np.zeros_like(pred_in_clique, dtype=np.float32)
for c_id, clique in enumerate(pred_in_clique):
    for s_id, samp in enumerate(clique):
        dist_in_clique[c_id][s_id] = dist[s_id][samp]

```

```
[253]: for i in range(task_num + 1):
        clique_dist = dist_in_clique[:,i+1,:test_splt[i]]
        clique_pred = np.argmin(clique_dist, axis=0)
        merge_pred = [pred_in_clique[cli,s_id] for s_id, cli in
        →enumerate(clique_pred)]
        merge_acc = np.mean(merge_pred == query_label_[:test_splt[i]])
        print(merge_acc)
    print('DaC:', 'beta:', be, '| l2:', l2)
```

```
[28]: print('===== Experiment Done! =====')
```

```
===== Experiment Done! =====
```

## iVoro on TinyImageNet Dataset (20 Phases)

```
[1]: import matplotlib.pyplot as plt
import os
import pickle
import numpy as np
import pandas as pd
import seaborn as sns
import time
import sys
sys.path.append('../')
sys.path.append('../analysis/')
import copy
import platform
import json
import pickle
import random

import torch
from scipy.stats import mode
```

```
[127]: from ResNet import resnet18_cbam

data_name      = 'Tiny' # 'Subset' # 'Tiny' # 'CIFAR100' # 'MNIST'
total_nc       = 200 # 200 # 100 # 10
fg_nc          = 100 # 100 # 40 # 50 # 4
task_num       = 20 # 20 # 5 # 10 # 2

# constant params
class_set      = list(range(total_nc))
ROTATION       = True
EMB2D          = False
DESIGN         = True
virtual_class  = 4*total_nc if ROTATION else total_nc
suffix         = 'voros' # 'prob' 'voros'
assert (total_nc - fg_nc)%task_num == 0
task_size      = int((total_nc - fg_nc)/task_num)
file_name      =
    ↳data_name+'_'+str(fg_nc)+'_'+str(task_num)+'x'+str(task_size)+suffix
```

```
print(file_name)

brother      = False # True False
```

Tiny\_100\_20x5voro

```
[128]: save_path = '../checkpoints/'
path    = save_path + file_name + '/'
filename = path + '%d_model.pkl' % (fg_nc+0) # +5
model    = torch.load(filename)
model.eval()
print('> loaded base phase model from:', filename)
```

> loaded base phase model from: ../checkpoints/Tiny\_100\_20x5voro/100\_model.pkl

```
[129]: from voro_helper import num_param, t2n, \
        load_feat, sanity_check, \
        id2emb_, num_samp, merge_sc, funbtch

num_param(model)

# voronoi centers:
vcenter = t2n(model.module.classifier.weight.data / 2.)
print(vcenter.shape)
```

```
module.classifier.weight      torch.Size([400, 512])  204800  True
total: 204800
(400, 512)
```

```
[130]: '''
CIFAR:
    'CIFAR100_50_5x10_test.pkl'
    'CIFAR100_50_5x10_train.pkl'
    'CIFAR100_40_20x3_test.pkl'
    'CIFAR100_40_20x3_train.pkl'
more CIFAR:
    'CIFAR100_40_12x5_test.pkl'
    'CIFAR100_40_12x5_train.pkl'
    'CIFAR100_30_14x5_test.pkl'
    'CIFAR100_30_14x5_train.pkl'
    'CIFAR100_20_16x5_test.pkl'
    'CIFAR100_20_16x5_train.pkl'
    'CIFAR100_10_18x5_test.pkl'
    'CIFAR100_10_18x5_train.pkl'
Tiny:
    'Tiny_100_20x5_test.pkl'
    'Tiny_100_20x5_train.pkl'
TinyL3:
```

```

        'Tiny_100_5x20_test.pkl'
        'Tiny_100_5x20_train.pkl'
Subset:
        'Subset_50_10x5_test.pkl'
        'Subset_50_10x5_train.pkl'
'''
ffile = '../embedding/prob/' + 'Tiny_100_20x5_test.pkl' # prob probL3
data_phas, last_tsk = load_feat(ffile)

labs, embeds, outputs = data_phas[last_tsk][last_tsk]
false_id, pred_ = sanity_check(labs, embeds, outputs)

```

```

feature file: ../embedding/prob/Tiny_100_20x5_test.pkl
> loaded tasks: dict_keys([20])
> classes: [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18,
19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38,
39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58,
59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78,
79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98,
99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114,
115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130,
131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146,
147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162,
163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178,
179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194,
195, 196, 197, 198, 199]
> samples: 10000
> embedding: 512
> classification: 800
~ acc (single): 51.51%
~ acc (quadruple): 46.10%

```

```

[131]: ffile = '../embedding/prob/' + 'Tiny_100_20x5_train.pkl' # prob probL3
data_phas, last_tsk = load_feat(ffile)

labst, embedst, outputst = data_phas[last_tsk][last_tsk]
false_id, pred_ = sanity_check(labst, embedst, outputst)

```

```

feature file: ../embedding/prob/Tiny_100_20x5_train.pkl
> loaded tasks: dict_keys([20])
> classes: [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18,
19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38,
39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58,
59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78,
79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98,
99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114,
115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130,
131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146,

```

```

147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162,
163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178,
179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194,
195, 196, 197, 198, 199]
> samples: 99968
> embedding: 512
> classification: 800
~ acc (single): 71.57%
~ acc (quadruple): 67.88%

```

```

[132]: embs = id2emb_(labs, embeds, brother=brother)
        embst = id2emb_(labst, embedst, brother=brother)

```

```

        sam_max, sam_min = num_samp(embst)
        print('> loading data done!')

```

```

0 498,1 500,2 500,3 500,4 500,5 500,6 500,7 500,8 500,9 500,10 500,11 500,12
500,13 499,14 500,15 500,16 500,17 500,18 500,19 500,20 500,21 499,22 500,23
500,24 500,25 500,26 500,27 500,28 499,29 500,30 500,31 500,32 500,33 500,34
500,35 500,36 500,37 500,38 500,39 499,40 500,41 500,42 500,43 500,44 500,45
500,46 500,47 500,48 500,49 499,50 500,51 499,52 500,53 500,54 500,55 500,56
500,57 500,58 500,59 500,60 500,61 500,62 499,63 500,64 500,65 500,66 500,67
500,68 500,69 499,70 500,71 500,72 500,73 499,74 499,75 500,76 500,77 500,78
500,79 500,80 500,81 498,82 499,83 500,84 500,85 500,86 500,87 500,88 500,89
500,90 500,91 500,92 500,93 498,94 500,95 500,96 500,97 500,98 499,99 499,100
500,101 500,102 499,103 500,104 500,105 500,106 500,107 500,108 500,109 500,110
499,111 500,112 500,113 500,114 500,115 500,116 499,117 500,118 500,119 500,120
500,121 500,122 500,123 500,124 500,125 500,126 500,127 500,128 500,129 500,130
500,131 500,132 500,133 500,134 500,135 500,136 500,137 500,138 500,139 500,140
500,141 500,142 500,143 500,144 499,145 500,146 500,147 500,148 500,149 500,150
499,151 500,152 499,153 499,154 500,155 500,156 500,157 500,158 500,159 499,160
500,161 500,162 500,163 500,164 500,165 500,166 500,167 500,168 500,169 500,170
500,171 500,172 500,173 500,174 500,175 500,176 500,177 499,178 500,179 500,180
500,181 500,182 499,183 500,184 500,185 500,186 500,187 499,188 500,189 500,190
500,191 500,192 500,193 500,194 500,195 500,196 498,197 500,198 500,199 500,
max samples: 500
min samples: 498
> loading data done!

```

```

[133]: for k,v in embst.items():
        if v.shape[0] < sam_max:
            rid = np.random.choice(v.shape[0], sam_max-v.shape[0], replace=False)
            print('filling', sam_max-v.shape[0], 'samples')
            embst[k] = np.vstack((v, v[rid]))

```

```

filling 2 samples
filling 1 samples
filling 1 samples
filling 1 samples

```



```

filling 1 samples
filling 1 samples
filling 1 samples
filling 1 samples
filling 1 samples
filling 1 samples
filling 1 samples
filling 2 samples
filling 1 samples
filling 2 samples
filling 1 samples
filling 1 samples
filling 1 samples
filling 1 samples
filling 1 samples
filling 1 samples
filling 1 samples
filling 1 samples
filling 1 samples
filling 1 samples
filling 1 samples
filling 2 samples

```

```

[134]: from voro_helper import get_task_data, feat_trans, NC_o, tsk_cls, fun, \
        ↪acc_brother, forgetting

i = task_num
support_data_, support_label_, query_data_, query_label_, n_ways_, n_shot_, _ = \
    get_task_data(embst, embs, i, fg_nc, class_set, task_size, brother=brother)

```

```

##### current_task: 20 #####
current classes [195, 196, 197, 198, 199]
[output] all classes 0 -> 199

```

```

[135]: #%% =====
        ↪=====

be      = 1. # 1.
l2      = False # False True
protots = np.mean(feat_trans(support_data_, beta=be, l2=l2), axis=1)

```

```

[136]: i = 0
support_data, support_label, query_data, query_label, n_ways, n_shot, classes = \
    get_task_data(embst, embs, i, fg_nc, class_set, task_size, brother=brother)
acc, _, nn_pre = NC_o(support_data, support_label,
                      query_data, query_label,

```

```

n_ways, n_shot,
beta = be, l2 = l2,
given_cen = protots[classes], given_only = True,
brother = brother)

```

```

##### current_task: 0 #####
current classes [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17,
18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37,
38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57,
58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77,
78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97,
98, 99]
[output] all classes 0 -> 99
0.5320

```

```

[137]: local      = False # True / False
nn_acc   = []
savefile = path+'NN' if brother else None # NN / NNp / NN3 / only saved NN
→results!
savefil2 = path+'NN3'
forget    = True # True False # calculate forgetting
class_ladder = []
a         = []
for i in range(task_num + 1):
    support_data, support_label, query_data, query_label, n_ways, n_shot,
→classes = \
        get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                        local = local, brother = brother) # False
    if forget:
        class_ladder.append(classes)
    acc, _, nn_pre = NC_o(support_data, support_label,
                           query_data, query_label,
                           n_ways, n_shot,
                           beta = be, l2 = l2,
                           given_cen = protots[classes] if local else protots[:
→classes[-1]+1],
                           given_only = True,
                           brother = brother,
                           savefile = savefile+'_'+str(i) if brother else None,
                           savefile2 = None, # savefil2+'_'+str(i), # None, #
                           weights = [0.7, 0.3],
                           class_ladder = class_ladder,
                           acc_all = a
                           )
    nn_acc.append(acc)
    # if all classes up2now: local = False, and protots[:classes[-1]+1]

```

```

print('local:', local, '| beta:', be, '| l2:', l2)
if brother:
    for accs in nn_acc:
        print('\t'.join([str(i) for i in accs]))
else:
    print('\n'.join([str(i) for i in nn_acc]))
if forget:
    avgf = forgetting(a, task_num)
    print(avgf)

```

```

##### current_task: 0 #####
current classes [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17,
18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37,
38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57,
58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77,
78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97,
98, 99]
[output] all classes 0 -> 99
0.5320

##### current_task: 1 #####
current classes [100, 101, 102, 103, 104]
[output] all classes 0 -> 104
0.5192

##### current_task: 2 #####
current classes [105, 106, 107, 108, 109]
[output] all classes 0 -> 109
0.5133

##### current_task: 3 #####
current classes [110, 111, 112, 113, 114]
[output] all classes 0 -> 114
0.5002

##### current_task: 4 #####
current classes [115, 116, 117, 118, 119]
[output] all classes 0 -> 119
0.4887

##### current_task: 5 #####
current classes [120, 121, 122, 123, 124]
[output] all classes 0 -> 124
0.4779

##### current_task: 6 #####
current classes [125, 126, 127, 128, 129]

```

```
[output] all classes 0 -> 129
0.4683

##### current_task: 7 #####
current classes [130, 131, 132, 133, 134]
[output] all classes 0 -> 134
0.4641

##### current_task: 8 #####
current classes [135, 136, 137, 138, 139]
[output] all classes 0 -> 139
0.4604

##### current_task: 9 #####
current classes [140, 141, 142, 143, 144]
[output] all classes 0 -> 144
0.4552

##### current_task: 10 #####
current classes [145, 146, 147, 148, 149]
[output] all classes 0 -> 149
0.4468

##### current_task: 11 #####
current classes [150, 151, 152, 153, 154]
[output] all classes 0 -> 154
0.4415

##### current_task: 12 #####
current classes [155, 156, 157, 158, 159]
[output] all classes 0 -> 159
0.4349

##### current_task: 13 #####
current classes [160, 161, 162, 163, 164]
[output] all classes 0 -> 164
0.4288

##### current_task: 14 #####
current classes [165, 166, 167, 168, 169]
[output] all classes 0 -> 169
0.4247

##### current_task: 15 #####
current classes [170, 171, 172, 173, 174]
[output] all classes 0 -> 174
0.4167
```

```

##### current_task: 16 #####
current classes [175, 176, 177, 178, 179]
[output] all classes 0 -> 179
0.4087

##### current_task: 17 #####
current classes [180, 181, 182, 183, 184]
[output] all classes 0 -> 184
0.4032

##### current_task: 18 #####
current classes [185, 186, 187, 188, 189]
[output] all classes 0 -> 189
0.3974

##### current_task: 19 #####
current classes [190, 191, 192, 193, 194]
[output] all classes 0 -> 194
0.3906

##### current_task: 20 #####
current classes [195, 196, 197, 198, 199]
[output] all classes 0 -> 199
0.3826
local: False | beta: 1.0 | l2: False
0.532
0.5192380952380953
0.5132727272727273
0.5001739130434782
0.4886666666666667
0.47792
0.4683076923076923
0.46414814814814814
0.4604285714285714
0.45517241379310347
0.4468
0.4415483870967742
0.434875
0.42884848484848487
0.42470588235294116
0.41668571428571427
0.4086666666666667
0.40324324324324323
0.3973684210526316
0.39056410256410257
0.3826
[[0.532  0.      0.      0.      0.      0.      0.      0.      0.      0.
  0.      0.      0.      0.      0.      0.      0.      0.      0.      0.]

```

0.	]								
[0.522	0.464	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	]								
[0.5128	0.46	0.576	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	]								
[0.5044	0.428	0.568	0.42	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	]								
[0.4978	0.408	0.544	0.408	0.412	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	]								
[0.4914	0.4	0.544	0.404	0.412	0.36	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	]								
[0.4856	0.396	0.54	0.392	0.408	0.348	0.38	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	]								
[0.481	0.388	0.54	0.376	0.4	0.34	0.38	0.488	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	]								
[0.4736	0.388	0.532	0.372	0.392	0.332	0.368	0.488	0.548	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	]								
[0.4676	0.38	0.532	0.372	0.392	0.328	0.36	0.476	0.548	0.46
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	]								
[0.4642	0.38	0.532	0.368	0.392	0.312	0.356	0.476	0.536	0.448
0.32	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	]								
[0.4616	0.38	0.532	0.368	0.392	0.3	0.348	0.472	0.516	0.436
0.316	0.396	0.	0.	0.	0.	0.	0.	0.	0.
0.	]								
[0.4564	0.38	0.528	0.364	0.392	0.3	0.324	0.468	0.516	0.424
0.292	0.396	0.404	0.	0.	0.	0.	0.	0.	0.
0.	]								
[0.4524	0.38	0.512	0.364	0.384	0.296	0.324	0.468	0.516	0.424
0.292	0.392	0.4	0.352	0.	0.	0.	0.	0.	0.
0.	]								
[0.4482	0.38	0.508	0.364	0.384	0.296	0.32	0.468	0.48	0.412
0.292	0.392	0.384	0.352	0.444	0.	0.	0.	0.	0.
0.	]								
[0.4462	0.372	0.5	0.356	0.38	0.292	0.312	0.468	0.48	0.412
0.284	0.376	0.384	0.352	0.444	0.248	0.	0.	0.	0.
0.	]								
[0.4408	0.352	0.496	0.356	0.38	0.288	0.308	0.468	0.476	0.408
0.268	0.368	0.372	0.344	0.444	0.244	0.324	0.	0.	0.

```

0.    ]
[0.4378 0.348 0.492 0.352 0.38 0.288 0.308 0.46 0.476 0.388
0.252 0.364 0.372 0.344 0.444 0.244 0.312 0.34 0. 0.
0.    ]
[0.4348 0.348 0.48 0.352 0.38 0.28 0.288 0.456 0.476 0.388
0.252 0.36 0.372 0.344 0.444 0.24 0.312 0.336 0.296 0.
0.    ]
[0.4322 0.332 0.48 0.352 0.376 0.276 0.284 0.456 0.476 0.388
0.244 0.352 0.372 0.344 0.444 0.24 0.312 0.332 0.292 0.236
0.    ]
[0.4284 0.32 0.48 0.344 0.372 0.276 0.276 0.456 0.476 0.384
0.24 0.352 0.364 0.34 0.444 0.236 0.304 0.332 0.284 0.232
0.224 ]]
[0, 1.0000000000000009, 1.16, 2.38666666666666703, 3.3549999999999995,
3.0519999999999983, 3.2399999999999993, 3.414285714285713, 3.5799999999999983,
3.6044444444444435, 3.7579999999999996, 3.9854545454545454, 4.2966666666666668,
4.273846153846153, 4.512857142857144, 4.652000000000001, 4.945000000000001,
5.09529411764706, 5.1400000000000015, 5.15684210526316, 5.298000000000001]

```

```

[138]: def predict(model, x, voro=True):
        x = torch.from_numpy(x.astype(np.float32)).cuda()
        with torch.no_grad():
            predi = model.module.classifier(x)
            if voro:
                predi += - torch.sum((model.module.classifier.weight/2.)**2, dim=1)
            return predi

classes_all = []
test_share = []
paccS = []
for i in range(task_num + 1):
    support_data, support_label, query_data, query_label, n_ways, n_shot, \
    classes = \
        get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                        local = True, brother = brother)

    # load model:
    if brother:
        cls_01 = classes[-1]+1
        assert cls_01 % 4 == 0
        filename = path + '%d_model.pkl' % (int(cls_01/4))
    else:
        filename = path + '%d_model.pkl' % (classes[-1]+1)
    model = torch.load(filename)
    model.eval()
    print('> loaded base phase model from:', filename)
    num_param(model)
    # do prediction:

```

```

min_cls = min(classes)
if brother:
    pred = predict(model, query_data)
else:
    pred = predict(model, query_data)[:,:,:4]
pmax = torch.max(pred, dim=1)[1]
pacc = np.mean(t2n(pmax) == query_label - min_cls)
print(pacc)
if brother:
    accs = acc_brother(t2n(pred), t2n(pmax), query_label - min_cls,
→forLG=True)
    pacc = [pacc] + accs
    paccS.append(pacc)
    classes_all.append(classes)
    test_share.append(len(query_label))
print('all logistic locally:')
if brother:
    for accs in paccS:
        print('\t'.join([str(i) for i in accs]))
else:
    print('\n'.join([str(i) for i in paccS]))

```

```

##### current_task: 0 #####
[output] current classes [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15,
16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35,
36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55,
56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75,
76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95,
96, 97, 98, 99]
all classes 0 -> 99
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/100_model.pkl
module.classifier.weight      torch.Size([400, 512])  204800  True
total: 204800
0.6284

```

```

##### current_task: 1 #####
[output] current classes [100, 101, 102, 103, 104]
all classes 0 -> 104
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/105_model.pkl
module.classifier.weight      torch.Size([20, 512])  10240  True
total: 10240
0.9

```

```

##### current_task: 2 #####
[output] current classes [105, 106, 107, 108, 109]
all classes 0 -> 109
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/110_model.pkl

```



```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.948

##### current_task: 3 #####
[output] current classes [110, 111, 112, 113, 114]
all classes 0 -> 114
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/115_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.868

##### current_task: 4 #####
[output] current classes [115, 116, 117, 118, 119]
all classes 0 -> 119
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/120_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.908

##### current_task: 5 #####
[output] current classes [120, 121, 122, 123, 124]
all classes 0 -> 124
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/125_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.904

##### current_task: 6 #####
[output] current classes [125, 126, 127, 128, 129]
all classes 0 -> 129
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/130_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.928

##### current_task: 7 #####
[output] current classes [130, 131, 132, 133, 134]
all classes 0 -> 134
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/135_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.94

##### current_task: 8 #####
[output] current classes [135, 136, 137, 138, 139]
all classes 0 -> 139
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/140_model.pkl

```

```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.944

##### current_task: 9 #####
[output] current classes [140, 141, 142, 143, 144]
all classes 0 -> 144
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/145_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.936

##### current_task: 10 #####
[output] current classes [145, 146, 147, 148, 149]
all classes 0 -> 149
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/150_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.956

##### current_task: 11 #####
[output] current classes [150, 151, 152, 153, 154]
all classes 0 -> 154
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/155_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.964

##### current_task: 12 #####
[output] current classes [155, 156, 157, 158, 159]
all classes 0 -> 159
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/160_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.884

##### current_task: 13 #####
[output] current classes [160, 161, 162, 163, 164]
all classes 0 -> 164
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/165_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.852

##### current_task: 14 #####
[output] current classes [165, 166, 167, 168, 169]
all classes 0 -> 169
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/170_model.pkl

```

```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.916

##### current_task: 15 #####
[output] current classes [170, 171, 172, 173, 174]
all classes 0 -> 174
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/175_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.896

##### current_task: 16 #####
[output] current classes [175, 176, 177, 178, 179]
all classes 0 -> 179
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/180_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.928

##### current_task: 17 #####
[output] current classes [180, 181, 182, 183, 184]
all classes 0 -> 184
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/185_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.916

##### current_task: 18 #####
[output] current classes [185, 186, 187, 188, 189]
all classes 0 -> 189
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/190_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.872

##### current_task: 19 #####
[output] current classes [190, 191, 192, 193, 194]
all classes 0 -> 194
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/195_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.96

##### current_task: 20 #####
[output] current classes [195, 196, 197, 198, 199]
all classes 0 -> 199
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/200_model.pkl

```

```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.9
all logistic locally:
0.6284
0.9
0.948
0.868
0.908
0.904
0.928
0.94
0.944
0.936
0.956
0.964
0.884
0.852
0.916
0.896
0.928
0.916
0.872
0.96
0.9

```

```

[139]: for i in range(task_num + 1):
        support_data, support_label, query_data, query_label, n_ways, n_shot, \
        classes = \
            get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                          local = True, brother = brother)
        pred_all = []
        for classes in classes_all:
            # load model:
            if brother:
                cls_01 = classes[-1]+1
                assert cls_01 % 4 == 0
                filename = path + '%d_model.pkl' % (int(cls_01/4))
            else:
                filename = path + '%d_model.pkl' % (classes[-1]+1)
            model = torch.load(filename)
            model.eval()
            print('> loaded base phase model from:', filename)
            num_param(model)
            # do prediction:
            min_cls = min(classes)
            if brother:

```

```

        pred = predict(model, query_data)
    else:
        pred = predict(model, query_data)[:,:,:4]
        pmax = torch.max(pred, dim=1)[1]
        # pacc = np.mean(t2n(pmax) == query_label - min_cls)
        # print(pacc)
    if brother:
        labs_01 = query_label[:4]//4
        acc_, sc_pre = merge_sc(t2n(pred), labs_01,
                                mth='softmax', forLG=True, return_pre=True)
        min_cls = int(min_cls / 4)
        pred_all.append( (sc_pre + min_cls).tolist() )
    else:
        pred_all.append( (t2n(pmax) + min_cls).tolist() )
pred_all = np.array(pred_all)
print(pred_all.shape)

if i == 0:
    pred_in_clique = copy.deepcopy(pred_all)
else:
    pred_in_clique = np.hstack((pred_in_clique, pred_all))

```

##### current\_task: 0 #####

[output] current classes [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99]

all classes 0 -> 99

> loaded base phase model from: ../checkpoints/Tiny\_100\_20x5voro/100\_model.pkl

module.classifier.weight torch.Size([400, 512]) 204800 True

total: 204800

> loaded base phase model from: ../checkpoints/Tiny\_100\_20x5voro/105\_model.pkl

module.classifier.weight torch.Size([20, 512]) 10240 True

total: 10240

> loaded base phase model from: ../checkpoints/Tiny\_100\_20x5voro/110\_model.pkl

module.classifier.weight torch.Size([20, 512]) 10240 True

total: 10240

> loaded base phase model from: ../checkpoints/Tiny\_100\_20x5voro/115\_model.pkl

module.classifier.weight torch.Size([20, 512]) 10240 True

total: 10240

> loaded base phase model from: ../checkpoints/Tiny\_100\_20x5voro/120\_model.pkl

module.classifier.weight torch.Size([20, 512]) 10240 True

total: 10240

> loaded base phase model from: ../checkpoints/Tiny\_100\_20x5voro/125\_model.pkl

module.classifier.weight torch.Size([20, 512]) 10240 True

```

total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/130_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/135_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/140_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/145_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/150_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/155_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/160_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/165_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/170_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/175_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/180_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/185_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/190_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/195_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/200_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(21, 5000)

```

```

##### current_task: 1 #####
[output] current classes [100, 101, 102, 103, 104]
all classes 0 -> 104
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/100_model.pkl
module.classifier.weight      torch.Size([400, 512])  204800  True
total: 204800
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/105_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/110_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/115_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/120_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/125_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/130_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/135_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/140_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/145_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/150_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/155_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/160_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/165_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/170_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240

```

```

> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/175_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/180_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/185_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/190_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/195_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/200_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(21, 250)

##### current_task: 2 #####
[output] current classes [105, 106, 107, 108, 109]
all classes 0 -> 109
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/100_model.pkl
module.classifier.weight      torch.Size([400, 512])   204800   True
total: 204800
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/105_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/110_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/115_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/120_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/125_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/130_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/135_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/140_model.pkl

```



```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/145_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/150_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/155_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/160_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/165_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/170_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/175_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/180_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/185_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/190_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/195_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/200_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(21, 250)

```

```
##### current_task: 3 #####
```

```
[output] current classes [110, 111, 112, 113, 114]
```

```
all classes 0 -> 114
```

```

> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/100_model.pkl
module.classifier.weight      torch.Size([400, 512])  204800    True
total: 204800
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/105_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True

```



```

total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/190_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/195_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/200_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(21, 250)

##### current_task: 4 #####
[output] current classes [115, 116, 117, 118, 119]
all classes 0 -> 119
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/100_model.pkl
module.classifier.weight      torch.Size([400, 512])   204800   True
total: 204800
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/105_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/110_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/115_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/120_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/125_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/130_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/135_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/140_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/145_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/150_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240

```

```

> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/155_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/160_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/165_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/170_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/175_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/180_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/185_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/190_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/195_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/200_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(21, 250)

```

```
##### current_task: 5 #####
```

```
[output] current classes [120, 121, 122, 123, 124]
```

```
all classes 0 -> 124
```

```

> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/100_model.pkl
module.classifier.weight      torch.Size([400, 512])   204800   True
total: 204800
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/105_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/110_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/115_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/120_model.pkl

```

[illegible]

```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(21, 250)

##### current_task: 6 #####
[output] current classes [125, 126, 127, 128, 129]
all classes 0 -> 129
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/100_model.pkl
module.classifier.weight      torch.Size([400, 512])  204800    True
total: 204800
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/105_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/110_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/115_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/120_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/125_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/130_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/135_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/140_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/145_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/150_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/155_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/160_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/165_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True

```

```

total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/170_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/175_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/180_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/185_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/190_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/195_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/200_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(21, 250)

```

```
##### current_task: 7 #####
```

```
[output] current classes [130, 131, 132, 133, 134]
```

```
all classes 0 -> 134
```

```

> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/100_model.pkl
module.classifier.weight      torch.Size([400, 512])   204800   True
total: 204800
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/105_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/110_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/115_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/120_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/125_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/130_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240

```

```

> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/135_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/140_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/145_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/150_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/155_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/160_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/165_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/170_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/175_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/180_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/185_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/190_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/195_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/200_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(21, 250)

```

```
##### current_task: 8 #####
```

```
[output] current classes [135, 136, 137, 138, 139]
```

```
all classes 0 -> 139
```

```
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/100_model.pkl
```



```

module.classifier.weight      torch.Size([400, 512])  204800  True
total: 204800
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/105_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/110_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/115_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/120_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/125_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/130_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/135_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/140_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/145_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/150_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/155_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/160_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/165_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/170_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/175_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/180_model.pkl

```

```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/185_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/190_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/195_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/200_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(21, 250)

##### current_task: 9 #####
[output] current classes [140, 141, 142, 143, 144]
all classes 0 -> 144
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/100_model.pkl
module.classifier.weight      torch.Size([400, 512])  204800   True
total: 204800
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/105_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/110_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/115_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/120_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/125_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/130_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/135_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/140_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/145_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True

```

```

total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/150_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/155_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/160_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/165_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/170_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/175_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/180_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/185_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/190_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/195_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/200_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(21, 250)

```

```
##### current_task: 10 #####
```

```
[output] current classes [145, 146, 147, 148, 149]
```

```
all classes 0 -> 149
```

```

> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/100_model.pkl
module.classifier.weight      torch.Size([400, 512])  204800    True
total: 204800
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/105_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/110_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240

```

[illegible]

```

> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/195_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/200_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(21, 250)

##### current_task: 11 #####
[output] current classes [150, 151, 152, 153, 154]
all classes 0 -> 154
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/100_model.pkl
module.classifier.weight      torch.Size([400, 512])   204800   True
total: 204800
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/105_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/110_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/115_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/120_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/125_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/130_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/135_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/140_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/145_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/150_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/155_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/160_model.pkl

```

```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/165_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/170_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/175_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/180_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/185_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/190_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/195_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/200_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(21, 250)

##### current_task: 12 #####
[output] current classes [155, 156, 157, 158, 159]
all classes 0 -> 159
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/100_model.pkl
module.classifier.weight      torch.Size([400, 512])   204800   True
total: 204800
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/105_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/110_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/115_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/120_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/125_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True

```

```

total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/130_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/135_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/140_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/145_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/150_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/155_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/160_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/165_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/170_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/175_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/180_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/185_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/190_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/195_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/200_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(21, 250)

```

```

##### current_task: 13 #####
[output] current classes [160, 161, 162, 163, 164]
all classes 0 -> 164
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/100_model.pkl
module.classifier.weight      torch.Size([400, 512])  204800  True
total: 204800
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/105_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240  True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/110_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240  True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/115_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240  True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/120_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240  True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/125_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240  True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/130_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240  True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/135_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240  True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/140_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240  True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/145_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240  True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/150_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240  True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/155_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240  True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/160_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240  True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/165_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240  True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/170_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240  True
total: 10240

```



```

> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/175_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/180_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/185_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/190_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/195_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/200_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(21, 250)

```

```
##### current_task: 14 #####
```

```
[output] current classes [165, 166, 167, 168, 169]
```

```
all classes 0 -> 169
```

```

> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/100_model.pkl
module.classifier.weight      torch.Size([400, 512])  204800    True
total: 204800
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/105_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/110_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/115_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/120_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/125_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/130_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/135_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/140_model.pkl

```

```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/145_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/150_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/155_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/160_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/165_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/170_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/175_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/180_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/185_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/190_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/195_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/200_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(21, 250)

```

```
##### current_task: 15 #####
```

```
[output] current classes [170, 171, 172, 173, 174]
```

```
all classes 0 -> 174
```

```

> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/100_model.pkl
module.classifier.weight      torch.Size([400, 512])  204800   True
total: 204800
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/105_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True

```

[illegible]

```

total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/190_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/195_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/200_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(21, 250)

##### current_task: 16 #####
[output] current classes [175, 176, 177, 178, 179]
all classes 0 -> 179
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/100_model.pkl
module.classifier.weight      torch.Size([400, 512])  204800   True
total: 204800
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/105_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/110_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/115_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/120_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/125_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/130_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/135_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/140_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/145_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/150_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240

```

```

> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/155_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/160_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/165_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/170_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/175_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/180_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/185_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/190_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/195_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/200_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(21, 250)

```

```
##### current_task: 17 #####
```

```
[output] current classes [180, 181, 182, 183, 184]
```

```
all classes 0 -> 184
```

```

> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/100_model.pkl
module.classifier.weight      torch.Size([400, 512])   204800   True
total: 204800
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/105_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/110_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/115_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/120_model.pkl

```

```
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/125_model.pkl  
module.classifier.weight      torch.Size([20, 512])    10240   True  
total: 10240
```

```
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/130_model.pkl  
module.classifier.weight      torch.Size([20, 512])    10240   True  
total: 10240
```

```
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/135_model.pkl  
module.classifier.weight      torch.Size([20, 512])    10240   True  
total: 10240
```

```
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/140_model.pkl  
module.classifier.weight      torch.Size([20, 512])    10240   True  
total: 10240
```

```
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/145_model.pkl  
module.classifier.weight      torch.Size([20, 512])    10240   True  
total: 10240
```

```
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/150_model.pkl  
module.classifier.weight      torch.Size([20, 512])    10240   True  
total: 10240
```

```
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/155_model.pkl  
module.classifier.weight      torch.Size([20, 512])    10240   True  
total: 10240
```

```
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/160_model.pkl  
module.classifier.weight      torch.Size([20, 512])    10240   True  
total: 10240
```

```
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/165_model.pkl  
module.classifier.weight      torch.Size([20, 512])    10240   True  
total: 10240
```

```
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/170_model.pkl  
module.classifier.weight      torch.Size([20, 512])    10240   True  
total: 10240
```

```
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/175_model.pkl  
module.classifier.weight      torch.Size([20, 512])    10240   True  
total: 10240
```

```
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/180_model.pkl  
module.classifier.weight      torch.Size([20, 512])    10240   True  
total: 10240
```

```
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/185_model.pkl  
module.classifier.weight      torch.Size([20, 512])    10240   True  
total: 10240
```

```
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/190_model.pkl  
module.classifier.weight      torch.Size([20, 512])    10240   True  
total: 10240
```

```
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/195_model.pkl  
module.classifier.weight      torch.Size([20, 512])    10240   True  
total: 10240
```

```
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/200_model.pkl
```

```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(21, 250)

##### current_task: 18 #####
[output] current classes [185, 186, 187, 188, 189]
all classes 0 -> 189
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/100_model.pkl
module.classifier.weight      torch.Size([400, 512])  204800    True
total: 204800
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/105_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/110_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/115_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/120_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/125_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/130_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/135_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/140_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/145_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/150_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/155_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/160_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/165_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True

```

```

total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/170_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/175_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/180_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/185_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/190_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/195_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/200_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(21, 250)

```

```
##### current_task: 19 #####
```

```
[output] current classes [190, 191, 192, 193, 194]
```

```
all classes 0 -> 194
```

```

> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/100_model.pkl
module.classifier.weight      torch.Size([400, 512])   204800   True
total: 204800
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/105_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/110_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/115_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/120_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/125_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/130_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240

```



```

> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/135_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/140_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/145_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/150_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/155_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/160_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/165_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/170_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/175_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/180_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/185_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/190_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/195_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/200_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(21, 250)

##### current_task: 20 #####
[output] current classes [195, 196, 197, 198, 199]
all classes 0 -> 199
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/100_model.pkl

```

```

module.classifier.weight      torch.Size([400, 512])  204800  True
total: 204800
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/105_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/110_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/115_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/120_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/125_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/130_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/135_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/140_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/145_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/150_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/155_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/160_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/165_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/170_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/175_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/180_model.pkl

```

```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/185_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/190_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/195_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/200_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(21, 250)

```

```

[140]: print('cliques by test samples:', pred_in_clique.shape)

# compute prototypes
be      = 0.6 # 1.
l2      = True # False True
bias    = 0 # 0.05
protots = np.mean(feats_trans(support_data_, beta=be, l2=l2, bias=bias), axis=1)
query_pts = feats_trans(query_data_, beta=be, l2=l2, bias=bias)
# acenss = feats_trans(acens, beta=be, l2=l2, bias=bias)
if brother:
    dist = funbtch(query_pts, protots) # protots / acenss
else:
    dist = fun(query_pts, protots) # protots / acenss

test_splt = [sum(test_share[:t+1]) for t in range(len(test_share))]

```

cliques by test samples: (21, 10000)

```

[141]: dist_in_clique = np.zeros_like(pred_in_clique, dtype=np.float32)
for c_id, clique in enumerate(pred_in_clique):
    for s_id, samp in enumerate(clique):
        dist_in_clique[c_id][s_id] = dist[s_id][samp]

```

```

[142]: for i in range(task_num + 1):
    clique_dist = dist_in_clique[:i+1,:test_splt[i]]
    clique_pred = np.argmax(clique_dist, axis=0)
    merge_pred = [pred_in_clique[cli,s_id] for s_id, cli in
    ↪ enumerate(clique_pred)]
    merge_acc = np.mean(merge_pred == query_label_[:test_splt[i]])
    print(merge_acc)
print('DaC:', 'beta:', be, '| l2:', l2)

```

0.6284

```
0.5925714285714285
0.5809090909090909
0.5613913043478261
0.5433333333333333
0.52928
0.5175384615384615
0.5140740740740741
0.5102857142857142
0.5017931034482759
0.4932
0.4868387096774194
0.47875
0.47163636363636363
0.4647058823529412
0.45622857142857143
0.44822222222222224
0.4424864864864865
0.4343157894736842
0.4268717948717949
0.4201
DaC: beta: 0.6 | l2: True
```

```
[28]: print('===== Experiment Done! =====')
```

```
===== Experiment Done! =====
```

## iVoro-AC/AI on TinyImageNet Dataset (20 Phases)

```
[9]: import matplotlib.pyplot as plt
import os
import pickle
import numpy as np
import pandas as pd
import seaborn as sns
import time
import sys
sys.path.append('../')
sys.path.append('../analysis/')
import copy
import platform
import json
import pickle
import random

import torch
from scipy.stats import mode
```

```
[43]: from ResNet import resnet18_cbam

data_name      = 'Tiny' # 'Subset' # 'Tiny' # 'CIFAR100' # 'MNIST'
total_nc       = 200 # 200 # 100 # 10
fg_nc          = 100 # 100 # 40 # 50 # 4
task_num       = 20 # 20 # 5 # 10 # 2

# constant params
class_set      = list(range(total_nc))
ROTATION       = True
EMB2D          = False
DESIGN         = True
virtual_class  = 4*total_nc if ROTATION else total_nc
suffix         = 'voro' # 'prob' 'voro'
assert (total_nc - fg_nc)%task_num == 0
task_size      = int((total_nc - fg_nc)/task_num)
file_name      = _
    ↳data_name+'_'+str(fg_nc)+'_'+str(task_num)+'x'+str(task_size)+suffix
```

```
print(file_name)

brother      = True # True False
```

Tiny\_100\_20x5voro

```
[44]: save_path = '../checkpoints/'
      path      = save_path + file_name + '/'
      filename   = path + '%d_model.pkl' % (fg_nc+0) # +5
      model      = torch.load(filename)
      model.eval()
      print('> loaded base phase model from:', filename)
```

> loaded base phase model from: ../checkpoints/Tiny\_100\_20x5voro/100\_model.pkl

```
[45]: from voro_helper import num_param, t2n, \
      load_feat, sanity_check, \
      id2emb_, num_samp, merge_sc, funbtch

num_param(model)

# voronoi centers:
vcenter = t2n(model.module.classifier.weight.data / 2.)
print(vcenter.shape)
```

```
module.classifier.weight      torch.Size([400, 512])  204800  True
total: 204800
(400, 512)
```

```
[46]: '''
      CIFAR:
          'CIFAR100_50_5x10_test.pkl'
          'CIFAR100_50_5x10_train.pkl'
          'CIFAR100_40_20x3_test.pkl'
          'CIFAR100_40_20x3_train.pkl'
      more CIFAR:
          'CIFAR100_40_12x5_test.pkl'
          'CIFAR100_40_12x5_train.pkl'
          'CIFAR100_30_14x5_test.pkl'
          'CIFAR100_30_14x5_train.pkl'
          'CIFAR100_20_16x5_test.pkl'
          'CIFAR100_20_16x5_train.pkl'
          'CIFAR100_10_18x5_test.pkl'
          'CIFAR100_10_18x5_train.pkl'
      Tiny:
          'Tiny_100_20x5_test.pkl'
          'Tiny_100_20x5_train.pkl'
      TinyL3:
```

```

        'Tiny_100_5x20_test.pkl'
        'Tiny_100_5x20_train.pkl'
Subset:
        'Subset_50_10x5_test.pkl'
        'Subset_50_10x5_train.pkl'
'''
ffile = '../embedding/prob/' + 'Tiny_100_20x5_test.pkl' # prob probL3
data_phas, last_tsk = load_feat(ffile)

labs, embeds, outputs = data_phas[last_tsk][last_tsk]
false_id, pred_ = sanity_check(labs, embeds, outputs)

```

```

feature file: ../embedding/prob/Tiny_100_20x5_test.pkl
> loaded tasks: dict_keys([20])
> classes: [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18,
19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38,
39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58,
59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78,
79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98,
99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114,
115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130,
131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146,
147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162,
163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178,
179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194,
195, 196, 197, 198, 199]
> samples: 10000
> embedding: 512
> classification: 800
~ acc (single): 51.51%
~ acc (quadruple): 46.10%

```

```

[47]: ffile = '../embedding/prob/' + 'Tiny_100_20x5_train.pkl' # prob probL3
data_phas, last_tsk = load_feat(ffile)

labst, embedst, outputst = data_phas[last_tsk][last_tsk]
false_id, pred_ = sanity_check(labst, embedst, outputst)

```

```

feature file: ../embedding/prob/Tiny_100_20x5_train.pkl
> loaded tasks: dict_keys([20])
> classes: [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18,
19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38,
39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58,
59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78,
79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98,
99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114,
115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130,
131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146,

```

```

147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162,
163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178,
179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194,
195, 196, 197, 198, 199]
> samples: 99968
> embedding: 512
> classification: 800
~ acc (single): 71.57%
~ acc (quadruple): 67.88%

```

```

[48]: embs = id2emb_(labs, embeds, brother=brother)
      embst = id2emb_(labst, embedst, brother=brother)

      sam_max, sam_min = num_samp(embst)
      print('> loading data done!')

```

```

0 498,1 498,2 498,3 498,4 500,5 500,6 500,7 500,8 500,9 500,10 500,11 500,12
500,13 500,14 500,15 500,16 500,17 500,18 500,19 500,20 500,21 500,22 500,23
500,24 500,25 500,26 500,27 500,28 500,29 500,30 500,31 500,32 500,33 500,34
500,35 500,36 500,37 500,38 500,39 500,40 500,41 500,42 500,43 500,44 500,45
500,46 500,47 500,48 500,49 500,50 500,51 500,52 499,53 499,54 499,55 499,56
500,57 500,58 500,59 500,60 500,61 500,62 500,63 500,64 500,65 500,66 500,67
500,68 500,69 500,70 500,71 500,72 500,73 500,74 500,75 500,76 500,77 500,78
500,79 500,80 500,81 500,82 500,83 500,84 499,85 499,86 499,87 499,88 500,89
500,90 500,91 500,92 500,93 500,94 500,95 500,96 500,97 500,98 500,99 500,100
500,101 500,102 500,103 500,104 500,105 500,106 500,107 500,108 500,109 500,110
500,111 500,112 499,113 499,114 499,115 499,116 500,117 500,118 500,119 500,120
500,121 500,122 500,123 500,124 500,125 500,126 500,127 500,128 500,129 500,130
500,131 500,132 500,133 500,134 500,135 500,136 500,137 500,138 500,139 500,140
500,141 500,142 500,143 500,144 500,145 500,146 500,147 500,148 500,149 500,150
500,151 500,152 500,153 500,154 500,155 500,156 499,157 499,158 499,159 499,160
500,161 500,162 500,163 500,164 500,165 500,166 500,167 500,168 500,169 500,170
500,171 500,172 500,173 500,174 500,175 500,176 500,177 500,178 500,179 500,180
500,181 500,182 500,183 500,184 500,185 500,186 500,187 500,188 500,189 500,190
500,191 500,192 500,193 500,194 500,195 500,196 499,197 499,198 499,199 499,200
500,201 500,202 500,203 500,204 499,205 499,206 499,207 499,208 500,209 500,210
500,211 500,212 500,213 500,214 500,215 500,216 500,217 500,218 500,219 500,220
500,221 500,222 500,223 500,224 500,225 500,226 500,227 500,228 500,229 500,230
500,231 500,232 500,233 500,234 500,235 500,236 500,237 500,238 500,239 500,240
500,241 500,242 500,243 500,244 500,245 500,246 500,247 500,248 499,249 499,250
499,251 499,252 500,253 500,254 500,255 500,256 500,257 500,258 500,259 500,260
500,261 500,262 500,263 500,264 500,265 500,266 500,267 500,268 500,269 500,270
500,271 500,272 500,273 500,274 500,275 500,276 499,277 499,278 499,279 499,280
500,281 500,282 500,283 500,284 500,285 500,286 500,287 500,288 500,289 500,290
500,291 500,292 499,293 499,294 499,295 499,296 499,297 499,298 499,299 499,300
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500,771 500,772 500,773 500,774 500,775 500,776 500,777 500,778 500,779 500,780  
500,781 500,782 500,783 500,784 498,785 498,786 498,787 498,788 500,789 500,790  
500,791 500,792 500,793 500,794 500,795 500,796 500,797 500,798 500,799 500,  
max samples: 500

```
min samples: 498
> loading data done!
```

```
[49]: for k,v in embst.items():
      if v.shape[0] < sam_max:
          rid = np.random.choice(v.shape[0], sam_max-v.shape[0], replace=False)
          print('filling', sam_max-v.shape[0], 'samples')
          embst[k] = np.vstack((v, v[rid]))
```

[illegible]

[illegible]

filling	1	samples
filling	1	samples
filling	1	samples
filling	1	samples
filling	1	samples
filling	1	samples
filling	1	samples
filling	1	samples
filling	1	samples
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filling	1	samples
filling	1	samples
filling	1	samples
filling	1	samples
filling	1	samples
filling	1	samples
filling	1	samples
filling	2	samples
filling	2	samples
filling	2	samples
filling	2	samples

```
[50]: from voro_helper import get_task_data, feat_trans, NC_o, tsk_cls, fun, \
      ↪ acc_brother, forgetting

      i = task_num
      support_data_, support_label_, query_data_, query_label_, n_ways_, n_shot_, _ = \
          get_task_data(embst, embs, i, fg_nc, class_set, task_size, brother=brother)
```

```
##### current_task: 20 #####
current classes [780 781 782 783 784 785 786 787 788 789 790 791 792 793 794 795
796 797
798 799]
[output] all classes 0 -> 799
```

```
[51]: %% =====
      ↪ =====
be      = 1. # 1.
l2      = False # False True
protots = np.mean(feats_trans(support_data_, beta=be, l2=l2), axis=1)
```

```
[25]: i = 0
      support_data, support_label, query_data, query_label, n_ways, n_shot, classes = \
```

```

    get_task_data(embst, embs, i, fg_nc, class_set, task_size, brother=brother)
acc, _, nn_pre = NC_o(support_data, support_label,
                      query_data, query_label,
                      n_ways, n_shot,
                      beta = be, l2 = l2,
                      given_cen = protots[classes], given_only = True,
                      brother = brother)

```

```

[52]: local      = False # True / False
nn_acc  = []
savefile = path+'NNp' if brother else None # NN / NNp / NN3 / only saved NN
→results!
savefil2 = path+'NN3'
forget   = True # True False # calculate forgetting
class_ladder = []
a        = []
for i in range(task_num + 1):
    support_data, support_label, query_data, query_label, n_ways, n_shot,
→classes = \
        get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                        local = local, brother = brother) # False

    if forget:
        class_ladder.append(classes)
    acc, _, nn_pre = NC_o(support_data, support_label,
                          query_data, query_label,
                          n_ways, n_shot,
                          beta = be, l2 = l2,
                          given_cen = protots[classes] if local else protots[:
→classes[-1]+1],

                          given_only = True,
                          brother = brother,
                          savefile = savefile+'_'+str(i) if brother else None,
                          savefil2 = None, # savefil2+'_'+str(i), # None, #
                          weights = [0.7, 0.3],
                          class_ladder = class_ladder,
                          acc_all = a
                          )

    nn_acc.append(acc)
    # if all classes up2now: local = False, and protots[:classes[-1]+1]
print('local:', local, '| beta:', be, '| l2:', l2)
if brother:
    for accs in nn_acc:
        print('\t'.join([str(i) for i in accs]))
else:
    print('\n'.join([str(i) for i in nn_acc]))
if forget:
    avgf = forgetting(a, task_num)

```

```
print(avgf)
```

```
##### current_task: 0 #####
current classes [ 0  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15
16 17
 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35
 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53
 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71
 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89
 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107
108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125
126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143
144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161
162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179
180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197
198 199 200 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215
216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233
234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250 251
252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269
270 271 272 273 274 275 276 277 278 279 280 281 282 283 284 285 286 287
288 289 290 291 292 293 294 295 296 297 298 299 300 301 302 303 304 305
306 307 308 309 310 311 312 313 314 315 316 317 318 319 320 321 322 323
324 325 326 327 328 329 330 331 332 333 334 335 336 337 338 339 340 341
342 343 344 345 346 347 348 349 350 351 352 353 354 355 356 357 358 359
360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375 376 377
378 379 380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395
396 397 398 399]
[output] all classes 0 -> 399
<<< loaded from: ../checkpoints/Tiny_100_20x5voro/NNp_0.npy
0.4658

##### current_task: 1 #####
current classes [400 401 402 403 404 405 406 407 408 409 410 411 412 413 414 415
416 417
 418 419]
[output] all classes 0 -> 419
<<< loaded from: ../checkpoints/Tiny_100_20x5voro/NNp_1.npy
0.4549

##### current_task: 2 #####
current classes [420 421 422 423 424 425 426 427 428 429 430 431 432 433 434 435
436 437
 438 439]
[output] all classes 0 -> 439
<<< loaded from: ../checkpoints/Tiny_100_20x5voro/NNp_2.npy
0.4492
```

```

##### current_task: 3 #####
current classes [440 441 442 443 444 445 446 447 448 449 450 451 452 453 454 455
456 457
458 459]
[output] all classes 0 -> 459
<<< loaded from: ../checkpoints/Tiny_100_20x5voro/NNp_3.npy
0.4394

##### current_task: 4 #####
current classes [460 461 462 463 464 465 466 467 468 469 470 471 472 473 474 475
476 477
478 479]
[output] all classes 0 -> 479
<<< loaded from: ../checkpoints/Tiny_100_20x5voro/NNp_4.npy
0.4299

##### current_task: 5 #####
current classes [480 481 482 483 484 485 486 487 488 489 490 491 492 493 494 495
496 497
498 499]
[output] all classes 0 -> 499
<<< loaded from: ../checkpoints/Tiny_100_20x5voro/NNp_5.npy
0.4218

##### current_task: 6 #####
current classes [500 501 502 503 504 505 506 507 508 509 510 511 512 513 514 515
516 517
518 519]
[output] all classes 0 -> 519
<<< loaded from: ../checkpoints/Tiny_100_20x5voro/NNp_6.npy
0.4121

##### current_task: 7 #####
current classes [520 521 522 523 524 525 526 527 528 529 530 531 532 533 534 535
536 537
538 539]
[output] all classes 0 -> 539
<<< loaded from: ../checkpoints/Tiny_100_20x5voro/NNp_7.npy
0.4082

##### current_task: 8 #####
current classes [540 541 542 543 544 545 546 547 548 549 550 551 552 553 554 555
556 557
558 559]
[output] all classes 0 -> 559
<<< loaded from: ../checkpoints/Tiny_100_20x5voro/NNp_8.npy
0.4045

```

```

##### current_task: 9 #####
current classes [560 561 562 563 564 565 566 567 568 569 570 571 572 573 574 575
576 577
578 579]
[output] all classes 0 -> 579
<<< loaded from: ../checkpoints/Tiny_100_20x5voro/NNp_9.npy
0.3986

##### current_task: 10 #####
current classes [580 581 582 583 584 585 586 587 588 589 590 591 592 593 594 595
596 597
598 599]
[output] all classes 0 -> 599
<<< loaded from: ../checkpoints/Tiny_100_20x5voro/NNp_10.npy
0.3907

##### current_task: 11 #####
current classes [600 601 602 603 604 605 606 607 608 609 610 611 612 613 614 615
616 617
618 619]
[output] all classes 0 -> 619
<<< loaded from: ../checkpoints/Tiny_100_20x5voro/NNp_11.npy
0.3845

##### current_task: 12 #####
current classes [620 621 622 623 624 625 626 627 628 629 630 631 632 633 634 635
636 637
638 639]
[output] all classes 0 -> 639
<<< loaded from: ../checkpoints/Tiny_100_20x5voro/NNp_12.npy
0.3755

##### current_task: 13 #####
current classes [640 641 642 643 644 645 646 647 648 649 650 651 652 653 654 655
656 657
658 659]
[output] all classes 0 -> 659
<<< loaded from: ../checkpoints/Tiny_100_20x5voro/NNp_13.npy
0.3695

##### current_task: 14 #####
current classes [660 661 662 663 664 665 666 667 668 669 670 671 672 673 674 675
676 677
678 679]
[output] all classes 0 -> 679
<<< loaded from: ../checkpoints/Tiny_100_20x5voro/NNp_14.npy
0.3632

```



```

##### current_task: 15 #####
current classes [680 681 682 683 684 685 686 687 688 689 690 691 692 693 694 695
696 697
698 699]
[output] all classes 0 -> 699
<<< loaded from: ../checkpoints/Tiny_100_20x5voro/NNp_15.npy
0.3558

##### current_task: 16 #####
current classes [700 701 702 703 704 705 706 707 708 709 710 711 712 713 714 715
716 717
718 719]
[output] all classes 0 -> 719
<<< loaded from: ../checkpoints/Tiny_100_20x5voro/NNp_16.npy
0.3501

##### current_task: 17 #####
current classes [720 721 722 723 724 725 726 727 728 729 730 731 732 733 734 735
736 737
738 739]
[output] all classes 0 -> 739
<<< loaded from: ../checkpoints/Tiny_100_20x5voro/NNp_17.npy
0.3459

##### current_task: 18 #####
current classes [740 741 742 743 744 745 746 747 748 749 750 751 752 753 754 755
756 757
758 759]
[output] all classes 0 -> 759
<<< loaded from: ../checkpoints/Tiny_100_20x5voro/NNp_18.npy
0.3412

##### current_task: 19 #####
current classes [760 761 762 763 764 765 766 767 768 769 770 771 772 773 774 775
776 777
778 779]
[output] all classes 0 -> 779
<<< loaded from: ../checkpoints/Tiny_100_20x5voro/NNp_19.npy
0.3345

##### current_task: 20 #####
current classes [780 781 782 783 784 785 786 787 788 789 790 791 792 793 794 795
796 797
798 799]
[output] all classes 0 -> 799
<<< loaded from: ../checkpoints/Tiny_100_20x5voro/NNp_20.npy
0.3285
local: False | beta: 1.0 | 12: False

```

0.46585	0.704	0.8208	0.8118	0.7686				
0.4549047619047619			0.6883809523809524		0.8097142857142857			
0.8013333333333333			0.7575238095238095					
0.44922727272727275			0.686	0.8058181818181818		0.7961818181818182		
0.7525454545454545								
0.4394347826086957			0.6695652173913044		0.794608695652174			
0.7838260869565218			0.7387826086956522					
0.429875	0.655		0.7828333333333334		0.7733333333333333			
0.7263333333333334								
0.4218	0.64496	0.76992	0.75904	0.71632				
0.4121153846153846			0.63	0.7501538461538462		0.7398461538461538		
0.6906153846153846								
0.4081851851851852			0.6237037037037036		0.7451851851851852			
0.7352592592592593			0.6816296296296296					
0.4045357142857143			0.6204285714285714		0.7335714285714285		0.725	
0.6664285714285715								
0.39855172413793105			0.6117241379310345		0.7313103448275862			
0.7233103448275862			0.6649655172413793					
0.3907	0.5981333333333333		0.7269333333333333		0.7197333333333333			
0.66								
0.3844516129032258			0.5869677419354838		0.7209032258064516			
0.7148387096774194			0.655483870967742					
0.3755	0.573625		0.712875	0.705625	0.646625			
0.36954545454545457			0.561939393939394		0.7084848484848485		0.7	
0.6425454545454545								
0.36320588235294116			0.5565882352941176		0.6982352941176471			
0.6889411764705883			0.6297647058823529					
0.35582857142857144			0.5459428571428572		0.6928	0.6829714285714286		
0.6252571428571428								
0.3501111111111111			0.5355555555555556		0.6848888888888889			
0.6754444444444444			0.6183333333333333					
0.3458918918918919			0.5278918918918919		0.6766486486486486			
0.667027027027027			0.6088648648648649					
0.34123684210526317			0.5201052631578947		0.6707368421052632			
0.6613684210526316			0.6021052631578947					
0.33453846153846156			0.5078974358974359		0.6622564102564102			
0.6538461538461539			0.5925128205128205					
0.328525	0.4978		0.6583	0.6506	0.5908			
[0.46585	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	]					
[0.46055	0.342	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	]					
[0.4532	0.339	0.48	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	]					
[0.4503	0.334	0.48	0.287	0.	0.	0.	0.	0.

0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	]					
[0.4465	0.327	0.472	0.283	0.305	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	]					
[0.4419	0.325	0.47	0.277	0.305	0.33	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	]					
[0.4395	0.32	0.467	0.277	0.305	0.323	0.233	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	]					
[0.43535	0.309	0.464	0.257	0.301	0.311	0.228	0.444	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	]					
[0.43105	0.309	0.462	0.256	0.301	0.307	0.219	0.441	0.411
0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	]					
[0.42875	0.307	0.462	0.254	0.3	0.305	0.219	0.427	0.41
0.299	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	]					
[0.4279	0.307	0.462	0.254	0.3	0.293	0.218	0.427	0.407
0.297	0.198	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	]					
[0.42545	0.307	0.462	0.254	0.3	0.29	0.217	0.427	0.385
0.282	0.198	0.287	0.	0.	0.	0.	0.	0.
0.	0.	0.	]					
[0.4232	0.307	0.461	0.253	0.3	0.289	0.202	0.427	0.385
0.28	0.192	0.287	0.169	0.	0.	0.	0.	0.
0.	0.	0.	]					
[0.4209	0.307	0.46	0.253	0.294	0.288	0.202	0.424	0.384
0.279	0.192	0.285	0.169	0.24	0.	0.	0.	0.
0.	0.	0.	]					
[0.41655	0.305	0.457	0.252	0.294	0.284	0.196	0.42	0.363
0.275	0.186	0.285	0.146	0.24	0.315	0.	0.	0.
0.	0.	0.	]					
[0.41595	0.302	0.454	0.252	0.294	0.281	0.196	0.42	0.362
0.274	0.186	0.277	0.145	0.239	0.314	0.139	0.	0.
0.	0.	0.	]					
[0.4135	0.273	0.45	0.251	0.289	0.279	0.185	0.414	0.359
0.272	0.185	0.272	0.145	0.237	0.314	0.138	0.271	0.
0.	0.	0.	]					
[0.41035	0.273	0.449	0.25	0.289	0.274	0.185	0.406	0.359
0.259	0.179	0.272	0.145	0.237	0.312	0.138	0.269	0.295
0.	0.	0.	]					
[0.40805	0.272	0.436	0.25	0.289	0.268	0.179	0.405	0.356
0.259	0.179	0.272	0.145	0.237	0.312	0.137	0.268	0.295
0.247	0.	0.	]					
[0.40685	0.27	0.435	0.25	0.289	0.268	0.179	0.405	0.355

```

0.259 0.179 0.271 0.145 0.236 0.312 0.136 0.268 0.294
0.247 0.112 0.    ]
[0.40575 0.268 0.434 0.246 0.288 0.264 0.163 0.405 0.355
0.259 0.178 0.271 0.143 0.234 0.311 0.132 0.266 0.294
0.238 0.112 0.165 ]]
[0, 0.5299999999999971, 0.7824999999999999, 0.7850000000000005, 1.15875,
1.2189999999999999, 1.3058333333333318, 1.9642857142857135, 2.01,
2.0566666666666666, 2.0395000000000003, 2.2490909090909095, 2.2970833333333327,
2.253461538461538, 2.6521428571428576, 2.626, 2.9271875, 2.9970588235294113,
3.021111111111111, 2.9105263157894736, 3.0155]

```

```

[53]: def predict(model, x, voro=True):
    x = torch.from_numpy(x.astype(np.float32)).cuda()
    with torch.no_grad():
        predi = model.module.classifier(x)
    if voro:
        predi += - torch.sum((model.module.classifier.weight/2.)**2, dim=1)
    return predi

classes_all = []
test_share = []
paccS = []
for i in range(task_num + 1):
    support_data, support_label, query_data, query_label, n_ways, n_shot, \
    classes = \
        get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                        local = True, brother = brother)
    # load model:
    if brother:
        cls_01 = classes[-1]+1
        assert cls_01 % 4 == 0
        filename = path + '%d_model.pkl' % (int(cls_01/4))
    else:
        filename = path + '%d_model.pkl' % (classes[-1]+1)
    model = torch.load(filename)
    model.eval()
    print('> loaded base phase model from:', filename)
    num_param(model)
    # do prediction:
    min_cls = min(classes)
    if brother:
        pred = predict(model, query_data)
    else:
        pred = predict(model, query_data)[:,:,:4]
    pmax = torch.max(pred, dim=1)[1]
    pacc = np.mean(t2n(pmax) == query_label - min_cls)
    print(pacc)

```

```

    if brother:
        accs = acc_brother(t2n(pred), t2n(pmax), query_label - min_cls,
→forLG=True)
        pacc = [pacc] + accs
        paccS.append(pacc)
        classes_all.append(classes)
        test_share.append(len(query_label))
print('all logistic locally:')
if brother:
    for accs in paccS:
        print('\t'.join([str(i) for i in accs]))
else:
    print('\n'.join([str(i) for i in paccS]))

```

##### current\_task: 0 #####

[output] current classes [ 0 1 2 3 4 5 6 7 8 9 10 11 12  
13 14 15 16 17

18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35  
36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53  
54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71  
72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89  
90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107  
108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125  
126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143  
144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161  
162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179  
180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197  
198 199 200 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215  
216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233  
234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250 251  
252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269  
270 271 272 273 274 275 276 277 278 279 280 281 282 283 284 285 286 287  
288 289 290 291 292 293 294 295 296 297 298 299 300 301 302 303 304 305  
306 307 308 309 310 311 312 313 314 315 316 317 318 319 320 321 322 323  
324 325 326 327 328 329 330 331 332 333 334 335 336 337 338 339 340 341  
342 343 344 345 346 347 348 349 350 351 352 353 354 355 356 357 358 359  
360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375 376 377  
378 379 380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395  
396 397 398 399]

all classes 0 -> 399

> loaded base phase model from: ../checkpoints/Tiny\_100\_20x5voro/100\_model.pkl  
module.classifier.weight torch.Size([400, 512]) 204800 True  
total: 204800  
0.5617

##### current\_task: 1 #####

[output] current classes [400 401 402 403 404 405 406 407 408 409 410 411 412

```

413 414 415 416 417
  418 419]
all classes 0 -> 419
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/105_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.759

##### current_task: 2 #####
[output] current classes [420 421 422 423 424 425 426 427 428 429 430 431 432
433 434 435 436 437
  438 439]
all classes 0 -> 439
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/110_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.859

##### current_task: 3 #####
[output] current classes [440 441 442 443 444 445 446 447 448 449 450 451 452
453 454 455 456 457
  458 459]
all classes 0 -> 459
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/115_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.779

##### current_task: 4 #####
[output] current classes [460 461 462 463 464 465 466 467 468 469 470 471 472
473 474 475 476 477
  478 479]
all classes 0 -> 479
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/120_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.815

##### current_task: 5 #####
[output] current classes [480 481 482 483 484 485 486 487 488 489 490 491 492
493 494 495 496 497
  498 499]
all classes 0 -> 499
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/125_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.84

```

```
##### current_task: 6 #####
[output] current classes [500 501 502 503 504 505 506 507 508 509 510 511 512
513 514 515 516 517
518 519]
all classes 0 -> 519
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/130_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.801
```

```
##### current_task: 7 #####
[output] current classes [520 521 522 523 524 525 526 527 528 529 530 531 532
533 534 535 536 537
538 539]
all classes 0 -> 539
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/135_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.828
```

```
##### current_task: 8 #####
[output] current classes [540 541 542 543 544 545 546 547 548 549 550 551 552
553 554 555 556 557
558 559]
all classes 0 -> 559
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/140_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.791
```

```
##### current_task: 9 #####
[output] current classes [560 561 562 563 564 565 566 567 568 569 570 571 572
573 574 575 576 577
578 579]
all classes 0 -> 579
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/145_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.812
```

```
##### current_task: 10 #####
[output] current classes [580 581 582 583 584 585 586 587 588 589 590 591 592
593 594 595 596 597
598 599]
all classes 0 -> 599
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/150_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
```

0.8

```
##### current_task: 11 #####
[output] current classes [600 601 602 603 604 605 606 607 608 609 610 611 612
613 614 615 616 617
618 619]
all classes 0 -> 619
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/155_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.897
```

```
##### current_task: 12 #####
[output] current classes [620 621 622 623 624 625 626 627 628 629 630 631 632
633 634 635 636 637
638 639]
all classes 0 -> 639
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/160_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.743
```

```
##### current_task: 13 #####
[output] current classes [640 641 642 643 644 645 646 647 648 649 650 651 652
653 654 655 656 657
658 659]
all classes 0 -> 659
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/165_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.745
```

```
##### current_task: 14 #####
[output] current classes [660 661 662 663 664 665 666 667 668 669 670 671 672
673 674 675 676 677
678 679]
all classes 0 -> 679
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/170_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.731
```

```
##### current_task: 15 #####
[output] current classes [680 681 682 683 684 685 686 687 688 689 690 691 692
693 694 695 696 697
698 699]
all classes 0 -> 699
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/175_model.pkl
```



```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.775

##### current_task: 16 #####
[output] current classes [700 701 702 703 704 705 706 707 708 709 710 711 712
713 714 715 716 717
718 719]
all classes 0 -> 719
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/180_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.818

##### current_task: 17 #####
[output] current classes [720 721 722 723 724 725 726 727 728 729 730 731 732
733 734 735 736 737
738 739]
all classes 0 -> 739
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/185_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.841

##### current_task: 18 #####
[output] current classes [740 741 742 743 744 745 746 747 748 749 750 751 752
753 754 755 756 757
758 759]
all classes 0 -> 759
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/190_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.765

##### current_task: 19 #####
[output] current classes [760 761 762 763 764 765 766 767 768 769 770 771 772
773 774 775 776 777
778 779]
all classes 0 -> 779
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/195_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.824

##### current_task: 20 #####
[output] current classes [780 781 782 783 784 785 786 787 788 789 790 791 792
793 794 795 796 797
798 799]

```

```

all classes 0 -> 799
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/200_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.854
all logistic locally:
0.5617  0.843  0.91   0.0   0.9362
0.759   0.968  0.972  0.0   0.976
0.859   1.0   1.0   0.0   1.0
0.779   0.976  1.0   0.0   1.0
0.815   0.992  0.992  0.0   0.996
0.84    0.996  0.968  0.0   0.996
0.801   0.992  1.0   0.0   1.0
0.828   0.996  0.992  0.0   0.996
0.791   1.0   1.0   0.0   1.0
0.812   0.988  0.988  0.0   0.988
0.8     0.988  1.0   0.0   1.0
0.897   0.996  1.0   0.0   1.0
0.743   0.98   0.92   0.0   0.996
0.745   0.92   0.964  0.0   0.968
0.731   0.98   0.964  0.0   0.992
0.775   0.984  0.964  0.0   0.988
0.818   0.992  0.984  0.0   0.988
0.841   0.988  1.0   0.0   1.0
0.765   0.948  0.968  0.0   0.968
0.824   0.996  1.0   0.0   1.0
0.854   0.988  0.984  0.0   0.984

```

```

[54]: for i in range(task_num + 1):
        support_data, support_label, query_data, query_label, n_ways, n_shot, \
        classes = \
            get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                           local = True, brother = brother)
    pred_all = []
    for classes in classes_all:
        # load model:
        if brother:
            cls_01 = classes[-1]+1
            assert cls_01 % 4 == 0
            filename = path + '%d_model.pkl' % (int(cls_01/4))
        else:
            filename = path + '%d_model.pkl' % (classes[-1]+1)
        model = torch.load(filename)
        model.eval()
        print('> loaded base phase model from:', filename)
        num_param(model)
        # do prediction:

```

```

min_cls = min(classes)
if brother:
    pred = predict(model, query_data)
else:
    pred = predict(model, query_data)[:,:,:4]
pmax = torch.max(pred, dim=1)[1]
# pacc = np.mean(t2n(pmax) == query_label - min_cls)
# print(pacc)
if brother:
    labs_01 = query_label[:4]//4
    acc_, sc_pre = merge_sc(t2n(pred), labs_01,
                           mth='softmax', forLG=True, return_pre=True)
    min_cls = int(min_cls / 4)
    pred_all.append( (sc_pre + min_cls).tolist() )
else:
    pred_all.append( (t2n(pmax) + min_cls).tolist() )
pred_all = np.array(pred_all)
print(pred_all.shape)

if i == 0:
    pred_in_clique = copy.deepcopy(pred_all)
else:
    pred_in_clique = np.hstack((pred_in_clique, pred_all))

```

##### current\_task: 0 #####

[output] current classes [ 0 1 2 3 4 5 6 7 8 9 10 11 12  
13 14 15 16 17

18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53
54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71
72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89
90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107
108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125
126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143
144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161
162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179
180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197
198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215
216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233
234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251
252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269
270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287
288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305
306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323
324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341
342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359
360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377

```

378 379 380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395
396 397 398 399]
all classes 0 -> 399
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/100_model.pkl
module.classifier.weight      torch.Size([400, 512])  204800   True
total: 204800
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/105_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/110_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/115_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/120_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/125_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/130_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/135_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/140_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/145_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/150_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/155_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/160_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/165_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/170_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240    True
total: 10240

```

```

> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/175_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/180_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/185_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/190_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/195_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/200_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(21, 5000)

##### current_task: 1 #####
[output] current classes [400 401 402 403 404 405 406 407 408 409 410 411 412
413 414 415 416 417
 418 419]
all classes 0 -> 419
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/100_model.pkl
module.classifier.weight      torch.Size([400, 512])   204800   True
total: 204800
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/105_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/110_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/115_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/120_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/125_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/130_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/135_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True

```

```

total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/140_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/145_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/150_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/155_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/160_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/165_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/170_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/175_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/180_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/185_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/190_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/195_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/200_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(21, 250)

##### current_task: 2 #####
[output] current classes [420 421 422 423 424 425 426 427 428 429 430 431 432
433 434 435 436 437
438 439]
all classes 0 -> 439
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/100_model.pkl

```

```

module.classifier.weight      torch.Size([400, 512])  204800  True
total: 204800
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/105_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/110_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/115_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/120_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/125_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/130_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/135_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/140_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/145_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/150_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/155_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/160_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/165_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/170_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/175_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/180_model.pkl

```

```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/185_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/190_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/195_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/200_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(21, 250)

##### current_task: 3 #####
[output] current classes [440 441 442 443 444 445 446 447 448 449 450 451 452
453 454 455 456 457
458 459]
all classes 0 -> 459
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/100_model.pkl
module.classifier.weight      torch.Size([400, 512])   204800   True
total: 204800
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/105_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/110_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/115_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/120_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/125_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/130_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/135_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/140_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240

```



```

> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/145_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/150_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/155_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/160_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/165_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/170_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/175_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/180_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/185_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/190_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/195_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/200_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(21, 250)

```

```
##### current_task: 4 #####
```

```

[output] current classes [460 461 462 463 464 465 466 467 468 469 470 471 472
473 474 475 476 477
478 479]

```

```
all classes 0 -> 479
```

```

> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/100_model.pkl
module.classifier.weight      torch.Size([400, 512])   204800    True
total: 204800
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/105_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True

```

[illegible]

```

total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/190_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/195_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/200_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(21, 250)

##### current_task: 5 #####
[output] current classes [480 481 482 483 484 485 486 487 488 489 490 491 492
493 494 495 496 497
498 499]
all classes 0 -> 499
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/100_model.pkl
module.classifier.weight      torch.Size([400, 512])   204800   True
total: 204800
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/105_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/110_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/115_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/120_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/125_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/130_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/135_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/140_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/145_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/150_model.pkl

```

```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/155_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/160_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/165_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/170_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/175_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/180_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/185_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/190_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/195_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/200_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(21, 250)

##### current_task: 6 #####
[output] current classes [500 501 502 503 504 505 506 507 508 509 510 511 512
513 514 515 516 517
518 519]
all classes 0 -> 519
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/100_model.pkl
module.classifier.weight      torch.Size([400, 512])  204800    True
total: 204800
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/105_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/110_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240

```



```

> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/195_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/200_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(21, 250)

##### current_task: 7 #####
[output] current classes [520 521 522 523 524 525 526 527 528 529 530 531 532
533 534 535 536 537
538 539]
all classes 0 -> 539
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/100_model.pkl
module.classifier.weight      torch.Size([400, 512])   204800   True
total: 204800
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/105_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/110_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/115_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/120_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/125_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/130_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/135_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/140_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/145_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/150_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/155_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True

```

```

total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/160_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/165_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/170_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/175_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/180_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/185_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/190_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/195_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/200_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(21, 250)

```

```
##### current_task: 8 #####
```

```

[output] current classes [540 541 542 543 544 545 546 547 548 549 550 551 552
553 554 555 556 557
558 559]
all classes 0 -> 559
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/100_model.pkl
module.classifier.weight      torch.Size([400, 512])  204800    True
total: 204800
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/105_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/110_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/115_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/120_model.pkl

```

[illegible]



```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(21, 250)

```

```
##### current_task: 9 #####
```

```

[output] current classes [560 561 562 563 564 565 566 567 568 569 570 571 572
573 574 575 576 577
578 579]

```

```
all classes 0 -> 579
```

```
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/100_model.pkl
```

```

module.classifier.weight      torch.Size([400, 512])    204800    True
total: 204800

```

```
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/105_model.pkl
```

```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240

```

```
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/110_model.pkl
```

```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240

```

```
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/115_model.pkl
```

```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240

```

```
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/120_model.pkl
```

```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240

```

```
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/125_model.pkl
```

```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240

```

```
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/130_model.pkl
```

```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240

```

```
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/135_model.pkl
```

```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240

```

```
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/140_model.pkl
```

```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240

```

```
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/145_model.pkl
```

```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240

```

```
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/150_model.pkl
```

```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240

```

```
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/155_model.pkl
```

```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240

```

```
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/160_model.pkl
```

```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240

```

```

> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/165_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/170_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/175_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/180_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/185_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/190_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/195_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/200_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(21, 250)

```

```
##### current_task: 10 #####
```

```

[output] current classes [580 581 582 583 584 585 586 587 588 589 590 591 592
593 594 595 596 597
598 599]
all classes 0 -> 599
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/100_model.pkl
module.classifier.weight      torch.Size([400, 512])  204800    True
total: 204800
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/105_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/110_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/115_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/120_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/125_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True

```

```

total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/130_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/135_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/140_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/145_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/150_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/155_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/160_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/165_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/170_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/175_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/180_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/185_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/190_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/195_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/200_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(21, 250)

```

```

##### current_task: 11 #####
[output] current classes [600 601 602 603 604 605 606 607 608 609 610 611 612
613 614 615 616 617
618 619]
all classes 0 -> 619
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/100_model.pkl
module.classifier.weight      torch.Size([400, 512])  204800  True
total: 204800
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/105_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/110_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/115_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/120_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/125_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/130_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/135_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/140_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/145_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/150_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/155_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/160_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/165_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/170_model.pkl

```

```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/175_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/180_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/185_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/190_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/195_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/200_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(21, 250)

```

##### current\_task: 12 #####

```

[output] current classes [620 621 622 623 624 625 626 627 628 629 630 631 632
633 634 635 636 637
638 639]
all classes 0 -> 639
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/100_model.pkl
module.classifier.weight      torch.Size([400, 512])    204800    True
total: 204800
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/105_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/110_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/115_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/120_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/125_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/130_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240

```

```

> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/135_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/140_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/145_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/150_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/155_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/160_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/165_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/170_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/175_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/180_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/185_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/190_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/195_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/200_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(21, 250)

```

```
##### current_task: 13 #####
```

```

[output] current classes [640 641 642 643 644 645 646 647 648 649 650 651 652
653 654 655 656 657
658 659]

```

```

all classes 0 -> 659
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/100_model.pkl
module.classifier.weight      torch.Size([400, 512])  204800  True
total: 204800
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/105_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/110_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/115_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/120_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/125_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/130_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/135_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/140_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/145_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/150_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/155_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/160_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/165_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/170_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/175_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True

```

```

total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/180_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/185_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/190_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/195_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/200_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(21, 250)

```

```
##### current_task: 14 #####
```

```

[output] current classes [660 661 662 663 664 665 666 667 668 669 670 671 672
673 674 675 676 677
678 679]
all classes 0 -> 679
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/100_model.pkl
module.classifier.weight      torch.Size([400, 512])  204800   True
total: 204800
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/105_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/110_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/115_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/120_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/125_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/130_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/135_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/140_model.pkl

```



```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/145_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/150_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/155_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/160_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/165_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/170_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/175_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/180_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/185_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/190_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/195_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/200_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(21, 250)

##### current_task: 15 #####
[output] current classes [680 681 682 683 684 685 686 687 688 689 690 691 692
693 694 695 696 697
698 699]
all classes 0 -> 699
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/100_model.pkl
module.classifier.weight      torch.Size([400, 512])  204800   True
total: 204800

```

[illegible]

```

> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/185_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/190_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/195_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/200_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(21, 250)

```

```
##### current_task: 16 #####
```

```

[output] current classes [700 701 702 703 704 705 706 707 708 709 710 711 712
713 714 715 716 717
718 719]

```

```
all classes 0 -> 719
```

```

> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/100_model.pkl
module.classifier.weight      torch.Size([400, 512])  204800    True
total: 204800
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/105_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/110_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/115_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/120_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/125_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/130_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/135_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/140_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/145_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True

```

```

total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/150_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/155_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/160_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/165_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/170_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/175_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/180_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/185_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/190_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/195_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/200_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(21, 250)

```

```
##### current_task: 17 #####
```

```

[output] current classes [720 721 722 723 724 725 726 727 728 729 730 731 732
733 734 735 736 737
738 739]

```

```
all classes 0 -> 739
```

```

> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/100_model.pkl
module.classifier.weight      torch.Size([400, 512])  204800    True
total: 204800
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/105_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/110_model.pkl

```

[illegible]

```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/195_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/200_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(21, 250)

##### current_task: 18 #####
[output] current classes [740 741 742 743 744 745 746 747 748 749 750 751 752
753 754 755 756 757
758 759]
all classes 0 -> 759
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/100_model.pkl
module.classifier.weight      torch.Size([400, 512])  204800    True
total: 204800
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/105_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/110_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/115_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/120_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/125_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/130_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/135_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/140_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/145_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/150_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240

```

```

> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/155_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/160_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/165_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/170_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/175_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/180_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/185_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/190_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/195_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/200_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(21, 250)

```

```
##### current_task: 19 #####
```

```

[output] current classes [760 761 762 763 764 765 766 767 768 769 770 771 772
773 774 775 776 777
778 779]

```

```
all classes 0 -> 779
```

```

> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/100_model.pkl
module.classifier.weight      torch.Size([400, 512])   204800    True
total: 204800
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/105_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/110_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/115_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True

```





```

total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/200_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(21, 250)

##### current_task: 20 #####
[output] current classes [780 781 782 783 784 785 786 787 788 789 790 791 792
793 794 795 796 797
798 799]
all classes 0 -> 799
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/100_model.pkl
module.classifier.weight      torch.Size([400, 512])  204800   True
total: 204800
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/105_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/110_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/115_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/120_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/125_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/130_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/135_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/140_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/145_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/150_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/155_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/160_model.pkl

```

```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/165_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/170_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/175_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/180_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/185_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/190_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/195_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Tiny_100_20x5voro/200_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(21, 250)

```

```

[42]: print('cliques by test samples:', pred_in_clique.shape)

# compute prototypes
be      = 0.6 # 1.
l2      = True # False True
bias    = 0 # 0.05
protots = np.mean(feats_trans(support_data_, beta=be, l2=l2, bias=bias), axis=1)
query_pts = feats_trans(query_data_, beta=be, l2=l2, bias=bias)
# acenss  = feats_trans(acens, beta=be, l2=l2, bias=bias)
if brother:
    dist      = funbtch(query_pts, protots) # protots / acenss
else:
    dist      = fun(query_pts, protots) # protots / acenss

test_splt = [sum(test_share[:t+1]) for t in range(len(test_share))]

```

```

[238]: dist_in_clique = np.zeros_like(pred_in_clique, dtype=np.float32)
for c_id, clique in enumerate(pred_in_clique):
    for s_id, samp in enumerate(clique):

```

```
dist_in_clique[c_id][s_id] = dist[s_id][samp]
```

```
[253]: for i in range(task_num + 1):
        clique_dist = dist_in_clique[:i+1,:test_splt[i]]
        clique_pred = np.argmin(clique_dist, axis=0)
        merge_pred = [pred_in_clique[cli,s_id] for s_id, cli in
        ↪enumerate(clique_pred)]
        merge_acc = np.mean(merge_pred == query_label_[:test_splt[i]])
        print(merge_acc)
    print('DaC:', 'beta:', be, '| 12:', 12)
```

```
[28]: print('===== Experiment Done! =====')
```

```
===== Experiment Done! =====
```

## iVoro on ImageNet-Subset Dataset

```
[1]: import matplotlib.pyplot as plt
import os
import pickle
import numpy as np
import pandas as pd
import seaborn as sns
import time
import sys
sys.path.append('../')
sys.path.append('../analysis/')
import copy
import platform
import json
import pickle
import random

import torch
from scipy.stats import mode
```

```
[12]: from ResNet import resnet18_cbam

data_name      = 'Subset' # 'Subset' # 'Tiny' # 'CIFAR100' # 'MNIST'
total_nc       = 100 # 200 # 100 # 10
fg_nc          = 50 # 100 # 40 # 50 # 4
task_num       = 10 # 20 # 5 # 10 # 2

# constant params
class_set      = list(range(total_nc))
ROTATION       = True
EMB2D          = False
DESIGN         = True
virtual_class  = 4*total_nc if ROTATION else total_nc
suffix         = 'voro' # 'prob' 'voro'
assert (total_nc - fg_nc)%task_num == 0
task_size      = int((total_nc - fg_nc)/task_num)
file_name      = _
    ↳data_name+'_'+str(fg_nc)+'_'+str(task_num)+'x'+str(task_size)+suffix
```

```
print(file_name)

brother      = False # True False
```

Subset\_50\_10x5voro

```
[13]: save_path = '../checkpoints/'
      path      = save_path + file_name + '/'
      filename   = path + '%d_model.pkl' % (fg_nc+0) # +5
      model      = torch.load(filename)
      model.eval()
      print('> loaded base phase model from:', filename)
```

> loaded base phase model from: ../checkpoints/Subset\_50\_10x5voro/50\_model.pkl

```
[14]: from voro_helper import num_param, t2n, \
      load_feat, sanity_check, \
      id2emb_, num_samp, merge_sc, funbtch

      num_param(model)

      # voronoi centers:
      vcenter = t2n(model.module.classifier.weight.data / 2.)
      print(vcenter.shape)
```

```
module.classifier.weight      torch.Size([200, 512])  102400  True
total: 102400
(200, 512)
```

```
[15]: '''
      CIFAR:
          'CIFAR100_50_5x10_test.pkl'
          'CIFAR100_50_5x10_train.pkl'
          'CIFAR100_40_20x3_test.pkl'
          'CIFAR100_40_20x3_train.pkl'
      more CIFAR:
          'CIFAR100_40_12x5_test.pkl'
          'CIFAR100_40_12x5_train.pkl'
          'CIFAR100_30_14x5_test.pkl'
          'CIFAR100_30_14x5_train.pkl'
          'CIFAR100_20_16x5_test.pkl'
          'CIFAR100_20_16x5_train.pkl'
          'CIFAR100_10_18x5_test.pkl'
          'CIFAR100_10_18x5_train.pkl'
      Tiny:
          'Tiny_100_20x5_test.pkl'
          'Tiny_100_20x5_train.pkl'
      TinyL3:
```

```

        'Tiny_100_5x20_test.pkl'
        'Tiny_100_5x20_train.pkl'
Subset:
        'Subset_50_10x5_test.pkl'
        'Subset_50_10x5_train.pkl'
'''
ffile = '../embedding/prob/' + 'Subset_50_10x5_test.pkl' # prob probL3
dataphas, last_tsk = load_feat(ffile)

labs, embeds, outputs = dataphas[last_tsk][last_tsk]
false_id, pred_ = sanity_check(labs, embeds, outputs)

```

```

feature file: ../embedding/prob/Subset_50_10x5_test.pkl
> loaded tasks: dict_keys([10])
> classes: [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18,
19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38,
39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58,
59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78,
79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98,
99]
> samples: 5000
> embedding: 512
> classification: 400
~ acc (single): 63.80%
~ acc (quadruple): 53.82%

```

```

[16]: ffile = '../embedding/prob/' + 'Subset_50_10x5_train.pkl' # prob probL3
dataphas, last_tsk = load_feat(ffile)

labst, embedst, outputst = dataphas[last_tsk][last_tsk]
false_id, pred_ = sanity_check(labst, embedst, outputst)

```

```

feature file: ../embedding/prob/Subset_50_10x5_train.pkl
> loaded tasks: dict_keys([10])
> classes: [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18,
19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38,
39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58,
59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78,
79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98,
99]
> samples: 128832
> embedding: 512
> classification: 400
~ acc (single): 68.95%
~ acc (quadruple): 60.20%

```

```

[17]: embs = id2emb_(labs, embeds, brother=brother)
embst = id2emb_(labst, embedst, brother=brother)

```

```
sam_max, sam_min = num_samp(embst)
print('> loading data done!')
```

```
0 1300,1 1299,2 1266,3 1300,4 1300,5 1300,6 1300,7 1300,8 1282,9 1300,10 1300,11
1213,12 1300,13 1300,14 1300,15 1300,16 1069,17 1238,18 1298,19 1165,20 1300,21
1300,22 1299,23 1300,24 1300,25 1300,26 1300,27 1298,28 1300,29 1300,30 1299,31
1300,32 1300,33 1300,34 1300,35 1299,36 1300,37 1300,38 1300,39 1300,40 1300,41
1300,42 1300,43 1299,44 1299,45 1300,46 1299,47 1300,48 1300,49 1216,50 1300,51
1300,52 1300,53 1299,54 1299,55 1300,56 1299,57 1300,58 1300,59 1300,60 1300,61
1300,62 1299,63 1300,64 1300,65 1300,66 1300,67 1300,68 1300,69 1300,70 1299,71
1300,72 1300,73 1300,74 1300,75 1300,76 1300,77 1300,78 1299,79 1299,80 1034,81
1299,82 1300,83 1299,84 1300,85 1300,86 1300,87 1071,88 1299,89 1300,90 1300,91
1300,92 1299,93 1300,94 1300,95 1300,96 1300,97 1300,98 1300,99 1300,
max samples: 1300
min samples: 1034
> loading data done!
```

```
[18]: for k,v in embst.items():
        if v.shape[0] < sam_max:
            rid = np.random.choice(v.shape[0], sam_max-v.shape[0], replace=False)
            print('filling', sam_max-v.shape[0], 'samples')
            embst[k] = np.vstack((v, v[rid]))
```

```
filling 1 samples
filling 34 samples
filling 18 samples
filling 87 samples
filling 231 samples
filling 62 samples
filling 2 samples
filling 135 samples
filling 1 samples
filling 2 samples
filling 1 samples
filling 1 samples
filling 1 samples
filling 1 samples
filling 1 samples
filling 1 samples
filling 84 samples
filling 1 samples
filling 1 samples
filling 1 samples
filling 1 samples
filling 1 samples
filling 1 samples
filling 1 samples
filling 1 samples
filling 266 samples
```

```

filling 1 samples
filling 1 samples
filling 229 samples
filling 1 samples
filling 1 samples

```

```

[19]: from voro_helper import get_task_data, feat_trans, NC_o, tsk_cls, fun, \
      →acc_brother, forgetting

      i = task_num
      support_data_, support_label_, query_data_, query_label_, n_ways_, n_shot_, _ = \
          get_task_data(embst, embs, i, fg_nc, class_set, task_size, brother=brother)

```

```

##### current_task: 10 #####
current classes [95, 96, 97, 98, 99]
[output] all classes 0 -> 99

```

```

[20]: ### =====
      →=====

      be          = 1. # 1.
      l2          = False # False True
      protots     = np.mean(feat_trans(support_data_, beta=be, l2=l2), axis=1)

```

```

[21]: i = 0
      support_data, support_label, query_data, query_label, n_ways, n_shot, classes = \
          get_task_data(embst, embs, i, fg_nc, class_set, task_size, brother=brother)
      acc, _, nn_pre = NC_o(support_data, support_label,
                           query_data, query_label,
                           n_ways, n_shot,
                           beta = be, l2 = l2,
                           given_cen = protots[classes], given_only = True,
                           brother = brother)

```

```

##### current_task: 0 #####
current classes [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17,
18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37,
38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49]
[output] all classes 0 -> 49
0.8296

```

```

[22]: local      = False # True / False
      nn_acc     = []
      savefile   = path+'NN' if brother else None # NN / NNp / NN3 / only saved NN
      →results!
      savefil2   = path+'NN3'
      forget     = True # True False # calculate forgetting

```



```

class_ladder = []
a = []
for i in range(task_num + 1):
    support_data, support_label, query_data, query_label, n_ways, n_shot, \
    →classes = \
        get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                        local = local, brother = brother) # False
    if forget:
        class_ladder.append(classes)
    acc, _, nn_pre = NC_o(support_data, support_label,
                          query_data, query_label,
                          n_ways, n_shot,
                          beta = be, l2 = l2,
                          given_cen = protots[classes] if local else protots[:
    →classes[-1]+1],

                          given_only = True,
                          brother = brother,
                          savefile = savefile+'_'+str(i) if brother else None,
                          savefile2 = None, # savefil2+'_'+str(i), # None, #
                          weights = [0.7, 0.3],
                          class_ladder = class_ladder,
                          acc_all = a
                          )

    nn_acc.append(acc)
    # if all classes up2now: local = False, and protots[:classes[-1]+1]
print('local:', local, '| beta:', be, '| l2:', l2)
if brother:
    for accs in nn_acc:
        print('\t'.join([str(i) for i in accs]))
else:
    print('\n'.join([str(i) for i in nn_acc]))
if forget:
    avgf = forgetting(a, task_num)
    print(avgf)

```

```

##### current_task: 0 #####
current classes [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17,
18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37,
38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49]
[output] all classes 0 -> 49
0.8296

```

```

##### current_task: 1 #####
current classes [50, 51, 52, 53, 54]
[output] all classes 0 -> 54
0.7836

```

```

##### current_task: 2 #####
current classes [55, 56, 57, 58, 59]
[output] all classes 0 -> 59
0.7343

##### current_task: 3 #####
current classes [60, 61, 62, 63, 64]
[output] all classes 0 -> 64
0.6966

##### current_task: 4 #####
current classes [65, 66, 67, 68, 69]
[output] all classes 0 -> 69
0.6714

##### current_task: 5 #####
current classes [70, 71, 72, 73, 74]
[output] all classes 0 -> 74
0.6485

##### current_task: 6 #####
current classes [75, 76, 77, 78, 79]
[output] all classes 0 -> 79
0.6265

##### current_task: 7 #####
current classes [80, 81, 82, 83, 84]
[output] all classes 0 -> 84
0.6092

##### current_task: 8 #####
current classes [85, 86, 87, 88, 89]
[output] all classes 0 -> 89
0.5913

##### current_task: 9 #####
current classes [90, 91, 92, 93, 94]
[output] all classes 0 -> 94
0.5724

##### current_task: 10 #####
current classes [95, 96, 97, 98, 99]
[output] all classes 0 -> 99
0.5544
local: False | beta: 1.0 | l2: False
0.8296
0.7836363636363637

```

```

0.7343333333333333
0.6966153846153846
0.6714285714285714
0.6485333333333333
0.6265
0.6091764705882353
0.5913333333333334
0.5724210526315789
0.5544
[[0.8296 0.      0.      0.      0.      0.      0.      0.      0.
  0.      ]
 [0.792  0.7     0.      0.      0.      0.      0.      0.      0.
  0.      ]
 [0.7664 0.616  0.532  0.      0.      0.      0.      0.      0.
  0.      ]
 [0.754  0.604  0.484  0.428  0.      0.      0.      0.      0.
  0.      ]
 [0.7424 0.584  0.46   0.36   0.572  0.      0.      0.      0.
  0.      ]
 [0.7328 0.56   0.448  0.348  0.552  0.492  0.      0.      0.
  0.      ]
 [0.7264 0.556  0.44   0.312  0.516  0.456  0.48   0.      0.
  0.      ]
 [0.7228 0.556  0.416  0.292  0.496  0.452  0.476  0.44   0.
  0.      ]
 [0.7132 0.54   0.408  0.292  0.488  0.448  0.464  0.44   0.432  0.
  0.      ]
 [0.7056 0.524  0.388  0.28   0.472  0.448  0.444  0.424  0.424  0.416
  0.      ]
 [0.7028 0.524  0.372  0.264  0.444  0.44   0.432  0.416  0.412  0.408
  0.348 ]]
[0, 3.7599999999999967, 7.359999999999999, 7.32, 8.580000000000002,
8.415999999999997, 9.12, 8.897142857142855, 8.504999999999999,
8.844444444444441, 9.068000000000001]

```

```

[23]: def predict(model, x, voro=True):
        x = torch.from_numpy(x.astype(np.float32)).cuda()
        with torch.no_grad():
            predi = model.module.classifier(x)
            if voro:
                predi += - torch.sum((model.module.classifier.weight/2.)**2, dim=1)
        return predi

classes_all = []
test_share = []
paccS = []
for i in range(task_num + 1):

```

```

support_data, support_label, query_data, query_label, n_ways, n_shot, \
→classes = \
    get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                  local = True, brother = brother)

# load model:
if brother:
    cls_01 = classes[-1]+1
    assert cls_01 % 4 == 0
    filename = path + '%d_model.pkl' % (int(cls_01/4))
else:
    filename = path + '%d_model.pkl' % (classes[-1]+1)
model = torch.load(filename)
model.eval()
print('> loaded base phase model from:', filename)
num_param(model)
# do prediction:
min_cls = min(classes)
if brother:
    pred = predict(model, query_data)
else:
    pred = predict(model, query_data)[:,:,:4]
pmax = torch.max(pred, dim=1)[1]
pacc = np.mean(t2n(pmax) == query_label - min_cls)
print(pacc)
if brother:
    accs = acc_brother(t2n(pred), t2n(pmax), query_label - min_cls, \
→forLG=True)
    pacc = [pacc] + accs
    paccS.append(pacc)
    classes_all.append(classes)
    test_share.append(len(query_label))
print('all logistic locally:')
if brother:
    for accs in paccS:
        print('\t'.join([str(i) for i in accs]))
else:
    print('\n'.join([str(i) for i in paccS]))

```

##### current\_task: 0 #####

[output] current classes [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49]

all classes 0 -> 49

> loaded base phase model from: ../checkpoints/Subset\_50\_10x5voro/50\_model.pkl

module.classifier.weight torch.Size([200, 512]) 102400 True

total: 102400

0.8388

```
##### current_task: 1 #####
[output] current classes [50, 51, 52, 53, 54]
all classes 0 -> 54
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.916
```

```
##### current_task: 2 #####
[output] current classes [55, 56, 57, 58, 59]
all classes 0 -> 59
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.856
```

```
##### current_task: 3 #####
[output] current classes [60, 61, 62, 63, 64]
all classes 0 -> 64
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.932
```

```
##### current_task: 4 #####
[output] current classes [65, 66, 67, 68, 69]
all classes 0 -> 69
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.928
```

```
##### current_task: 5 #####
[output] current classes [70, 71, 72, 73, 74]
all classes 0 -> 74
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.94
```

```
##### current_task: 6 #####
[output] current classes [75, 76, 77, 78, 79]
all classes 0 -> 79
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
```

0.932

##### current\_task: 7 #####

[output] current classes [80, 81, 82, 83, 84]

all classes 0 -> 84

> loaded base phase model from: ../checkpoints/Subset\_50\_10x5voro/85\_model.pkl

module.classifier.weight          torch.Size([20, 512])    10240    True

total: 10240

0.928

##### current\_task: 8 #####

[output] current classes [85, 86, 87, 88, 89]

all classes 0 -> 89

> loaded base phase model from: ../checkpoints/Subset\_50\_10x5voro/90\_model.pkl

module.classifier.weight          torch.Size([20, 512])    10240    True

total: 10240

0.872

##### current\_task: 9 #####

[output] current classes [90, 91, 92, 93, 94]

all classes 0 -> 94

> loaded base phase model from: ../checkpoints/Subset\_50\_10x5voro/95\_model.pkl

module.classifier.weight          torch.Size([20, 512])    10240    True

total: 10240

0.9

##### current\_task: 10 #####

[output] current classes [95, 96, 97, 98, 99]

all classes 0 -> 99

> loaded base phase model from: ../checkpoints/Subset\_50\_10x5voro/100\_model.pkl

module.classifier.weight          torch.Size([20, 512])    10240    True

total: 10240

0.884

all logistic locally:

0.8388

0.916

0.856

0.932

0.928

0.94

0.932

0.928

0.872

0.9

0.884

```

[24]: for i in range(task_num + 1):
        support_data, support_label, query_data, query_label, n_ways, n_shot, \
        classes = \
            get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                           local = True, brother = brother)

        pred_all = []
        for classes in classes_all:
            # load model:
            if brother:
                cls_01 = classes[-1]+1
                assert cls_01 % 4 == 0
                filename = path + '%d_model.pkl' % (int(cls_01/4))
            else:
                filename = path + '%d_model.pkl' % (classes[-1]+1)
            model = torch.load(filename)
            model.eval()
            print('> loaded base phase model from:', filename)
            num_param(model)
            # do prediction:
            min_cls = min(classes)
            if brother:
                pred = predict(model, query_data)
            else:
                pred = predict(model, query_data)[:,:4]
            pmax = torch.max(pred, dim=1)[1]
            # pacc = np.mean(t2n(pmax) == query_label - min_cls)
            # print(pacc)
            if brother:
                labs_01 = query_label[:4]//4
                acc_, sc_pre = merge_sc(t2n(pred), labs_01,
                                         mth='softmax', forLG=True, return_pre=True)
                min_cls = int(min_cls / 4)
                pred_all.append( (sc_pre + min_cls).tolist() )
            else:
                pred_all.append( (t2n(pmax) + min_cls).tolist() )
        pred_all = np.array(pred_all)
        print(pred_all.shape)

        if i == 0:
            pred_in_clique = copy.deepcopy(pred_all)
        else:
            pred_in_clique = np.hstack((pred_in_clique, pred_all))

```

##### current\_task: 0 #####

[output] current classes [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49]

```

all classes 0 -> 49
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/50_model.pkl
module.classifier.weight      torch.Size([200, 512])  102400  True
total: 102400
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
(11, 2500)

```

```
##### current_task: 1 #####
```

```
[output] current classes [50, 51, 52, 53, 54]
```

```
all classes 0 -> 54
```

```

> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/50_model.pkl
module.classifier.weight      torch.Size([200, 512])  102400  True
total: 102400
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240

```



```

> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(11, 250)

```

```
##### current_task: 2 #####
```

```
[output] current classes [55, 56, 57, 58, 59]
```

```
all classes 0 -> 59
```

```

> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/50_model.pkl
module.classifier.weight      torch.Size([200, 512])   102400    True
total: 102400
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/80_model.pkl

```

```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(11, 250)

```

```
##### current_task: 3 #####
```

```
[output] current classes [60, 61, 62, 63, 64]
```

```
all classes 0 -> 64
```

```

> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/50_model.pkl
module.classifier.weight      torch.Size([200, 512])  102400   True
total: 102400
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True

```

```

total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(11, 250)

```

```
##### current_task: 4 #####
```

```
[output] current classes [65, 66, 67, 68, 69]
```

```
all classes 0 -> 69
```

```

> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/50_model.pkl
module.classifier.weight      torch.Size([200, 512])  102400   True
total: 102400
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240    True
total: 10240
(11, 250)

```

```
##### current_task: 5 #####
```

```
[output] current classes [70, 71, 72, 73, 74]
```

```
all classes 0 -> 74
```

```
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/50_model.pkl
```

```

module.classifier.weight      torch.Size([200, 512])  102400  True
total: 102400
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
(11, 250)

```

```
##### current_task: 6 #####
```

```
[output] current classes [75, 76, 77, 78, 79]
```

```
all classes 0 -> 79
```

```

> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/50_model.pkl
module.classifier.weight      torch.Size([200, 512])  102400  True
total: 102400
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True

```

```

total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(11, 250)

```

```
##### current_task: 7 #####
```

```
[output] current classes [80, 81, 82, 83, 84]
```

```
all classes 0 -> 84
```

```

> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/50_model.pkl
module.classifier.weight      torch.Size([200, 512])  102400   True
total: 102400
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240    True
total: 10240

```

```

> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(11, 250)

```

```
##### current_task: 8 #####
```

```
[output] current classes [85, 86, 87, 88, 89]
```

```
all classes 0 -> 89
```

```

> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/50_model.pkl
module.classifier.weight      torch.Size([200, 512])  102400    True
total: 102400
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/100_model.pkl

```

```
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(11, 250)
```

```
##### current_task: 9 #####
```

```
[output] current classes [90, 91, 92, 93, 94]
```

```
all classes 0 -> 94
```

```
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/50_model.pkl
```

```
module.classifier.weight      torch.Size([200, 512])  102400    True
```

```
total: 102400
```

```
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/55_model.pkl
```

```
module.classifier.weight      torch.Size([20, 512])    10240    True
```

```
total: 10240
```

```
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/60_model.pkl
```

```
module.classifier.weight      torch.Size([20, 512])    10240    True
```

```
total: 10240
```

```
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/65_model.pkl
```

```
module.classifier.weight      torch.Size([20, 512])    10240    True
```

```
total: 10240
```

```
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/70_model.pkl
```

```
module.classifier.weight      torch.Size([20, 512])    10240    True
```

```
total: 10240
```

```
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/75_model.pkl
```

```
module.classifier.weight      torch.Size([20, 512])    10240    True
```

```
total: 10240
```

```
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/80_model.pkl
```

```
module.classifier.weight      torch.Size([20, 512])    10240    True
```

```
total: 10240
```

```
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/85_model.pkl
```

```
module.classifier.weight      torch.Size([20, 512])    10240    True
```

```
total: 10240
```

```
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/90_model.pkl
```

```
module.classifier.weight      torch.Size([20, 512])    10240    True
```

```
total: 10240
```

```
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/95_model.pkl
```

```
module.classifier.weight      torch.Size([20, 512])    10240    True
```

```
total: 10240
```

```
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/100_model.pkl
```

```
module.classifier.weight      torch.Size([20, 512])    10240    True
```

```
total: 10240
```

```
(11, 250)
```

```
##### current_task: 10 #####
```

```
[output] current classes [95, 96, 97, 98, 99]
```

```
all classes 0 -> 99
```

```
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/50_model.pkl
```

```
module.classifier.weight      torch.Size([200, 512])  102400    True
```

```
total: 102400
```

```

> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(11, 250)

```

```

[25]: print('cliques by test samples:', pred_in_clique.shape)

# compute prototypes
be      = 0.6 # 1.
l2      = True # False True
bias    = 0 # 0.05
protots = np.mean(feats_trans(support_data_, beta=be, l2=l2, bias=bias), axis=1)
query_pts = feats_trans(query_data_, beta=be, l2=l2, bias=bias)
# acenss = feats_trans(acens, beta=be, l2=l2, bias=bias)
if brother:
    dist      = funbtch(query_pts, protots) # protots / acenss
else:
    dist      = fun(query_pts, protots) # protots / acenss

test_splt = [sum(test_share[:t+1]) for t in range(len(test_share))]

```



cliques by test samples: (11, 5000)

```
[26]: dist_in_clique = np.zeros_like(pred_in_clique, dtype=np.float32)
      for c_id, clique in enumerate(pred_in_clique):
          for s_id, samp in enumerate(clique):
              dist_in_clique[c_id][s_id] = dist[s_id][samp]
```

```
[27]: for i in range(task_num + 1):
      clique_dist = dist_in_clique[:i+1,:test_splt[i]]
      clique_pred = np.argmin(clique_dist, axis=0)
      merge_pred = [pred_in_clique[cli,s_id] for s_id, cli in
      ↪ enumerate(clique_pred)]
      merge_acc = np.mean(merge_pred == query_label_[:test_splt[i]])
      print(merge_acc)
      print('DaC:', 'beta:', be, '| 12:', 12)
```

```
0.8388
0.8069090909090909
0.7593333333333333
0.7273846153846154
0.7
0.6722666666666667
0.65325
0.6343529411764706
0.6186666666666667
0.6008421052631578
0.583
DaC: beta: 0.6 | 12: True
```

```
[28]: print('===== Experiment Done! =====')
```

```
===== Experiment Done! =====
```

```
[ ]:
```

## iVoro-AC/ AI on ImageNet-Subset Dataset

```
[1]: import matplotlib.pyplot as plt
import os
import pickle
import numpy as np
import pandas as pd
import seaborn as sns
import time
import sys
sys.path.append('../')
sys.path.append('../analysis/')
import copy
import platform
import json
import pickle
import random

import torch
from scipy.stats import mode
```

```
[40]: from ResNet import resnet18_cbam

data_name      = 'Subset' # 'Subset' # 'Tiny' # 'CIFAR100' # 'MNIST'
total_nc       = 100 # 200 # 100 # 10
fg_nc          = 50 # 100 # 40 # 50 # 4
task_num       = 10 # 20 # 5 # 10 # 2

# constant params
class_set      = list(range(total_nc))
ROTATION       = True
EMB2D          = False
DESIGN         = True
virtual_class  = 4*total_nc if ROTATION else total_nc
suffix         = 'voro' # 'prob' 'voro'
assert (total_nc - fg_nc)%task_num == 0
task_size      = int((total_nc - fg_nc)/task_num)
file_name      = _
    ↳data_name+'_'+str(fg_nc)+'_'+str(task_num)+'x'+str(task_size)+suffix
```

```
print(file_name)

brother      = True # True False
```

Subset\_50\_10x5voro

```
[41]: save_path = '../checkpoints/'
      path      = save_path + file_name + '/'
      filename   = path + '%d_model.pkl' % (fg_nc+0) # +5
      model      = torch.load(filename)
      model.eval()
      print('> loaded base phase model from:', filename)
```

> loaded base phase model from: ../checkpoints/Subset\_50\_10x5voro/50\_model.pkl

```
[42]: from voro_helper import num_param, t2n, \
      load_feat, sanity_check, \
      id2emb_, num_samp, merge_sc, funbtch

      num_param(model)

      # voronoi centers:
      vcenter = t2n(model.module.classifier.weight.data / 2.)
      print(vcenter.shape)
```

```
module.classifier.weight      torch.Size([200, 512])  102400  True
total: 102400
(200, 512)
```

```
[43]: '''
      CIFAR:
          'CIFAR100_50_5x10_test.pkl'
          'CIFAR100_50_5x10_train.pkl'
          'CIFAR100_40_20x3_test.pkl'
          'CIFAR100_40_20x3_train.pkl'
      more CIFAR:
          'CIFAR100_40_12x5_test.pkl'
          'CIFAR100_40_12x5_train.pkl'
          'CIFAR100_30_14x5_test.pkl'
          'CIFAR100_30_14x5_train.pkl'
          'CIFAR100_20_16x5_test.pkl'
          'CIFAR100_20_16x5_train.pkl'
          'CIFAR100_10_18x5_test.pkl'
          'CIFAR100_10_18x5_train.pkl'
      Tiny:
          'Tiny_100_20x5_test.pkl'
          'Tiny_100_20x5_train.pkl'
      TinyL3:
```

```

        'Tiny_100_5x20_test.pkl'
        'Tiny_100_5x20_train.pkl'
Subset:
        'Subset_50_10x5_test.pkl'
        'Subset_50_10x5_train.pkl'
'''
ffile = '../embedding/prob/' + 'Subset_50_10x5_test.pkl' # prob probL3
data_phas, last_tsk = load_feat(ffile)

labs, embeds, outputs = data_phas[last_tsk][last_tsk]
false_id, pred_ = sanity_check(labs, embeds, outputs)

```

```

feature file: ../embedding/prob/Subset_50_10x5_test.pkl
> loaded tasks: dict_keys([10])
> classes: [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18,
19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38,
39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58,
59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78,
79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98,
99]
> samples: 5000
> embedding: 512
> classification: 400
~ acc (single): 63.80%
~ acc (quadruple): 53.82%

```

```

[44]: ffile = '../embedding/prob/' + 'Subset_50_10x5_train.pkl' # prob probL3
data_phas, last_tsk = load_feat(ffile)

labst, embedst, outputst = data_phas[last_tsk][last_tsk]
false_id, pred_ = sanity_check(labst, embedst, outputst)

```

```

feature file: ../embedding/prob/Subset_50_10x5_train.pkl
> loaded tasks: dict_keys([10])
> classes: [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18,
19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38,
39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58,
59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78,
79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98,
99]
> samples: 128832
> embedding: 512
> classification: 400
~ acc (single): 68.95%
~ acc (quadruple): 60.20%

```

```

[45]: embs = id2emb_(labs, embeds, brother=brother)
embst = id2emb_(labst, embedst, brother=brother)

```

```
sam_max, sam_min = num_samp(embst)
print('> loading data done!')
```

```
0 1300,1 1300,2 1300,3 1300,4 1299,5 1299,6 1299,7 1299,8 1266,9 1266,10 1266,11
1266,12 1300,13 1300,14 1300,15 1300,16 1300,17 1300,18 1300,19 1300,20 1300,21
1300,22 1300,23 1300,24 1300,25 1300,26 1300,27 1300,28 1300,29 1300,30 1300,31
1300,32 1282,33 1282,34 1282,35 1282,36 1300,37 1300,38 1300,39 1300,40 1300,41
1300,42 1300,43 1300,44 1213,45 1213,46 1213,47 1213,48 1300,49 1300,50 1300,51
1300,52 1300,53 1300,54 1300,55 1300,56 1300,57 1300,58 1300,59 1300,60 1300,61
1300,62 1300,63 1300,64 1069,65 1069,66 1069,67 1069,68 1238,69 1238,70 1238,71
1238,72 1298,73 1298,74 1298,75 1298,76 1165,77 1165,78 1165,79 1165,80 1300,81
1300,82 1300,83 1300,84 1300,85 1300,86 1300,87 1300,88 1299,89 1299,90 1299,91
1299,92 1300,93 1300,94 1300,95 1300,96 1300,97 1300,98 1300,99 1300,100
1300,101 1300,102 1300,103 1300,104 1300,105 1300,106 1300,107 1300,108 1298,109
1298,110 1298,111 1298,112 1300,113 1300,114 1300,115 1300,116 1300,117 1300,118
1300,119 1300,120 1299,121 1299,122 1299,123 1299,124 1300,125 1300,126 1300,127
1300,128 1300,129 1300,130 1300,131 1300,132 1300,133 1300,134 1300,135 1300,136
1300,137 1300,138 1300,139 1300,140 1299,141 1299,142 1299,143 1299,144 1300,145
1300,146 1300,147 1300,148 1300,149 1300,150 1300,151 1300,152 1300,153 1300,154
1300,155 1300,156 1300,157 1300,158 1300,159 1300,160 1300,161 1300,162 1300,163
1300,164 1300,165 1300,166 1300,167 1300,168 1300,169 1300,170 1300,171 1300,172
1299,173 1299,174 1299,175 1299,176 1299,177 1299,178 1299,179 1299,180 1300,181
1300,182 1300,183 1300,184 1299,185 1299,186 1299,187 1299,188 1300,189 1300,190
1300,191 1300,192 1300,193 1300,194 1300,195 1300,196 1216,197 1216,198 1216,199
1216,200 1300,201 1300,202 1300,203 1300,204 1300,205 1300,206 1300,207 1300,208
1300,209 1300,210 1300,211 1300,212 1299,213 1299,214 1299,215 1299,216 1299,217
1299,218 1299,219 1299,220 1300,221 1300,222 1300,223 1300,224 1299,225 1299,226
1299,227 1299,228 1300,229 1300,230 1300,231 1300,232 1300,233 1300,234 1300,235
1300,236 1300,237 1300,238 1300,239 1300,240 1300,241 1300,242 1300,243 1300,244
1300,245 1300,246 1300,247 1300,248 1299,249 1299,250 1299,251 1299,252 1300,253
1300,254 1300,255 1300,256 1300,257 1300,258 1300,259 1300,260 1300,261 1300,262
1300,263 1300,264 1300,265 1300,266 1300,267 1300,268 1300,269 1300,270 1300,271
1300,272 1300,273 1300,274 1300,275 1300,276 1300,277 1300,278 1300,279 1300,280
1299,281 1299,282 1299,283 1299,284 1300,285 1300,286 1300,287 1300,288 1300,289
1300,290 1300,291 1300,292 1300,293 1300,294 1300,295 1300,296 1300,297 1300,298
1300,299 1300,300 1300,301 1300,302 1300,303 1300,304 1300,305 1300,306 1300,307
1300,308 1300,309 1300,310 1300,311 1300,312 1299,313 1299,314 1299,315 1299,316
1299,317 1299,318 1299,319 1299,320 1034,321 1034,322 1034,323 1034,324 1299,325
1299,326 1299,327 1299,328 1300,329 1300,330 1300,331 1300,332 1299,333 1299,334
1299,335 1299,336 1300,337 1300,338 1300,339 1300,340 1300,341 1300,342 1300,343
1300,344 1300,345 1300,346 1300,347 1300,348 1071,349 1071,350 1071,351 1071,352
1299,353 1299,354 1299,355 1299,356 1300,357 1300,358 1300,359 1300,360 1300,361
1300,362 1300,363 1300,364 1300,365 1300,366 1300,367 1300,368 1299,369 1299,370
1299,371 1299,372 1300,373 1300,374 1300,375 1300,376 1300,377 1300,378 1300,379
1300,380 1300,381 1300,382 1300,383 1300,384 1300,385 1300,386 1300,387 1300,388
1300,389 1300,390 1300,391 1300,392 1300,393 1300,394 1300,395 1300,396 1300,397
1300,398 1300,399 1300,
```

```
max samples: 1300
min samples: 1034
> loading data done!
```

```
[46]: for k,v in embst.items():
        if v.shape[0] < sam_max:
            rid = np.random.choice(v.shape[0], sam_max-v.shape[0], replace=False)
            print('filling', sam_max-v.shape[0], 'samples')
            embst[k] = np.vstack((v, v[rid]))
```

```
filling 1 samples
filling 1 samples
filling 1 samples
filling 1 samples
filling 34 samples
filling 34 samples
filling 34 samples
filling 34 samples
filling 18 samples
filling 18 samples
filling 18 samples
filling 18 samples
filling 87 samples
filling 87 samples
filling 87 samples
filling 87 samples
filling 231 samples
filling 231 samples
filling 231 samples
filling 231 samples
filling 62 samples
filling 62 samples
filling 62 samples
filling 62 samples
filling 2 samples
filling 2 samples
filling 2 samples
filling 2 samples
filling 135 samples
filling 135 samples
filling 135 samples
filling 135 samples
filling 1 samples
filling 1 samples
filling 1 samples
filling 1 samples
filling 2 samples
filling 2 samples
```

[illegible]

```

filling 1 samples
filling 1 samples
filling 1 samples
filling 1 samples
filling 1 samples
filling 1 samples
filling 266 samples
filling 266 samples
filling 266 samples
filling 266 samples
filling 1 samples
filling 1 samples
filling 1 samples
filling 1 samples
filling 1 samples
filling 1 samples
filling 1 samples
filling 1 samples
filling 229 samples
filling 229 samples
filling 229 samples
filling 229 samples
filling 1 samples
filling 1 samples
filling 1 samples
filling 1 samples
filling 1 samples
filling 1 samples
filling 1 samples
filling 1 samples

```

```

[47]: from voro_helper import get_task_data, feat_trans, NC_o, tsk_cls, fun,
      ↪acc_brother, forgetting

      i = task_num
      support_data_, support_label_, query_data_, query_label_, n_ways_, n_shot_, _ = \
          get_task_data(embst, embs, i, fg_nc, class_set, task_size, brother=brother)

```

```

##### current_task: 10 #####
current classes [380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395
396 397
398 399]
[output] all classes 0 -> 399

```

```

[48]: #%% =====
      ↪=====
      be          = 1. # 1.

```



```

l2          = False # False True
protots     = np.mean(feat_trans(support_data_, beta=be, l2=l2), axis=1)

```

```

[50]: i = 0
support_data, support_label, query_data, query_label, n_ways, n_shot, classes = \
    get_task_data(embst, embs, i, fg_nc, class_set, task_size, brother=brother)
acc, _, nn_pre = NC_o(support_data, support_label,
                      query_data, query_label,
                      n_ways, n_shot,
                      beta = be, l2 = l2,
                      given_cen = protots[classes], given_only = True,
                      brother = brother)

```

```

[51]: local      = False # True / False
nn_acc      = []
savefile    = path+'NN' if brother else None # NN / NNp / NN3 / only saved NN
           →results!
savefil2    = path+'NN3'
forget      = True # True False # calculate forgetting
class_ladder = []
a           = []
for i in range(task_num + 1):
    support_data, support_label, query_data, query_label, n_ways, n_shot,
    →classes = \
        get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                      local = local, brother = brother) # False
    if forget:
        class_ladder.append(classes)
    acc, _, nn_pre = NC_o(support_data, support_label,
                        query_data, query_label,
                        n_ways, n_shot,
                        beta = be, l2 = l2,
                        given_cen = protots[classes] if local else protots[:
    →classes[-1]+1],
                        given_only = True,
                        brother = brother,
                        savefile = savefile+'_'+str(i) if brother else None,
                        savefile2 = None, # savefil2+'_'+str(i), # None, #
                        weights = [0.7, 0.3],
                        class_ladder = class_ladder,
                        acc_all = a
                        )
    nn_acc.append(acc)
    # if all classes up2now: local = False, and protots[:classes[-1]+1]
print('local:', local, '| beta:', be, '| l2:', l2)
if brother:
    for accs in nn_acc:

```

```

        print('\t'.join([str(i) for i in accs]))
else:
    print('\n'.join([str(i) for i in nn_acc]))
if forget:
    avgf = forgetting(a, task_num)
    print(avgf)

```

```

##### current_task: 0 #####
current classes [ 0  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15
16 17
18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35
36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53
54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71
72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89
90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107
108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125
126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143
144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161
162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179
180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197
198 199]

```

[output] all classes 0 -> 199

```

<<< loaded from: ../checkpoints/Subset_50_10x5voro/NN_0.npy
0.7107

```

```

##### current_task: 1 #####
current classes [200 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215
216 217
218 219]

```

[output] all classes 0 -> 219

```

<<< loaded from: ../checkpoints/Subset_50_10x5voro/NN_1.npy
0.6875

```

```

##### current_task: 2 #####
current classes [220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235
236 237
238 239]

```

[output] all classes 0 -> 239

```

<<< loaded from: ../checkpoints/Subset_50_10x5voro/NN_2.npy
0.6462

```

```

##### current_task: 3 #####
current classes [240 241 242 243 244 245 246 247 248 249 250 251 252 253 254 255
256 257
258 259]

```

[output] all classes 0 -> 259

```

<<< loaded from: ../checkpoints/Subset_50_10x5voro/NN_3.npy

```

0.6132

```
##### current_task: 4 #####
current classes [260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275
276 277
278 279]
[output] all classes 0 -> 279
<<< loaded from: ../checkpoints/Subset_50_10x5voro/NN_4.npy
0.5931
```

```
##### current_task: 5 #####
current classes [280 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295
296 297
298 299]
[output] all classes 0 -> 299
<<< loaded from: ../checkpoints/Subset_50_10x5voro/NN_5.npy
0.5720
```

```
##### current_task: 6 #####
current classes [300 301 302 303 304 305 306 307 308 309 310 311 312 313 314 315
316 317
318 319]
[output] all classes 0 -> 319
<<< loaded from: ../checkpoints/Subset_50_10x5voro/NN_6.npy
0.5531
```

```
##### current_task: 7 #####
current classes [320 321 322 323 324 325 326 327 328 329 330 331 332 333 334 335
336 337
338 339]
[output] all classes 0 -> 339
<<< loaded from: ../checkpoints/Subset_50_10x5voro/NN_7.npy
0.5320
```

```
##### current_task: 8 #####
current classes [340 341 342 343 344 345 346 347 348 349 350 351 352 353 354 355
356 357
358 359]
[output] all classes 0 -> 359
<<< loaded from: ../checkpoints/Subset_50_10x5voro/NN_8.npy
0.5156
```

```
##### current_task: 9 #####
current classes [360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375
376 377
378 379]
[output] all classes 0 -> 379
<<< loaded from: ../checkpoints/Subset_50_10x5voro/NN_9.npy
```

0.5038

```
##### current_task: 10 #####
current classes [380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395
396 397
398 399]
[output] all classes 0 -> 399
<<< loaded from: ../checkpoints/Subset_50_10x5voro/NN_10.npy
0.4899
local: False | beta: 1.0 | l2: False
0.7107 0.9616 0.982 0.9804 0.9748
0.6875454545454546 0.9541818181818181 0.9752727272727273
0.9734545454545455 0.9570909090909091
0.64625 0.917 0.9186666666666666 0.9166666666666666 0.879
0.6131538461538462 0.8769230769230769 0.8821538461538462 0.88
0.8452307692307692
0.5931428571428572 0.8608571428571429 0.8705714285714286 0.868
0.8325714285714285
0.572 0.8365333333333334 0.8498666666666667 0.8477333333333333
0.8138666666666666
0.553125 0.81325 0.823 0.82025 0.77975
0.532 0.7872941176470588 0.8075294117647058 0.804
0.7628235294117647
0.5156111111111111 0.7697777777777778 0.7988888888888889
0.7955555555555556 0.7553333333333333
0.5038421052631579 0.759578947368421 0.7848421052631579
0.7810526315789473 0.7381052631578947
0.48985 0.7372 0.7712 0.768 0.726
[[0.7107 0. 0. 0. 0. 0. 0. 0. 0.
0. ]
[0.6956 0.607 0. 0. 0. 0. 0. 0. 0.
0. ]
[0.6854 0.569 0.332 0. 0. 0. 0. 0. 0.
0. ]
[0.6764 0.552 0.301 0.354 0. 0. 0. 0. 0.
0. ]
[0.6681 0.534 0.287 0.322 0.48 0. 0. 0. 0.
0. ]
[0.6602 0.517 0.282 0.313 0.47 0.396 0. 0. 0.
0. ]
[0.6561 0.514 0.279 0.282 0.433 0.361 0.42 0. 0.
0. ]
[0.6518 0.513 0.271 0.272 0.417 0.358 0.418 0.277 0.
0. ]
[0.6449 0.495 0.269 0.271 0.413 0.353 0.413 0.275 0.343 0.
0. ]
[0.6383 0.483 0.26 0.265 0.403 0.347 0.402 0.27 0.335 0.425
0. ]
```

```

[0.637  0.482  0.258  0.252  0.384  0.342  0.383  0.262  0.325  0.419
 0.32  ]]
[0, 1.5100000000000002, 3.1650000000000001, 4.0099999999999999, 4.8149999999999999,
4.8299999999999999, 5.9099999999999999, 5.6985714285714275, 5.5349999999999999,
5.7377777777777778, 6.0069999999999999]

```

```

[52]: def predict(model, x, voro=True):
        x = torch.from_numpy(x.astype(np.float32)).cuda()
        with torch.no_grad():
            predi = model.module.classifier(x)
        if voro:
            predi += - torch.sum((model.module.classifier.weight/2.)**2, dim=1)
        return predi

classes_all = []
test_share = []
paccS = []
for i in range(task_num + 1):
    support_data, support_label, query_data, query_label, n_ways, n_shot, \
    →classes = \
        get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                       local = True, brother = brother)

    # load model:
    if brother:
        cls_01 = classes[-1]+1
        assert cls_01 % 4 == 0
        filename = path + '%d_model.pkl' % (int(cls_01/4))
    else:
        filename = path + '%d_model.pkl' % (classes[-1]+1)
    model = torch.load(filename)
    model.eval()
    print('> loaded base phase model from:', filename)
    num_param(model)
    # do prediction:
    min_cls = min(classes)
    if brother:
        pred = predict(model, query_data)
    else:
        pred = predict(model, query_data)[:,:,:4]
    pmax = torch.max(pred, dim=1)[1]
    pacc = np.mean(t2n(pmax) == query_label - min_cls)
    print(pacc)
    if brother:
        accs = acc_brother(t2n(pred), t2n(pmax), query_label - min_cls, \
    →forLG=True)
        pacc = [pacc] + accs
    paccS.append(pacc)

```

```

        classes_all.append(classes)
        test_share.append(len(query_label))
print('all logistic locally:')
if brother:
    for accs in paccS:
        print('\t'.join([str(i) for i in accs]))
else:
    print('\n'.join([str(i) for i in paccS]))

```

##### current\_task: 0 #####

```

[output] current classes [ 0  1  2  3  4  5  6  7  8  9 10 11 12
13 14 15 16 17
 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35
 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53
 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71
 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89
 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107
108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125
126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143
144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161
162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179
180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197
198 199]

```

all classes 0 -> 199

```

> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/50_model.pkl
module.classifier.weight      torch.Size([200, 512])  102400  True
total: 102400
0.7253

```

##### current\_task: 1 #####

```

[output] current classes [200 201 202 203 204 205 206 207 208 209 210 211 212
213 214 215 216 217
 218 219]

```

all classes 0 -> 219

```

> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240  True
total: 10240
0.796

```

##### current\_task: 2 #####

```

[output] current classes [220 221 222 223 224 225 226 227 228 229 230 231 232
233 234 235 236 237
 238 239]

```

all classes 0 -> 239

```

> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240  True
total: 10240

```

0.57

```
##### current_task: 3 #####
[output] current classes [240 241 242 243 244 245 246 247 248 249 250 251 252
253 254 255 256 257
258 259]
all classes 0 -> 259
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.775
```

```
##### current_task: 4 #####
[output] current classes [260 261 262 263 264 265 266 267 268 269 270 271 272
273 274 275 276 277
278 279]
all classes 0 -> 279
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.754
```

```
##### current_task: 5 #####
[output] current classes [280 281 282 283 284 285 286 287 288 289 290 291 292
293 294 295 296 297
298 299]
all classes 0 -> 299
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.799
```

```
##### current_task: 6 #####
[output] current classes [300 301 302 303 304 305 306 307 308 309 310 311 312
313 314 315 316 317
318 319]
all classes 0 -> 319
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.752
```

```
##### current_task: 7 #####
[output] current classes [320 321 322 323 324 325 326 327 328 329 330 331 332
333 334 335 336 337
338 339]
all classes 0 -> 339
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/85_model.pkl
```

```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.613

##### current_task: 8 #####
[output] current classes [340 341 342 343 344 345 346 347 348 349 350 351 352
353 354 355 356 357
358 359]
all classes 0 -> 359
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.684

##### current_task: 9 #####
[output] current classes [360 361 362 363 364 365 366 367 368 369 370 371 372
373 374 375 376 377
378 379]
all classes 0 -> 379
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.73

##### current_task: 10 #####
[output] current classes [380 381 382 383 384 385 386 387 388 389 390 391 392
393 394 395 396 397
398 399]
all classes 0 -> 399
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.684
all logistic locally:
0.7253  0.9696  0.9888  0.0    0.9848
0.796   0.988   1.0    0.0    1.0
0.57    0.94    0.992  0.0    0.992
0.775   0.992  1.0    0.0    1.0
0.754   0.968  0.996  0.0    0.984
0.799   0.988  0.996  0.0    1.0
0.752   0.988  0.96   0.0    0.996
0.613   0.988  1.0    0.0    1.0
0.684   0.936  0.932  0.0    0.94
0.73    0.98   0.992  0.0    0.996
0.684   0.928  0.944  0.0    0.932

```



```

[53]: for i in range(task_num + 1):
        support_data, support_label, query_data, query_label, n_ways, n_shot, \
        classes = \
            get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                           local = True, brother = brother)

        pred_all = []
        for classes in classes_all:
            # load model:
            if brother:
                cls_01 = classes[-1]+1
                assert cls_01 % 4 == 0
                filename = path + '%d_model.pkl' % (int(cls_01/4))
            else:
                filename = path + '%d_model.pkl' % (classes[-1]+1)
            model = torch.load(filename)
            model.eval()
            print('> loaded base phase model from:', filename)
            num_param(model)
            # do prediction:
            min_cls = min(classes)
            if brother:
                pred = predict(model, query_data)
            else:
                pred = predict(model, query_data)[:,:,:4]
            pmax = torch.max(pred, dim=1)[1]
            # pacc = np.mean(t2n(pmax) == query_label - min_cls)
            # print(pacc)
            if brother:
                labs_01 = query_label[:4]//4
                acc_, sc_pre = merge_sc(t2n(pred), labs_01,
                                         mth='softmax', forLG=True, return_pre=True)
                min_cls = int(min_cls / 4)
                pred_all.append( (sc_pre + min_cls).tolist() )
            else:
                pred_all.append( (t2n(pmax) + min_cls).tolist() )
        pred_all = np.array(pred_all)
        print(pred_all.shape)

        if i == 0:
            pred_in_clique = copy.deepcopy(pred_all)
        else:
            pred_in_clique = np.hstack((pred_in_clique, pred_all))

```

##### current\_task: 0 #####

[output] current classes [ 0 1 2 3 4 5 6 7 8 9 10 11 12  
13 14 15 16 17  
18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35

```

36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53
54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71
72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89
90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107
108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125
126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143
144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161
162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179
180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197
198 199]
all classes 0 -> 199
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/50_model.pkl
module.classifier.weight      torch.Size([200, 512])  102400  True
total: 102400
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240  True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240  True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240  True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240  True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240  True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240  True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240  True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240  True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240  True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240  True
total: 10240
(11, 2500)

##### current_task: 1 #####
[output] current classes [200 201 202 203 204 205 206 207 208 209 210 211 212

```

```

213 214 215 216 217
218 219]
all classes 0 -> 219
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/50_model.pkl
module.classifier.weight      torch.Size([200, 512])  102400  True
total: 102400
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
(11, 250)

```

```
##### current_task: 2 #####
```

```

[output] current classes [220 221 222 223 224 225 226 227 228 229 230 231 232
233 234 235 236 237
238 239]
all classes 0 -> 239
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/50_model.pkl
module.classifier.weight      torch.Size([200, 512])  102400  True
total: 102400
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True

```

```

total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(11, 250)

```

```
##### current_task: 3 #####
```

```

[output] current classes [240 241 242 243 244 245 246 247 248 249 250 251 252
253 254 255 256 257
258 259]

```

```
all classes 0 -> 259
```

```

> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/50_model.pkl
module.classifier.weight      torch.Size([200, 512])  102400   True
total: 102400
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/70_model.pkl

```

```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(11, 250)

```

##### current\_task: 4 #####

```

[output] current classes [260 261 262 263 264 265 266 267 268 269 270 271 272
273 274 275 276 277
278 279]
all classes 0 -> 279
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/50_model.pkl
module.classifier.weight      torch.Size([200, 512])  102400    True
total: 102400
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240

```

```

> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(11, 250)

```

```
##### current_task: 5 #####
```

```

[output] current classes [280 281 282 283 284 285 286 287 288 289 290 291 292
293 294 295 296 297
298 299]

```

```
all classes 0 -> 299
```

```

> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/50_model.pkl
module.classifier.weight      torch.Size([200, 512])  102400    True
total: 102400
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True

```

```

total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(11, 250)

```

##### current\_task: 6 #####

```

[output] current classes [300 301 302 303 304 305 306 307 308 309 310 311 312
313 314 315 316 317
318 319]
all classes 0 -> 319
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/50_model.pkl
module.classifier.weight      torch.Size([200, 512])  102400   True
total: 102400
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(11, 250)

```

##### current\_task: 7 #####

```

[output] current classes [320 321 322 323 324 325 326 327 328 329 330 331 332

```

```

333 334 335 336 337
338 339]
all classes 0 -> 339
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/50_model.pkl
module.classifier.weight      torch.Size([200, 512])  102400  True
total: 102400
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
(11, 250)

```

```
##### current_task: 8 #####
```

```

[output] current classes [340 341 342 343 344 345 346 347 348 349 350 351 352
353 354 355 356 357
358 359]
all classes 0 -> 359
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/50_model.pkl
module.classifier.weight      torch.Size([200, 512])  102400  True
total: 102400
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True

```



```

total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(11, 250)

```

```
##### current_task: 9 #####
```

```

[output] current classes [360 361 362 363 364 365 366 367 368 369 370 371 372
373 374 375 376 377
378 379]

```

```
all classes 0 -> 379
```

```

> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/50_model.pkl
module.classifier.weight      torch.Size([200, 512])  102400   True
total: 102400
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/70_model.pkl

```

```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(11, 250)

```

##### current\_task: 10 #####

```

[output] current classes [380 381 382 383 384 385 386 387 388 389 390 391 392
393 394 395 396 397
398 399]

```

all classes 0 -> 399

```

> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/50_model.pkl
module.classifier.weight      torch.Size([200, 512])  102400    True
total: 102400
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240

```

```

> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/Subset_50_10x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(11, 250)

```

```

[59]: print('cliques by test samples:', pred_in_clique.shape)

# compute prototypes
be      = 0.6 # 1.
l2      = True # False True
bias    = 0 # 0.05
protots = np.mean(feats_trans(support_data_, beta=be, l2=l2, bias=bias), axis=1)
query_pts = feats_trans(query_data_, beta=be, l2=l2, bias=bias)
# acenss = feats_trans(acens, beta=be, l2=l2, bias=bias)
if brother:
    dist = funbtch(query_pts, protots) # protots / acenss
else:
    dist = fun(query_pts, protots) # protots / acenss

test_splt = [sum(test_share[:t+1]) for t in range(len(test_share))]

```

```

[58]: dist_in_clique = np.zeros_like(pred_in_clique, dtype=np.float32)
for c_id, clique in enumerate(pred_in_clique):
    for s_id, samp in enumerate(clique):
        dist_in_clique[c_id][s_id] = dist[s_id][samp]

```

```

[60]: for i in range(task_num + 1):
    clique_dist = dist_in_clique[:i+1,:test_splt[i]]
    clique_pred = np.argmax(clique_dist, axis=0)
    merge_pred = [pred_in_clique[cli,s_id] for s_id, cli in
    → enumerate(clique_pred)]
    merge_acc = np.mean(merge_pred == query_label_[:test_splt[i]])
    print(merge_acc)
print('DaC:', 'beta:', be, '| l2:', l2)

```

```

[28]: print('===== Experiment Done! =====')

```

```

===== Experiment Done! =====

```

## iVoro on CIFAR-100 Dataset (5 Phases, 3rd Block Features)

```
[12]: import matplotlib.pyplot as plt
import os
import pickle
import numpy as np
import pandas as pd
import seaborn as sns
import time
import sys
sys.path.append('../')
sys.path.append('../analysis/')
import copy
import platform
import json
import pickle
import random

import torch
from scipy.stats import mode
```

```
[34]: from ResNet import resnet18_cbam

data_name      = 'CIFAR100' # 'Subset' # 'Tiny' # 'CIFAR100' # 'MNIST'
total_nc       = 100 # 200 # 100 # 10
fg_nc          = 50 # 100 # 40 # 50 # 4
task_num       = 5 # 20 # 5 # 10 # 2

# constant params
class_set      = list(range(total_nc))
ROTATION       = True
EMB2D          = False
DESIGN         = True
virtual_class  = 4*total_nc if ROTATION else total_nc
suffix         = 'voro' # 'prob' 'voro'
assert (total_nc - fg_nc)%task_num == 0
task_size      = int((total_nc - fg_nc)/task_num)
file_name      =
    ↳data_name+'_'+str(fg_nc)+'_'+str(task_num)+'x'+str(task_size)+suffix
```

```
print(file_name)

brother      = False # True False
```

CIFAR100\_50\_5x10voro

```
[35]: save_path = '../checkpoints/'
path   = save_path + file_name + '/'
filename = path + '%d_model.pkl' % (fg_nc+0) # +5
model   = torch.load(filename)
model.eval()
print('> loaded base phase model from:', filename)
```

> loaded base phase model from: ../checkpoints/CIFAR100\_50\_5x10voro/50\_model.pkl

```
[36]: from voro_helper import num_param, t2n, \
        load_feat, sanity_check, \
        id2emb_, num_samp, merge_sc, funbtch

num_param(model)

# voronoi centers:
vcenter = t2n(model.module.classifier.weight.data / 2.)
print(vcenter.shape)
```

```
module.classifier.weight      torch.Size([200, 512])  102400  True
total: 102400
(200, 512)
```

```
[37]: '''
CIFAR:
    'CIFAR100_50_5x10_test.pkl'
    'CIFAR100_50_5x10_train.pkl'
    'CIFAR100_40_20x3_test.pkl'
    'CIFAR100_40_20x3_train.pkl'
more CIFAR:
    'CIFAR100_40_12x5_test.pkl'
    'CIFAR100_40_12x5_train.pkl'
    'CIFAR100_30_14x5_test.pkl'
    'CIFAR100_30_14x5_train.pkl'
    'CIFAR100_20_16x5_test.pkl'
    'CIFAR100_20_16x5_train.pkl'
    'CIFAR100_10_18x5_test.pkl'
    'CIFAR100_10_18x5_train.pkl'
Tiny:
    'Tiny_100_20x5_test.pkl'
    'Tiny_100_20x5_train.pkl'
TinyL3:
    'Tiny_100_5x20_test.pkl'
```

```

    'Tiny_100_5x20_train.pkl'
Subset:
    'Subset_50_10x5_test.pkl'
    'Subset_50_10x5_train.pkl'
'''
ffile = '../embedding/probL3/' + 'CIFAR100_50_5x10_test.pkl' # prob probL3
data_phas, last_tsk = load_feat(ffile)

labs, embeds, outputs = data_phas[last_tsk][last_tsk]
false_id, pred_ = sanity_check(labs, embeds, outputs)

```

```

feature file: ../embedding/probL3/CIFAR100_50_5x10_test.pkl
> loaded tasks: dict_keys([5])
> classes: [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18,
19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38,
39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58,
59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78,
79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98,
99]
> samples: 10000
> embedding: 256
> classification: 400
~ acc (single): 45.96%
~ acc (quadruple): 36.15%

```

```

[38]: ffile = '../embedding/probL3/' + 'CIFAR100_50_5x10_train.pkl' # prob probL3
data_phas, last_tsk = load_feat(ffile)

labst, embedst, outputst = data_phas[last_tsk][last_tsk]
false_id, pred_ = sanity_check(labst, embedst, outputst)

```

```

feature file: ../embedding/probL3/CIFAR100_50_5x10_train.pkl
> loaded tasks: dict_keys([5])
> classes: [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18,
19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38,
39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58,
59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78,
79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98,
99]
> samples: 50000
> embedding: 256
> classification: 400
~ acc (single): 49.57%
~ acc (quadruple): 39.82%

```

```

[39]: embs = id2emb_(labs, embeds, brother=brother)
embst = id2emb_(labst, embedst, brother=brother)

```

```
sam_max, sam_min = num_samp(embst)
print('> loading data done!')
```

```
0 500,1 500,2 500,3 500,4 500,5 500,6 500,7 500,8 500,9 500,10 500,11 500,12
500,13 500,14 500,15 500,16 500,17 500,18 500,19 500,20 500,21 500,22 500,23
500,24 500,25 500,26 500,27 500,28 500,29 500,30 500,31 500,32 500,33 500,34
500,35 500,36 500,37 500,38 500,39 500,40 500,41 500,42 500,43 500,44 500,45
500,46 500,47 500,48 500,49 500,50 500,51 500,52 500,53 500,54 500,55 500,56
500,57 500,58 500,59 500,60 500,61 500,62 500,63 500,64 500,65 500,66 500,67
500,68 500,69 500,70 500,71 500,72 500,73 500,74 500,75 500,76 500,77 500,78
500,79 500,80 500,81 500,82 500,83 500,84 500,85 500,86 500,87 500,88 500,89
500,90 500,91 500,92 500,93 500,94 500,95 500,96 500,97 500,98 500,99 500,
max samples: 500
min samples: 500
> loading data done!
```

```
[40]: for k,v in embst.items():
        if v.shape[0] < sam_max:
            rid = np.random.choice(v.shape[0], sam_max-v.shape[0], replace=False)
            print('filling', sam_max-v.shape[0], 'samples')
            embst[k] = np.vstack((v, v[rid]))
```

```
[41]: from voro_helper import get_task_data, feat_trans, NC_o, tsk_cls, fun, \
        ↪acc_brother, forgetting

i = task_num
support_data_, support_label_, query_data_, query_label_, n_ways_, n_shot_, _ = \
    get_task_data(embst, embs, i, fg_nc, class_set, task_size, brother=brother)
```

```
##### current_task: 5 #####
current classes [90, 91, 92, 93, 94, 95, 96, 97, 98, 99]
[output] all classes 0 -> 99
```

```
[42]: #%% =====
        ↪=====

be      = 1. # 1.
l2      = False # False True
protots = np.mean(feat_trans(support_data_, beta=be, l2=l2), axis=1)
```

```
[43]: i = 0
support_data, support_label, query_data, query_label, n_ways, n_shot, classes = \
    get_task_data(embst, embs, i, fg_nc, class_set, task_size, brother=brother)
acc, _, nn_pre = NC_o(support_data, support_label,
                      query_data, query_label,
                      n_ways, n_shot,
                      beta = be, l2 = l2,
                      given_cen = protots[classes], given_only = True,
```

```
brother = brother)
```

```
##### current_task: 0 #####
current classes [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17,
18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37,
38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49]
[output] all classes 0 -> 49
0.5822
```

```
[44]: local      = False # True / False
nn_acc   = []
savefile = path+'NN3' if brother else None # NN / NNp / NN3 / only saved NN_
→results!
savefil2 = path+'NN3'
forget    = True # True False # calculate forgetting
class_ladder = []
a         = []
for i in range(task_num + 1):
    support_data, support_label, query_data, query_label, n_ways, n_shot,
→classes = \
        get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                        local = local, brother = brother) # False
    if forget:
        class_ladder.append(classes)
    acc, _, nn_pre = NC_o(support_data, support_label,
                          query_data, query_label,
                          n_ways, n_shot,
                          beta = be, l2 = l2,
                          given_cen = protots[classes] if local else protots[:
→classes[-1]+1],
                          given_only = True,
                          brother = brother,
                          savefile = savefile+'_'+str(i) if brother else None,
                          savefile2 = None, # savefil2+'_'+str(i), # None, #
                          weights = [0.7, 0.3],
                          class_ladder = class_ladder,
                          acc_all = a
                          )
    nn_acc.append(acc)
    # if all classes up2now: local = False, and protots[:classes[-1]+1]
print('local:', local, '| beta:', be, '| l2:', l2)
if brother:
    for accs in nn_acc:
        print('\t'.join([str(i) for i in accs]))
else:
    print('\n'.join([str(i) for i in nn_acc]))
```



```

if forget:
    avgf = forgetting(a, task_num)
    print(avgf)

```

```

##### current_task: 0 #####
current classes [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17,
18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37,
38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49]
[output] all classes 0 -> 49
0.5822

```

```

##### current_task: 1 #####
current classes [50, 51, 52, 53, 54, 55, 56, 57, 58, 59]
[output] all classes 0 -> 59
0.5410

```

```

##### current_task: 2 #####
current classes [60, 61, 62, 63, 64, 65, 66, 67, 68, 69]
[output] all classes 0 -> 69
0.5096

```

```

##### current_task: 3 #####
current classes [70, 71, 72, 73, 74, 75, 76, 77, 78, 79]
[output] all classes 0 -> 79
0.4758

```

```

##### current_task: 4 #####
current classes [80, 81, 82, 83, 84, 85, 86, 87, 88, 89]
[output] all classes 0 -> 89
0.4548

```

```

##### current_task: 5 #####
current classes [90, 91, 92, 93, 94, 95, 96, 97, 98, 99]
[output] all classes 0 -> 99
0.4322

```

```

local: False | beta: 1.0 | l2: False

```

```

0.5822
0.541
0.5095714285714286
0.47575
0.4547777777777778
0.4322
[[0.5822 0.      0.      0.      0.      0.      ]
 [0.5558 0.467  0.      0.      0.      0.      ]
 [0.5332 0.447  0.454  0.      0.      0.      ]
 [0.5224 0.437  0.411  0.346  0.      0.      ]
 [0.4982 0.427  0.401  0.339  0.435  0.      ]

```

```
[0.4808 0.416 0.367 0.326 0.418 0.391 ]]
[0, 2.6400000000000009, 3.450000000000003, 4.426666666666671, 4.600000000000001,
5.528000000000001]
```

```
[14]: def predict(model, x, voro=True):
    x = torch.from_numpy(x.astype(np.float32)).cuda()
    with torch.no_grad():
        predi = model.module.classifier(x)
    if voro:
        predi += - torch.sum((model.module.classifier.weight/2.)**2, dim=1)
    return predi

classes_all = []
test_share = []
paccS = []
for i in range(task_num + 1):
    support_data, support_label, query_data, query_label, n_ways, n_shot, \
    classes = \
        get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                        local = True, brother = brother)

    # load model:
    if brother:
        cls_01 = classes[-1]+1
        assert cls_01 % 4 == 0
        filename = path + '%d_model.pkl' % (int(cls_01/4))
    else:
        filename = path + '%d_model.pkl' % (classes[-1]+1)
    model = torch.load(filename)
    model.eval()
    print('> loaded base phase model from:', filename)
    num_param(model)
    # do prediction:
    min_cls = min(classes)
    if brother:
        pred = predict(model, query_data)
    else:
        pred = predict(model, query_data)[:,:,:4]
    pmax = torch.max(pred, dim=1)[1]
    pacc = np.mean(t2n(pmax) == query_label - min_cls)
    print(pacc)
    if brother:
        accs = acc_brother(t2n(pred), t2n(pmax), query_label - min_cls, \
    forLG=True)
        pacc = [pacc] + accs
    paccS.append(pacc)
    classes_all.append(classes)
    test_share.append(len(query_label))
```

```

print('all logistic locally:')
if brother:
    for accs in paccS:
        print('\t'.join([str(i) for i in accs]))
else:
    print('\n'.join([str(i) for i in paccS]))

```

```

[15]: for i in range(task_num + 1):
        support_data, support_label, query_data, query_label, n_ways, n_shot, u
        ↪ classes = \
            get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                           local = True, brother = brother)

        pred_all = []
        for classes in classes_all:
            # load model:
            if brother:
                cls_01 = classes[-1]+1
                assert cls_01 % 4 == 0
                filename = path + '%d_model.pkl' % (int(cls_01/4))
            else:
                filename = path + '%d_model.pkl' % (classes[-1]+1)
            model = torch.load(filename)
            model.eval()
            print('> loaded base phase model from:', filename)
            num_param(model)
            # do prediction:
            min_cls = min(classes)
            if brother:
                pred = predict(model, query_data)
            else:
                pred = predict(model, query_data)[:,:,:4]
            pmax = torch.max(pred, dim=1)[1]
            # pacc = np.mean(t2n(pmax) == query_label - min_cls)
            # print(pacc)
            if brother:
                labs_01 = query_label[:4]//4
                acc_, sc_pre = merge_sc(t2n(pred), labs_01,
                                         mth='softmax', forLG=True, return_pre=True)
                min_cls = int(min_cls / 4)
                pred_all.append( (sc_pre + min_cls).tolist() )
            else:
                pred_all.append( (t2n(pmax) + min_cls).tolist() )
        pred_all = np.array(pred_all)
        print(pred_all.shape)

        if i == 0:
            pred_in_clique = copy.deepcopy(pred_all)

```

```

else:
    pred_in_clique = np.hstack((pred_in_clique, pred_all))

```

```

[42]: print('cliques by test samples:', pred_in_clique.shape)

# compute prototypes
be      = 0.6 # 1.
l2      = True # False True
bias    = 0 # 0.05
protots  = np.mean(feats_trans(support_data_, beta=be, l2=l2, bias=bias), axis=1)
query_pts = feats_trans(query_data_, beta=be, l2=l2, bias=bias)
# acenss  = feats_trans(acens, beta=be, l2=l2, bias=bias)
if brother:
    dist    = funbtch(query_pts, protots) # protots / acenss
else:
    dist    = fun(query_pts, protots) # protots / acenss

test_splt = [sum(test_share[:t+1]) for t in range(len(test_share))]

```

```

[238]: dist_in_clique = np.zeros_like(pred_in_clique, dtype=np.float32)
for c_id, clique in enumerate(pred_in_clique):
    for s_id, samp in enumerate(clique):
        dist_in_clique[c_id][s_id] = dist[s_id][samp]

```

```

[253]: for i in range(task_num + 1):
        clique_dist = dist_in_clique[:i+1,:test_splt[i]]
        clique_pred = np.argmax(clique_dist, axis=0)
        merge_pred = [pred_in_clique[cli,s_id] for s_id, cli in
            →enumerate(clique_pred)]
        merge_acc = np.mean(merge_pred == query_label_[:test_splt[i]])
        print(merge_acc)
print('DaC:', 'beta:', be, '| l2:', l2)

```

```

[28]: print('===== Experiment Done! =====')

```

```

===== Experiment Done! =====

```

## iVoro-AC/AI on CIFAR-100 Dataset (5 Phases, 3rd Block Features)

```
[12]: import matplotlib.pyplot as plt
import os
import pickle
import numpy as np
import pandas as pd
import seaborn as sns
import time
import sys
sys.path.append('../')
sys.path.append('../analysis/')
import copy
import platform
import json
import pickle
import random

import torch
from scipy.stats import mode
```

```
[45]: from ResNet import resnet18_cbam

data_name      = 'CIFAR100' # 'Subset' # 'Tiny' # 'CIFAR100' # 'MNIST'
total_nc       = 100 # 200 # 100 # 10
fg_nc          = 50 # 100 # 40 # 50 # 4
task_num       = 5 # 20 # 5 # 10 # 2

# constant params
class_set      = list(range(total_nc))
ROTATION       = True
EMB2D          = False
DESIGN         = True
virtual_class  = 4*total_nc if ROTATION else total_nc
suffix        = 'voro' # 'prob' 'voro'
assert (total_nc - fg_nc)%task_num == 0
task_size      = int((total_nc - fg_nc)/task_num)
```

```

file_name      =_
    ↳data_name+'_'+str(fg_nc)+'_'+str(task_num)+'x'+str(task_size)+suffix

print(file_name)

brother        = True # True False

```

CIFAR100\_50\_5x10voro

```

[46]: save_path = '../checkpoints/'
      path      = save_path + file_name + '/'
      filename   = path + '%d_model.pkl' % (fg_nc+0) # +5
      model      = torch.load(filename)
      model.eval()
      print('> loaded base phase model from:', filename)

```

> loaded base phase model from: ../checkpoints/CIFAR100\_50\_5x10voro/50\_model.pkl

```

[47]: from voro_helper import num_param, t2n, \
      load_feat, sanity_check, \
      id2emb_, num_samp, merge_sc, funbtch

num_param(model)

# voronoi centers:
vcenter = t2n(model.module.classifier.weight.data / 2.)
print(vcenter.shape)

```

```

module.classifier.weight      torch.Size([200, 512])  102400  True
total: 102400
(200, 512)

```

```

[48]: '''
      CIFAR:
          'CIFAR100_50_5x10_test.pkl'
          'CIFAR100_50_5x10_train.pkl'
          'CIFAR100_40_20x3_test.pkl'
          'CIFAR100_40_20x3_train.pkl'
      more CIFAR:
          'CIFAR100_40_12x5_test.pkl'
          'CIFAR100_40_12x5_train.pkl'
          'CIFAR100_30_14x5_test.pkl'
          'CIFAR100_30_14x5_train.pkl'
          'CIFAR100_20_16x5_test.pkl'
          'CIFAR100_20_16x5_train.pkl'
          'CIFAR100_10_18x5_test.pkl'
          'CIFAR100_10_18x5_train.pkl'
      Tiny:

```

```

        'Tiny_100_20x5_test.pkl'
        'Tiny_100_20x5_train.pkl'
TinyL3:
        'Tiny_100_5x20_test.pkl'
        'Tiny_100_5x20_train.pkl'
Subset:
        'Subset_50_10x5_test.pkl'
        'Subset_50_10x5_train.pkl'
'''
ffile = '../embedding/probL3/' + 'CIFAR100_50_5x10_test.pkl' # prob probL3
dataphas, last_tsk = load_feat(ffile)

labs, embeds, outputs = dataphas[last_tsk][last_tsk]
false_id, pred_ = sanity_check(labs, embeds, outputs)

```

```

feature file: ../embedding/probL3/CIFAR100_50_5x10_test.pkl
> loaded tasks: dict_keys([5])
> classes: [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18,
19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38,
39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58,
59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78,
79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98,
99]
> samples: 10000
> embedding: 256
> classification: 400
~ acc (single): 45.96%
~ acc (quadruple): 36.15%

```

```

[49]: ffile = '../embedding/probL3/' + 'CIFAR100_50_5x10_train.pkl' # prob probL3
dataphas, last_tsk = load_feat(ffile)

labst, embedst, outputst = dataphas[last_tsk][last_tsk]
false_id, pred_ = sanity_check(labst, embedst, outputst)

```

```

feature file: ../embedding/probL3/CIFAR100_50_5x10_train.pkl
> loaded tasks: dict_keys([5])
> classes: [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18,
19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38,
39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58,
59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78,
79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98,
99]
> samples: 50000
> embedding: 256
> classification: 400
~ acc (single): 49.57%
~ acc (quadruple): 39.82%

```

```
[50]: embs = id2emb_(labs, embeds, brother=brother)
      embst = id2emb_(labst, embedst, brother=brother)

      sam_max, sam_min = num_samp(embst)
      print('> loading data done!')
```

```
0 500,1 500,2 500,3 500,4 500,5 500,6 500,7 500,8 500,9 500,10 500,11 500,12
500,13 500,14 500,15 500,16 500,17 500,18 500,19 500,20 500,21 500,22 500,23
500,24 500,25 500,26 500,27 500,28 500,29 500,30 500,31 500,32 500,33 500,34
500,35 500,36 500,37 500,38 500,39 500,40 500,41 500,42 500,43 500,44 500,45
500,46 500,47 500,48 500,49 500,50 500,51 500,52 500,53 500,54 500,55 500,56
500,57 500,58 500,59 500,60 500,61 500,62 500,63 500,64 500,65 500,66 500,67
500,68 500,69 500,70 500,71 500,72 500,73 500,74 500,75 500,76 500,77 500,78
500,79 500,80 500,81 500,82 500,83 500,84 500,85 500,86 500,87 500,88 500,89
500,90 500,91 500,92 500,93 500,94 500,95 500,96 500,97 500,98 500,99 500,100
500,101 500,102 500,103 500,104 500,105 500,106 500,107 500,108 500,109 500,110
500,111 500,112 500,113 500,114 500,115 500,116 500,117 500,118 500,119 500,120
500,121 500,122 500,123 500,124 500,125 500,126 500,127 500,128 500,129 500,130
500,131 500,132 500,133 500,134 500,135 500,136 500,137 500,138 500,139 500,140
500,141 500,142 500,143 500,144 500,145 500,146 500,147 500,148 500,149 500,150
500,151 500,152 500,153 500,154 500,155 500,156 500,157 500,158 500,159 500,160
500,161 500,162 500,163 500,164 500,165 500,166 500,167 500,168 500,169 500,170
500,171 500,172 500,173 500,174 500,175 500,176 500,177 500,178 500,179 500,180
500,181 500,182 500,183 500,184 500,185 500,186 500,187 500,188 500,189 500,190
500,191 500,192 500,193 500,194 500,195 500,196 500,197 500,198 500,199 500,200
500,201 500,202 500,203 500,204 500,205 500,206 500,207 500,208 500,209 500,210
500,211 500,212 500,213 500,214 500,215 500,216 500,217 500,218 500,219 500,220
500,221 500,222 500,223 500,224 500,225 500,226 500,227 500,228 500,229 500,230
500,231 500,232 500,233 500,234 500,235 500,236 500,237 500,238 500,239 500,240
500,241 500,242 500,243 500,244 500,245 500,246 500,247 500,248 500,249 500,250
500,251 500,252 500,253 500,254 500,255 500,256 500,257 500,258 500,259 500,260
500,261 500,262 500,263 500,264 500,265 500,266 500,267 500,268 500,269 500,270
500,271 500,272 500,273 500,274 500,275 500,276 500,277 500,278 500,279 500,280
500,281 500,282 500,283 500,284 500,285 500,286 500,287 500,288 500,289 500,290
500,291 500,292 500,293 500,294 500,295 500,296 500,297 500,298 500,299 500,300
500,301 500,302 500,303 500,304 500,305 500,306 500,307 500,308 500,309 500,310
500,311 500,312 500,313 500,314 500,315 500,316 500,317 500,318 500,319 500,320
500,321 500,322 500,323 500,324 500,325 500,326 500,327 500,328 500,329 500,330
500,331 500,332 500,333 500,334 500,335 500,336 500,337 500,338 500,339 500,340
500,341 500,342 500,343 500,344 500,345 500,346 500,347 500,348 500,349 500,350
500,351 500,352 500,353 500,354 500,355 500,356 500,357 500,358 500,359 500,360
500,361 500,362 500,363 500,364 500,365 500,366 500,367 500,368 500,369 500,370
500,371 500,372 500,373 500,374 500,375 500,376 500,377 500,378 500,379 500,380
500,381 500,382 500,383 500,384 500,385 500,386 500,387 500,388 500,389 500,390
500,391 500,392 500,393 500,394 500,395 500,396 500,397 500,398 500,399 500,
max samples: 500
min samples: 500
> loading data done!
```



```
[51]: for k,v in embst.items():
        if v.shape[0] < sam_max:
            rid = np.random.choice(v.shape[0], sam_max-v.shape[0], replace=False)
            print('filling', sam_max-v.shape[0], 'samples')
            embst[k] = np.vstack((v, v[rid]))
```

```
[52]: from voro_helper import get_task_data, feat_trans, NC_o, tsk_cls, fun, \
        ↪acc_brother, forgetting

i = task_num
support_data_, support_label_, query_data_, query_label_, n_ways_, n_shot_, _ = \
    get_task_data(embst, embs, i, fg_nc, class_set, task_size, brother=brother)
```

```
##### current_task: 5 #####
current classes [360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375
376 377
378 379 380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395
396 397 398 399]
[output] all classes 0 -> 399
```

```
[53]: ### =====
        ↪=====
be      = 1. # 1.
l2      = False # False True
protots = np.mean(feat_trans(support_data_, beta=be, l2=l2), axis=1)
```

```
[43]: i = 0
support_data, support_label, query_data, query_label, n_ways, n_shot, classes = \
    get_task_data(embst, embs, i, fg_nc, class_set, task_size, brother=brother)
acc, _, nn_pre = NC_o(support_data, support_label,
                      query_data, query_label,
                      n_ways, n_shot,
                      beta = be, l2 = l2,
                      given_cen = protots[classes], given_only = True,
                      brother = brother)
```

```
##### current_task: 0 #####
current classes [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17,
18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37,
38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49]
[output] all classes 0 -> 49
0.5822
```

```
[54]: local      = False # True / False
nn_acc      = []
```

```

savefile = path+'NN3' if brother else None # NN / NNp / NN3 / only saved NN
→results!
savefil2 = path+'NN3'
forget = True # True False # calculate forgetting
class_ladder = []
a = []
for i in range(task_num + 1):
    support_data, support_label, query_data, query_label, n_ways, n_shot,
→classes = \
        get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                        local = local, brother = brother) # False
    if forget:
        class_ladder.append(classes)
    acc, _, nn_pre = NC_o(support_data, support_label,
                          query_data, query_label,
                          n_ways, n_shot,
                          beta = be, l2 = l2,
                          given_cen = protots[classes] if local else protots[:
→classes[-1]+1],

                          given_only = True,
                          brother = brother,
                          savefile = savefile+'_'+str(i) if brother else None,
                          savefile2 = None, # savefil2+'_'+str(i), # None, #
                          weights = [0.7, 0.3],
                          class_ladder = class_ladder,
                          acc_all = a
                          )

    nn_acc.append(acc)
    # if all classes up2now: local = False, and protots[:classes[-1]+1]
print('local:', local, '| beta:', be, '| l2:', l2)
if brother:
    for accs in nn_acc:
        print('\t'.join([str(i) for i in accs]))
else:
    print('\n'.join([str(i) for i in nn_acc]))
if forget:
    avgf = forgetting(a, task_num)
    print(avgf)

```

##### current\_task: 0 #####

```

current classes [ 0  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15
16 17
18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35
36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53
54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71
72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89

```

```

    90  91  92  93  94  95  96  97  98  99 100 101 102 103 104 105 106 107
108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125
126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143
144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161
162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179
180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197
198 199]
[output] all classes 0 -> 199
<<< loaded from: ../checkpoints/CIFAR100_50_5x10voro/NN3_0.npy
0.4930

##### current_task: 1 #####
current classes [200 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215
216 217
    218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235
    236 237 238 239]
[output] all classes 0 -> 239
<<< loaded from: ../checkpoints/CIFAR100_50_5x10voro/NN3_1.npy
0.4527

##### current_task: 2 #####
current classes [240 241 242 243 244 245 246 247 248 249 250 251 252 253 254 255
256 257
    258 259 260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275
    276 277 278 279]
[output] all classes 0 -> 279
<<< loaded from: ../checkpoints/CIFAR100_50_5x10voro/NN3_2.npy
0.4273

##### current_task: 3 #####
current classes [280 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295
296 297
    298 299 300 301 302 303 304 305 306 307 308 309 310 311 312 313 314 315
    316 317 318 319]
[output] all classes 0 -> 319
<<< loaded from: ../checkpoints/CIFAR100_50_5x10voro/NN3_3.npy
0.3968

##### current_task: 4 #####
current classes [320 321 322 323 324 325 326 327 328 329 330 331 332 333 334 335
336 337
    338 339 340 341 342 343 344 345 346 347 348 349 350 351 352 353 354 355
    356 357 358 359]
[output] all classes 0 -> 359
<<< loaded from: ../checkpoints/CIFAR100_50_5x10voro/NN3_4.npy
0.3779

##### current_task: 5 #####

```

```

current classes [360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375
376 377
378 379 380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395
396 397 398 399]
[output] all classes 0 -> 399
<<< loaded from: ../checkpoints/CIFAR100_50_5x10voro/NN3_5.npy
0.3567
local: False | beta: 1.0 | l2: False
0.493 0.7816 0.7848 0.786 0.7652
0.4527083333333333 0.7336666666666667 0.746 0.746
0.7253333333333334
0.42725 0.7051428571428572 0.7218571428571429 0.7208571428571429
0.6962857142857143
0.3968125 0.6625 0.698625 0.696125 0.6745
0.3779166666666667 0.6411111111111111 0.6807777777777778
0.6784444444444444 0.6561111111111111
0.3567 0.6112 0.6613 0.6591 0.6386
[[0.493 0. 0. 0. 0. 0. ]
[0.46895 0.3715 0. 0. 0. 0. ]
[0.45225 0.359 0.3705 0. 0. 0. ]
[0.441 0.34875 0.335 0.28575 0. 0. ]
[0.4253 0.3355 0.326 0.2795 0.33375 0. ]
[0.4096 0.32175 0.30125 0.2705 0.31775 0.30775]]
[0, 2.40500000000000016, 2.6625000000000001, 3.6749999999999985,
3.8612499999999998, 4.6729999999999999]

```

```

[14]: def predict(model, x, voro=True):
    x = torch.from_numpy(x.astype(np.float32)).cuda()
    with torch.no_grad():
        predi = model.module.classifier(x)
    if voro:
        predi += - torch.sum((model.module.classifier.weight/2.）**2, dim=1)
    return predi

classes_all = []
test_share = []
paccS = []
for i in range(task_num + 1):
    support_data, support_label, query_data, query_label, n_ways, n_shot, \
    classes = \
        get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                        local = True, brother = brother)

    # load model:
    if brother:
        cls_01 = classes[-1]+1
        assert cls_01 % 4 == 0
        filename = path + '%d_model.pkl' % (int(cls_01/4))

```

```

else:
    filename = path + '%d_model.pkl' % (classes[-1]+1)
    model = torch.load(filename)
    model.eval()
    print('> loaded base phase model from:', filename)
    num_param(model)
    # do prediction:
    min_cls = min(classes)
    if brother:
        pred = predict(model, query_data)
    else:
        pred = predict(model, query_data)[:,:4]
        pmax = torch.max(pred, dim=1)[1]
        pacc = np.mean(t2n(pmax) == query_label - min_cls)
    print(pacc)
    if brother:
        accs = acc_brother(t2n(pred), t2n(pmax), query_label - min_cls,
→forLG=True)
        pacc = [pacc] + accs
        paccS.append(pacc)
        classes_all.append(classes)
        test_share.append(len(query_label))
print('all logistic locally:')
if brother:
    for accs in paccS:
        print('\t'.join([str(i) for i in accs]))
else:
    print('\n'.join([str(i) for i in paccS]))

```

```

[15]: for i in range(task_num + 1):
    support_data, support_label, query_data, query_label, n_ways, n_shot,
→classes = \
        get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                        local = True, brother = brother)
    pred_all = []
    for classes in classes_all:
        # load model:
        if brother:
            cls_01 = classes[-1]+1
            assert cls_01 % 4 == 0
            filename = path + '%d_model.pkl' % (int(cls_01/4))
        else:
            filename = path + '%d_model.pkl' % (classes[-1]+1)
        model = torch.load(filename)
        model.eval()
        print('> loaded base phase model from:', filename)
        num_param(model)

```

```

    # do prediction:
    min_cls = min(classes)
    if brother:
        pred = predict(model, query_data)
    else:
        pred = predict(model, query_data)[:,:,:4]
    pmax = torch.max(pred, dim=1)[1]
    # pacc = np.mean(t2n(pmax) == query_label - min_cls)
    # print(pacc)
    if brother:
        labs_01 = query_label[:4]//4
        acc_, sc_pre = merge_sc(t2n(pred), labs_01,
                                mth='softmax', forLG=True, return_pre=True)
        min_cls = int(min_cls / 4)
        pred_all.append( (sc_pre + min_cls).tolist() )
    else:
        pred_all.append( (t2n(pmax) + min_cls).tolist() )
    pred_all = np.array(pred_all)
    print(pred_all.shape)

    if i == 0:
        pred_in_clique = copy.deepcopy(pred_all)
    else:
        pred_in_clique = np.hstack((pred_in_clique, pred_all))

```

```

[42]: print('cliques by test samples:', pred_in_clique.shape)

# compute prototypes
be      = 0.6 # 1.
l2      = True # False True
bias    = 0 # 0.05
protots = np.mean(feats_trans(support_data_, beta=be, l2=l2, bias=bias), axis=1)
query_pts = feats_trans(query_data_, beta=be, l2=l2, bias=bias)
# acenss  = feats_trans(acens, beta=be, l2=l2, bias=bias)
if brother:
    dist      = funbtch(query_pts, protots) # protots / acenss
else:
    dist      = fun(query_pts, protots) # protots / acenss

test_splt = [sum(test_share[:t+1]) for t in range(len(test_share))]

```

```

[238]: dist_in_clique = np.zeros_like(pred_in_clique, dtype=np.float32)
for c_id, clique in enumerate(pred_in_clique):
    for s_id, samp in enumerate(clique):
        dist_in_clique[c_id][s_id] = dist[s_id][samp]

```

```
[253]: for i in range(task_num + 1):
        clique_dist = dist_in_clique[:,i+1,:test_splt[i]]
        clique_pred = np.argmin(clique_dist, axis=0)
        merge_pred = [pred_in_clique[cli,s_id] for s_id, cli in
        →enumerate(clique_pred)]
        merge_acc = np.mean(merge_pred == query_label_[:test_splt[i]])
        print(merge_acc)
    print('DaC:', 'beta:', be, '| l2:', l2)
```

```
[28]: print('===== Experiment Done! =====')
```

```
===== Experiment Done! =====
```

## iVoro on CIFAR-100 Dataset (10 Phases, 3rd Block Features)

```
[12]: import matplotlib.pyplot as plt
import os
import pickle
import numpy as np
import pandas as pd
import seaborn as sns
import time
import sys
sys.path.append('../')
sys.path.append('../analysis/')
import copy
import platform
import json
import pickle
import random

import torch
from scipy.stats import mode
```

```
[55]: from ResNet import resnet18_cbam

data_name      = 'CIFAR100' # 'Subset' # 'Tiny' # 'CIFAR100' # 'MNIST'
total_nc       = 100 # 200 # 100 # 10
fg_nc          = 50 # 100 # 40 # 50 # 4
task_num       = 10 # 20 # 5 # 10 # 2

# constant params
class_set      = list(range(total_nc))
ROTATION       = True
EMB2D         = False
DESIGN        = True
virtual_class  = 4*total_nc if ROTATION else total_nc
suffix         = 'voro' # 'prob' 'voro'
assert (total_nc - fg_nc)%task_num == 0
task_size      = int((total_nc - fg_nc)/task_num)
file_name      =
    ↳data_name+'_'+str(fg_nc)+'_'+str(task_num)+'x'+str(task_size)+suffix
```



```
print(file_name)

brother      = False # True False
```

CIFAR100\_50\_10x5voro

```
[56]: save_path = '../checkpoints/'
path   = save_path + file_name + '/'
filename = path + '%d_model.pkl' % (fg_nc+0) # +5
model   = torch.load(filename)
model.eval()
print('> loaded base phase model from:', filename)
```

> loaded base phase model from: ../checkpoints/CIFAR100\_50\_10x5voro/50\_model.pkl

```
[57]: from voro_helper import num_param, t2n, \
        load_feat, sanity_check, \
        id2emb_, num_samp, merge_sc, funbtch

num_param(model)

# voronoi centers:
vcenter = t2n(model.module.classifier.weight.data / 2.)
print(vcenter.shape)
```

```
module.classifier.weight      torch.Size([200, 512])  102400  True
total: 102400
(200, 512)
```

```
[58]: '''
CIFAR:
    'CIFAR100_50_5x10_test.pkl'
    'CIFAR100_50_5x10_train.pkl'
    'CIFAR100_40_20x3_test.pkl'
    'CIFAR100_40_20x3_train.pkl'
more CIFAR:
    'CIFAR100_40_12x5_test.pkl'
    'CIFAR100_40_12x5_train.pkl'
    'CIFAR100_30_14x5_test.pkl'
    'CIFAR100_30_14x5_train.pkl'
    'CIFAR100_20_16x5_test.pkl'
    'CIFAR100_20_16x5_train.pkl'
    'CIFAR100_10_18x5_test.pkl'
    'CIFAR100_10_18x5_train.pkl'
Tiny:
    'Tiny_100_20x5_test.pkl'
    'Tiny_100_20x5_train.pkl'
TinyL3:
    'Tiny_100_5x20_test.pkl'
```

```

    'Tiny_100_5x20_train.pkl'
Subset:
    'Subset_50_10x5_test.pkl'
    'Subset_50_10x5_train.pkl'
'''
ffile = '../embedding/probL3/' + 'CIFAR100_50_5x10_test.pkl' # prob probL3
data_phas, last_tsk = load_feat(ffile)

labs, embeds, outputs = data_phas[last_tsk][last_tsk]
false_id, pred_ = sanity_check(labs, embeds, outputs)

```

```

feature file: ../embedding/probL3/CIFAR100_50_5x10_test.pkl
> loaded tasks: dict_keys([5])
> classes: [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18,
19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38,
39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58,
59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78,
79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98,
99]
> samples: 10000
> embedding: 256
> classification: 400
~ acc (single): 45.96%
~ acc (quadruple): 36.15%

```

```

[59]: ffile = '../embedding/probL3/' + 'CIFAR100_50_5x10_train.pkl' # prob probL3
data_phas, last_tsk = load_feat(ffile)

labst, embedst, outputst = data_phas[last_tsk][last_tsk]
false_id, pred_ = sanity_check(labst, embedst, outputst)

```

```

feature file: ../embedding/probL3/CIFAR100_50_5x10_train.pkl
> loaded tasks: dict_keys([5])
> classes: [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18,
19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38,
39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58,
59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78,
79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98,
99]
> samples: 50000
> embedding: 256
> classification: 400
~ acc (single): 49.57%
~ acc (quadruple): 39.82%

```

```

[60]: embs = id2emb_(labs, embeds, brother=brother)
embst = id2emb_(labst, embedst, brother=brother)

```

```
sam_max, sam_min = num_samp(embst)
print('> loading data done!')
```

```
0 500,1 500,2 500,3 500,4 500,5 500,6 500,7 500,8 500,9 500,10 500,11 500,12
500,13 500,14 500,15 500,16 500,17 500,18 500,19 500,20 500,21 500,22 500,23
500,24 500,25 500,26 500,27 500,28 500,29 500,30 500,31 500,32 500,33 500,34
500,35 500,36 500,37 500,38 500,39 500,40 500,41 500,42 500,43 500,44 500,45
500,46 500,47 500,48 500,49 500,50 500,51 500,52 500,53 500,54 500,55 500,56
500,57 500,58 500,59 500,60 500,61 500,62 500,63 500,64 500,65 500,66 500,67
500,68 500,69 500,70 500,71 500,72 500,73 500,74 500,75 500,76 500,77 500,78
500,79 500,80 500,81 500,82 500,83 500,84 500,85 500,86 500,87 500,88 500,89
500,90 500,91 500,92 500,93 500,94 500,95 500,96 500,97 500,98 500,99 500,
max samples: 500
min samples: 500
> loading data done!
```

```
[61]: for k,v in embst.items():
        if v.shape[0] < sam_max:
            rid = np.random.choice(v.shape[0], sam_max-v.shape[0], replace=False)
            print('filling', sam_max-v.shape[0], 'samples')
            embst[k] = np.vstack((v, v[rid]))
```

```
[62]: from voro_helper import get_task_data, feat_trans, NC_o, tsk_cls, fun, \
        ↪acc_brother, forgetting

i = task_num
support_data_, support_label_, query_data_, query_label_, n_ways_, n_shot_, _ = \
    get_task_data(embst, embs, i, fg_nc, class_set, task_size, brother=brother)
```

```
##### current_task: 10 #####
current classes [95, 96, 97, 98, 99]
[output] all classes 0 -> 99
```

```
[63]: #%% =====
        ↪=====
be      = 1. # 1.
l2      = False # False True
protots = np.mean(feat_trans(support_data_, beta=be, l2=l2), axis=1)
```

```
[64]: i = 0
support_data, support_label, query_data, query_label, n_ways, n_shot, classes = \
    get_task_data(embst, embs, i, fg_nc, class_set, task_size, brother=brother)
acc, _, nn_pre = NC_o(support_data, support_label,
                      query_data, query_label,
                      n_ways, n_shot,
                      beta = be, l2 = l2,
                      given_cen = protots[classes], given_only = True,
```

```
brother = brother)
```

```
##### current_task: 0 #####
current classes [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17,
18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37,
38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49]
[output] all classes 0 -> 49
0.5822
```

```
[65]: local      = False # True / False
nn_acc   = []
savefile = path+'NN3' if brother else None # NN / NNp / NN3 / only saved NN_
→results!
savefil2 = path+'NN3'
forget    = True # True False # calculate forgetting
class_ladder = []
a         = []
for i in range(task_num + 1):
    support_data, support_label, query_data, query_label, n_ways, n_shot,
→classes = \
        get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                        local = local, brother = brother) # False
    if forget:
        class_ladder.append(classes)
    acc, _, nn_pre = NC_o(support_data, support_label,
                           query_data, query_label,
                           n_ways, n_shot,
                           beta = be, l2 = l2,
                           given_cen = protots[classes] if local else protots[:
→classes[-1]+1],
                           given_only = True,
                           brother = brother,
                           savefile = savefile+'_'+str(i) if brother else None,
                           savefile2 = None, # savefil2+'_'+str(i), # None, #
                           weights = [0.7, 0.3],
                           class_ladder = class_ladder,
                           acc_all = a
                           )
    nn_acc.append(acc)
    # if all classes up2now: local = False, and protots[:classes[-1]+1]
print('local:', local, '| beta:', be, '| l2:', l2)
if brother:
    for accs in nn_acc:
        print('\t'.join([str(i) for i in accs]))
else:
    print('\n'.join([str(i) for i in nn_acc]))
```

```
if forget:
    avgf = forgetting(a, task_num)
    print(avgf)
```

```
##### current_task: 0 #####
current classes [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17,
18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37,
38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49]
[output] all classes 0 -> 49
0.5822
```

```
##### current_task: 1 #####
current classes [50, 51, 52, 53, 54]
[output] all classes 0 -> 54
0.5631
```

```
##### current_task: 2 #####
current classes [55, 56, 57, 58, 59]
[output] all classes 0 -> 59
0.5410
```

```
##### current_task: 3 #####
current classes [60, 61, 62, 63, 64]
[output] all classes 0 -> 64
0.5297
```

```
##### current_task: 4 #####
current classes [65, 66, 67, 68, 69]
[output] all classes 0 -> 69
0.5096
```

```
##### current_task: 5 #####
current classes [70, 71, 72, 73, 74]
[output] all classes 0 -> 74
0.4904
```

```
##### current_task: 6 #####
current classes [75, 76, 77, 78, 79]
[output] all classes 0 -> 79
0.4758
```

```
##### current_task: 7 #####
current classes [80, 81, 82, 83, 84]
[output] all classes 0 -> 84
0.4602
```

```
##### current_task: 8 #####
```

```
current classes [85, 86, 87, 88, 89]
[output] all classes 0 -> 89
0.4548
```

```
##### current_task: 9 #####
current classes [90, 91, 92, 93, 94]
[output] all classes 0 -> 94
0.4454
```

```
##### current_task: 10 #####
current classes [95, 96, 97, 98, 99]
[output] all classes 0 -> 99
0.4322
local: False | beta: 1.0 | l2: False
0.5822
```

```
0.5630909090909091
0.541
0.5296923076923077
0.5095714285714286
0.4904
0.47575
0.4602352941176471
0.4547777777777778
0.4453684210526316
0.4322
```

```
[[0.5822 0.      0.      0.      0.      0.      0.      0.      0.      0.
  0.      ]
 [0.565  0.544  0.      0.      0.      0.      0.      0.      0.      0.
  0.      ]
 [0.5558 0.514  0.42   0.      0.      0.      0.      0.      0.      0.
  0.      ]
 [0.5438 0.502  0.416  0.53   0.      0.      0.      0.      0.      0.
  0.      ]
 [0.5332 0.5    0.394  0.518  0.39   0.      0.      0.      0.      0.
  0.      ]
 [0.5248 0.492  0.384  0.468  0.358  0.406  0.      0.      0.      0.
  0.      ]
 [0.5224 0.492  0.382  0.468  0.354  0.404  0.288  0.      0.      0.
  0.      ]
 [0.5104 0.482  0.38   0.454  0.354  0.396  0.288  0.366  0.      0.
  0.      ]
 [0.4982 0.478  0.376  0.45   0.352  0.392  0.286  0.36   0.51   0.
  0.      ]
 [0.4914 0.472  0.372  0.444  0.348  0.382  0.284  0.35   0.492  0.404
  0.      ]
 [0.4808 0.466  0.366  0.428  0.306  0.374  0.278  0.344  0.492  0.402
  0.38   ]]
[0, 1.7200000000000104, 2.8200000000000056, 2.8133333333333383,
```

3.2750000000000017, 4.788000000000001, 4.163333333333336, 4.225714285714288,  
4.1750000000000025, 4.453333333333336, 5.034000000000001]

```
[14]: def predict(model, x, voro=True):
    x = torch.from_numpy(x.astype(np.float32)).cuda()
    with torch.no_grad():
        predi = model.module.classifier(x)
    if voro:
        predi += - torch.sum((model.module.classifier.weight/2.)**2, dim=1)
    return predi

classes_all = []
test_share = []
paccS = []
for i in range(task_num + 1):
    support_data, support_label, query_data, query_label, n_ways, n_shot, \
    classes = \
        get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                      local = True, brother = brother)
    # load model:
    if brother:
        cls_01 = classes[-1]+1
        assert cls_01 % 4 == 0
        filename = path + '%d_model.pkl' % (int(cls_01/4))
    else:
        filename = path + '%d_model.pkl' % (classes[-1]+1)
    model = torch.load(filename)
    model.eval()
    print('> loaded base phase model from:', filename)
    num_param(model)
    # do prediction:
    min_cls = min(classes)
    if brother:
        pred = predict(model, query_data)
    else:
        pred = predict(model, query_data)[:,:,:4]
    pmax = torch.max(pred, dim=1)[1]
    pacc = np.mean(t2n(pmax) == query_label - min_cls)
    print(pacc)
    if brother:
        accs = acc_brother(t2n(pred), t2n(pmax), query_label - min_cls, \
    forLG=True)
        pacc = [pacc] + accs
    paccS.append(pacc)
    classes_all.append(classes)
    test_share.append(len(query_label))
print('all logistic locally:')
```

```

if brother:
    for accs in paccS:
        print('\t'.join([str(i) for i in accs]))
else:
    print('\n'.join([str(i) for i in paccS]))

```

```

[15]: for i in range(task_num + 1):
    support_data, support_label, query_data, query_label, n_ways, n_shot, \
    →classes = \
        get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                        local = True, brother = brother)
    pred_all = []
    for classes in classes_all:
        # load model:
        if brother:
            cls_01 = classes[-1]+1
            assert cls_01 % 4 == 0
            filename = path + '%d_model.pkl' % (int(cls_01/4))
        else:
            filename = path + '%d_model.pkl' % (classes[-1]+1)
        model = torch.load(filename)
        model.eval()
        print('> loaded base phase model from:', filename)
        num_param(model)
        # do prediction:
        min_cls = min(classes)
        if brother:
            pred = predict(model, query_data)
        else:
            pred = predict(model, query_data)[:,:,:4]
        pmax = torch.max(pred, dim=1)[1]
        # pacc = np.mean(t2n(pmax) == query_label - min_cls)
        # print(pacc)
        if brother:
            labs_01 = query_label[:4]//4
            acc_, sc_pre = merge_sc(t2n(pred), labs_01,
                                    mth='softmax', forLG=True, return_pre=True)
            min_cls = int(min_cls / 4)
            pred_all.append( (sc_pre + min_cls).tolist() )
        else:
            pred_all.append( (t2n(pmax) + min_cls).tolist() )
    pred_all = np.array(pred_all)
    print(pred_all.shape)

    if i == 0:
        pred_in_clique = copy.deepcopy(pred_all)
    else:

```



```
pred_in_clique = np.hstack((pred_in_clique, pred_all))
```

```
[42]: print('cliques by test samples:', pred_in_clique.shape)

# compute prototypes
be      = 0.6 # 1.
l2      = True # False True
bias    = 0 # 0.05
protots = np.mean(feats_trans(support_data_, beta=be, l2=l2, bias=bias), axis=1)
query_pts = feats_trans(query_data_, beta=be, l2=l2, bias=bias)
# acenss = feats_trans(acens, beta=be, l2=l2, bias=bias)
if brother:
    dist = funbtch(query_pts, protots) # protots / acenss
else:
    dist = fun(query_pts, protots) # protots / acenss

test_splt = [sum(test_share[:t+1]) for t in range(len(test_share))]
```

```
[238]: dist_in_clique = np.zeros_like(pred_in_clique, dtype=np.float32)
for c_id, clique in enumerate(pred_in_clique):
    for s_id, samp in enumerate(clique):
        dist_in_clique[c_id][s_id] = dist[s_id][samp]
```

```
[253]: for i in range(task_num + 1):
        clique_dist = dist_in_clique[:,i+1,:test_splt[i]]
        clique_pred = np.argmin(clique_dist, axis=0)
        merge_pred = [pred_in_clique[cli,s_id] for s_id, cli in
            ↪ enumerate(clique_pred)]
        merge_acc = np.mean(merge_pred == query_label_[:test_splt[i]])
        print(merge_acc)
print('DaC:', 'beta:', be, '| l2:', l2)
```

```
[28]: print('===== Experiment Done! =====')
```

```
===== Experiment Done! =====
```

## iVoro-AC/AI on CIFAR-100 Dataset (10 Phases, 3rd Block Features)

```
[12]: import matplotlib.pyplot as plt
import os
import pickle
import numpy as np
import pandas as pd
import seaborn as sns
import time
import sys
sys.path.append('../')
sys.path.append('../analysis/')
import copy
import platform
import json
import pickle
import random

import torch
from scipy.stats import mode
```

```
[66]: from ResNet import resnet18_cbam

data_name      = 'CIFAR100' # 'Subset' # 'Tiny' # 'CIFAR100' # 'MNIST'
total_nc       = 100 # 200 # 100 # 10
fg_nc          = 50 # 100 # 40 # 50 # 4
task_num       = 10 # 20 # 5 # 10 # 2

# constant params
class_set      = list(range(total_nc))
ROTATION       = True
EMB2D         = False
DESIGN        = True
virtual_class  = 4*total_nc if ROTATION else total_nc
suffix        = 'voro' # 'prob' 'voro'
assert (total_nc - fg_nc)%task_num == 0
task_size      = int((total_nc - fg_nc)/task_num)
```

```

file_name      =_
    ↳data_name+'_'+str(fg_nc)+'_'+str(task_num)+'x'+str(task_size)+suffix

print(file_name)

brother        = True # True False

```

CIFAR100\_50\_10x5voro

```

[67]: save_path = '../checkpoints/'
      path      = save_path + file_name + '/'
      filename   = path + '%d_model.pkl' % (fg_nc+0) # +5
      model      = torch.load(filename)
      model.eval()
      print('> loaded base phase model from:', filename)

```

> loaded base phase model from: ../checkpoints/CIFAR100\_50\_10x5voro/50\_model.pkl

```

[68]: from voro_helper import num_param, t2n, \
      load_feat, sanity_check, \
      id2emb_, num_samp, merge_sc, funbtch

num_param(model)

# voronoi centers:
vcenter = t2n(model.module.classifier.weight.data / 2.)
print(vcenter.shape)

```

```

module.classifier.weight      torch.Size([200, 512])  102400  True
total: 102400
(200, 512)

```

```

[69]: '''
      CIFAR:
          'CIFAR100_50_5x10_test.pkl'
          'CIFAR100_50_5x10_train.pkl'
          'CIFAR100_40_20x3_test.pkl'
          'CIFAR100_40_20x3_train.pkl'
      more CIFAR:
          'CIFAR100_40_12x5_test.pkl'
          'CIFAR100_40_12x5_train.pkl'
          'CIFAR100_30_14x5_test.pkl'
          'CIFAR100_30_14x5_train.pkl'
          'CIFAR100_20_16x5_test.pkl'
          'CIFAR100_20_16x5_train.pkl'
          'CIFAR100_10_18x5_test.pkl'
          'CIFAR100_10_18x5_train.pkl'
      Tiny:

```

```

        'Tiny_100_20x5_test.pkl'
        'Tiny_100_20x5_train.pkl'
TinyL3:
        'Tiny_100_5x20_test.pkl'
        'Tiny_100_5x20_train.pkl'
Subset:
        'Subset_50_10x5_test.pkl'
        'Subset_50_10x5_train.pkl'
'''
ffile = '../embedding/probL3/' + 'CIFAR100_50_5x10_test.pkl' # prob probL3
data_phas, last_tsk = load_feat(ffile)

labs, embeds, outputs = data_phas[last_tsk][last_tsk]
false_id, pred_ = sanity_check(labs, embeds, outputs)

```

```

feature file: ../embedding/probL3/CIFAR100_50_5x10_test.pkl
> loaded tasks: dict_keys([5])
> classes: [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18,
19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38,
39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58,
59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78,
79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98,
99]
> samples: 10000
> embedding: 256
> classification: 400
~ acc (single): 45.96%
~ acc (quadruple): 36.15%

```

```

[70]: ffile = '../embedding/probL3/' + 'CIFAR100_50_5x10_train.pkl' # prob probL3
data_phas, last_tsk = load_feat(ffile)

labst, embedst, outputst = data_phas[last_tsk][last_tsk]
false_id, pred_ = sanity_check(labst, embedst, outputst)

```

```

feature file: ../embedding/probL3/CIFAR100_50_5x10_train.pkl
> loaded tasks: dict_keys([5])
> classes: [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18,
19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38,
39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58,
59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78,
79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98,
99]
> samples: 50000
> embedding: 256
> classification: 400
~ acc (single): 49.57%
~ acc (quadruple): 39.82%

```

```
[71]: embs = id2emb_(labs, embeds, brother=brother)
      embst = id2emb_(labst, embedst, brother=brother)

      sam_max, sam_min = num_samp(embst)
      print('> loading data done!')
```

```
0 500,1 500,2 500,3 500,4 500,5 500,6 500,7 500,8 500,9 500,10 500,11 500,12
500,13 500,14 500,15 500,16 500,17 500,18 500,19 500,20 500,21 500,22 500,23
500,24 500,25 500,26 500,27 500,28 500,29 500,30 500,31 500,32 500,33 500,34
500,35 500,36 500,37 500,38 500,39 500,40 500,41 500,42 500,43 500,44 500,45
500,46 500,47 500,48 500,49 500,50 500,51 500,52 500,53 500,54 500,55 500,56
500,57 500,58 500,59 500,60 500,61 500,62 500,63 500,64 500,65 500,66 500,67
500,68 500,69 500,70 500,71 500,72 500,73 500,74 500,75 500,76 500,77 500,78
500,79 500,80 500,81 500,82 500,83 500,84 500,85 500,86 500,87 500,88 500,89
500,90 500,91 500,92 500,93 500,94 500,95 500,96 500,97 500,98 500,99 500,100
500,101 500,102 500,103 500,104 500,105 500,106 500,107 500,108 500,109 500,110
500,111 500,112 500,113 500,114 500,115 500,116 500,117 500,118 500,119 500,120
500,121 500,122 500,123 500,124 500,125 500,126 500,127 500,128 500,129 500,130
500,131 500,132 500,133 500,134 500,135 500,136 500,137 500,138 500,139 500,140
500,141 500,142 500,143 500,144 500,145 500,146 500,147 500,148 500,149 500,150
500,151 500,152 500,153 500,154 500,155 500,156 500,157 500,158 500,159 500,160
500,161 500,162 500,163 500,164 500,165 500,166 500,167 500,168 500,169 500,170
500,171 500,172 500,173 500,174 500,175 500,176 500,177 500,178 500,179 500,180
500,181 500,182 500,183 500,184 500,185 500,186 500,187 500,188 500,189 500,190
500,191 500,192 500,193 500,194 500,195 500,196 500,197 500,198 500,199 500,200
500,201 500,202 500,203 500,204 500,205 500,206 500,207 500,208 500,209 500,210
500,211 500,212 500,213 500,214 500,215 500,216 500,217 500,218 500,219 500,220
500,221 500,222 500,223 500,224 500,225 500,226 500,227 500,228 500,229 500,230
500,231 500,232 500,233 500,234 500,235 500,236 500,237 500,238 500,239 500,240
500,241 500,242 500,243 500,244 500,245 500,246 500,247 500,248 500,249 500,250
500,251 500,252 500,253 500,254 500,255 500,256 500,257 500,258 500,259 500,260
500,261 500,262 500,263 500,264 500,265 500,266 500,267 500,268 500,269 500,270
500,271 500,272 500,273 500,274 500,275 500,276 500,277 500,278 500,279 500,280
500,281 500,282 500,283 500,284 500,285 500,286 500,287 500,288 500,289 500,290
500,291 500,292 500,293 500,294 500,295 500,296 500,297 500,298 500,299 500,300
500,301 500,302 500,303 500,304 500,305 500,306 500,307 500,308 500,309 500,310
500,311 500,312 500,313 500,314 500,315 500,316 500,317 500,318 500,319 500,320
500,321 500,322 500,323 500,324 500,325 500,326 500,327 500,328 500,329 500,330
500,331 500,332 500,333 500,334 500,335 500,336 500,337 500,338 500,339 500,340
500,341 500,342 500,343 500,344 500,345 500,346 500,347 500,348 500,349 500,350
500,351 500,352 500,353 500,354 500,355 500,356 500,357 500,358 500,359 500,360
500,361 500,362 500,363 500,364 500,365 500,366 500,367 500,368 500,369 500,370
500,371 500,372 500,373 500,374 500,375 500,376 500,377 500,378 500,379 500,380
500,381 500,382 500,383 500,384 500,385 500,386 500,387 500,388 500,389 500,390
500,391 500,392 500,393 500,394 500,395 500,396 500,397 500,398 500,399 500,
max samples: 500
min samples: 500
> loading data done!
```

```
[72]: for k,v in embst.items():
        if v.shape[0] < sam_max:
            rid = np.random.choice(v.shape[0], sam_max-v.shape[0], replace=False)
            print('filling', sam_max-v.shape[0], 'samples')
            embst[k] = np.vstack((v, v[rid]))
```

```
[73]: from voro_helper import get_task_data, feat_trans, NC_o, tsk_cls, fun,
        ↪acc_brother, forgetting

i = task_num
support_data_, support_label_, query_data_, query_label_, n_ways_, n_shot_, _ = \
    get_task_data(embst, embs, i, fg_nc, class_set, task_size, brother=brother)
```

```
##### current_task: 10 #####
current classes [380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395
396 397
398 399]
[output] all classes 0 -> 399
```

```
[74]: #%% =====
        ↪=====
be      = 1. # 1.
l2      = False # False True
protots = np.mean(feat_trans(support_data_, beta=be, l2=l2), axis=1)
```

```
[64]: i = 0
support_data, support_label, query_data, query_label, n_ways, n_shot, classes = \
    get_task_data(embst, embs, i, fg_nc, class_set, task_size, brother=brother)
acc, _, nn_pre = NC_o(support_data, support_label,
                      query_data, query_label,
                      n_ways, n_shot,
                      beta = be, l2 = l2,
                      given_cen = protots[classes], given_only = True,
                      brother = brother)
```

```
##### current_task: 0 #####
current classes [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17,
18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37,
38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49]
[output] all classes 0 -> 49
0.5822
```

```
[75]: local      = False # True / False
nn_acc      = []
savefile = path+'NN3' if brother else None # NN / NNp / NN3 / only saved NN
        ↪results!
```

```

savefil2 = path+'NN3'
forget    = True # True False # calculate forgetting
class_ladder = []
a         = []
for i in range(task_num + 1):
    support_data, support_label, query_data, query_label, n_ways, n_shot, \
    →classes = \
        get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                        local = local, brother = brother) # False
    if forget:
        class_ladder.append(classes)
    acc, _, nn_pre = NC_o(support_data, support_label,
                          query_data, query_label,
                          n_ways, n_shot,
                          beta = be, l2 = l2,
                          given_cen = protots[classes] if local else protots[:
    →classes[-1]+1],

                          given_only = True,
                          brother = brother,
                          savefile = savefile+'_'+str(i) if brother else None,
                          savefile2 = None, # savefil2+'_'+str(i), # None, #
                          weights = [0.7, 0.3],
                          class_ladder = class_ladder,
                          acc_all = a
                          )

    nn_acc.append(acc)
    # if all classes up2now: local = False, and protots[:classes[-1]+1]
print('local:', local, '| beta:', be, '| l2:', l2)
if brother:
    for accs in nn_acc:
        print('\t'.join([str(i) for i in accs]))
else:
    print('\n'.join([str(i) for i in nn_acc]))
if forget:
    avgf = forgetting(a, task_num)
    print(avgf)

```

##### current\_task: 0 #####

```

current classes [ 0  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15
16 17
18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35
36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53
54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71
72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89
90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107
108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125

```

```

126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143
144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161
162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179
180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197
198 199]
[output] all classes 0 -> 199
<<< loaded from: ../checkpoints/CIFAR100_50_10x5voro/NN3_0.npy
0.4930

##### current_task: 1 #####
current classes [200 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215
216 217
218 219]
[output] all classes 0 -> 219
<<< loaded from: ../checkpoints/CIFAR100_50_10x5voro/NN3_1.npy
0.4710

##### current_task: 2 #####
current classes [220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235
236 237
238 239]
[output] all classes 0 -> 239
<<< loaded from: ../checkpoints/CIFAR100_50_10x5voro/NN3_2.npy
0.4527

##### current_task: 3 #####
current classes [240 241 242 243 244 245 246 247 248 249 250 251 252 253 254 255
256 257
258 259]
[output] all classes 0 -> 259
<<< loaded from: ../checkpoints/CIFAR100_50_10x5voro/NN3_3.npy
0.4413

##### current_task: 4 #####
current classes [260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275
276 277
278 279]
[output] all classes 0 -> 279
<<< loaded from: ../checkpoints/CIFAR100_50_10x5voro/NN3_4.npy
0.4273

##### current_task: 5 #####
current classes [280 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295
296 297
298 299]
[output] all classes 0 -> 299
<<< loaded from: ../checkpoints/CIFAR100_50_10x5voro/NN3_5.npy
0.4101

```



```

##### current_task: 6 #####
current classes [300 301 302 303 304 305 306 307 308 309 310 311 312 313 314 315
316 317
318 319]
[output] all classes 0 -> 319
<<< loaded from: ../checkpoints/CIFAR100_50_10x5voro/NN3_6.npy
0.3968

##### current_task: 7 #####
current classes [320 321 322 323 324 325 326 327 328 329 330 331 332 333 334 335
336 337
338 339]
[output] all classes 0 -> 339
<<< loaded from: ../checkpoints/CIFAR100_50_10x5voro/NN3_7.npy
0.3834

##### current_task: 8 #####
current classes [340 341 342 343 344 345 346 347 348 349 350 351 352 353 354 355
356 357
358 359]
[output] all classes 0 -> 359
<<< loaded from: ../checkpoints/CIFAR100_50_10x5voro/NN3_8.npy
0.3779

##### current_task: 9 #####
current classes [360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375
376 377
378 379]
[output] all classes 0 -> 379
<<< loaded from: ../checkpoints/CIFAR100_50_10x5voro/NN3_9.npy
0.3696

##### current_task: 10 #####
current classes [380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395
396 397
398 399]
[output] all classes 0 -> 399
<<< loaded from: ../checkpoints/CIFAR100_50_10x5voro/NN3_10.npy
0.3567
local: False | beta: 1.0 | l2: False
0.493 0.7816 0.7848 0.786 0.7652
0.4709545454545454 0.7603636363636364 0.7774545454545455 0.778
0.7583636363636364
0.4527083333333333 0.7336666666666667 0.746 0.746
0.7253333333333334
0.44134615384615383 0.726 0.7349230769230769 0.7350769230769231
0.7096923076923077

```

```

0.42725 0.7051428571428572      0.7218571428571429      0.7208571428571429
0.6962857142857143
0.41013333333333335      0.6836 0.6990666666666666      0.6964
0.6738666666666666
0.3968125      0.6625 0.698625      0.696125      0.6745
0.38335294117647056      0.644235294117647      0.680235294117647
0.6777647058823529      0.6564705882352941
0.37791666666666667      0.6411111111111111      0.6807777777777778
0.6784444444444444      0.6561111111111111
0.36955263157894735      0.6254736842105263      0.6642105263157895
0.6618947368421053      0.64
0.3567 0.6112 0.6613 0.6591 0.6386
[[0.493  0.      0.      0.      0.      0.      0.      0.      0.
  0.      0.      ]
 [0.4779 0.4015 0.      0.      0.      0.      0.      0.      0.
  0.      0.      ]
 [0.46895 0.3775 0.3655 0.      0.      0.      0.      0.      0.
  0.      0.      ]
 [0.45865 0.371  0.363  0.417  0.      0.      0.      0.      0.
  0.      0.      ]
 [0.45225 0.367  0.351  0.4055 0.3355 0.      0.      0.      0.
  0.      0.      ]
 [0.44345 0.3605 0.34   0.3635 0.316  0.3375 0.      0.      0.
  0.      0.      ]
 [0.441  0.359  0.3385 0.36   0.31   0.337  0.2345 0.      0.
  0.      0.      ]
 [0.43395 0.353  0.3345 0.348  0.3095 0.3315 0.233  0.268  0.
  0.      0.      ]
 [0.4253 0.3515 0.3195 0.344  0.308  0.3295 0.2295 0.2595 0.408
  0.      0.      ]
 [0.42   0.3455 0.316  0.3365 0.304  0.322  0.2275 0.246  0.395
  0.329  0.      ]
 [0.4096 0.336  0.3075 0.3265 0.276  0.316  0.225  0.2435 0.392
  0.3285 0.287  ]]
[0, 1.5100000000000002, 2.4025000000000016, 2.245000000000001, 2.53125,
3.7809999999999997, 3.4083333333333333, 3.4435714285714285, 3.57125,
3.8666666666666667, 4.288999999999999]

```

```

[14]: def predict(model, x, voro=True):
        x = torch.from_numpy(x.astype(np.float32)).cuda()
        with torch.no_grad():
            predi = model.module.classifier(x)
            if voro:
                predi += - torch.sum((model.module.classifier.weight/2.)**2, dim=1)
            return predi

classes_all = []

```

```

test_share = []
paccS = []
for i in range(task_num + 1):
    support_data, support_label, query_data, query_label, n_ways, n_shot, \
    →classes = \
        get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                        local = True, brother = brother)

    # load model:
    if brother:
        cls_01 = classes[-1]+1
        assert cls_01 % 4 == 0
        filename = path + '%d_model.pkl' % (int(cls_01/4))
    else:
        filename = path + '%d_model.pkl' % (classes[-1]+1)
    model = torch.load(filename)
    model.eval()
    print('> loaded base phase model from:', filename)
    num_param(model)
    # do prediction:
    min_cls = min(classes)
    if brother:
        pred = predict(model, query_data)
    else:
        pred = predict(model, query_data)[:,:,:4]
    pmax = torch.max(pred, dim=1)[1]
    pacc = np.mean(t2n(pmax) == query_label - min_cls)
    print(pacc)
    if brother:
        accs = acc_brother(t2n(pred), t2n(pmax), query_label - min_cls, \
    →forLG=True)
        pacc = [pacc] + accs
    paccS.append(pacc)
    classes_all.append(classes)
    test_share.append(len(query_label))
print('all logistic locally:')
if brother:
    for accs in paccS:
        print('\t'.join([str(i) for i in accs]))
else:
    print('\n'.join([str(i) for i in paccS]))

```

```

[15]: for i in range(task_num + 1):
        support_data, support_label, query_data, query_label, n_ways, n_shot, \
        →classes = \
            get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                            local = True, brother = brother)

        pred_all = []

```

```

for classes in classes_all:
    # load model:
    if brother:
        cls_01 = classes[-1]+1
        assert cls_01 % 4 == 0
        filename = path + '%d_model.pkl' % (int(cls_01/4))
    else:
        filename = path + '%d_model.pkl' % (classes[-1]+1)
    model = torch.load(filename)
    model.eval()
    print('> loaded base phase model from:', filename)
    num_param(model)
    # do prediction:
    min_cls = min(classes)
    if brother:
        pred = predict(model, query_data)
    else:
        pred = predict(model, query_data)[:,:,:4]
    pmax = torch.max(pred, dim=1)[1]
    # pacc = np.mean(t2n(pmax) == query_label - min_cls)
    # print(pacc)
    if brother:
        labs_01 = query_label[:4]//4
        acc_, sc_pre = merge_sc(t2n(pred), labs_01,
                                mth='softmax', forLG=True, return_pre=True)
        min_cls = int(min_cls / 4)
        pred_all.append( (sc_pre + min_cls).tolist() )
    else:
        pred_all.append( (t2n(pmax) + min_cls).tolist() )
    pred_all = np.array(pred_all)
    print(pred_all.shape)

    if i == 0:
        pred_in_clique = copy.deepcopy(pred_all)
    else:
        pred_in_clique = np.hstack((pred_in_clique, pred_all))

```

```

[42]: print('cliques by test samples:', pred_in_clique.shape)

# compute prototypes
be = 0.6 # 1.
l2 = True # False True
bias = 0 # 0.05
protots = np.mean(feats_trans(support_data_, beta=be, l2=l2, bias=bias), axis=1)
query_pts = feats_trans(query_data_, beta=be, l2=l2, bias=bias)
# acenss = feats_trans(acens, beta=be, l2=l2, bias=bias)
if brother:

```

```

        dist      = funbtch(query_pts, protots) # protots / acenss
    else:
        dist      = fun(query_pts, protots) # protots / acenss

test_splt = [sum(test_share[:t+1]) for t in range(len(test_share))]

```

```

[238]: dist_in_clique = np.zeros_like(pred_in_clique, dtype=np.float32)
        for c_id, clique in enumerate(pred_in_clique):
            for s_id, samp in enumerate(clique):
                dist_in_clique[c_id][s_id] = dist[s_id][samp]

```

```

[253]: for i in range(task_num + 1):
        clique_dist = dist_in_clique[:i+1,:test_splt[i]]
        clique_pred = np.argmin(clique_dist, axis=0)
        merge_pred = [pred_in_clique[cli,s_id] for s_id, cli in
            ↪enumerate(clique_pred)]
        merge_acc = np.mean(merge_pred == query_label_[:test_splt[i]])
        print(merge_acc)
        print('DaC:', 'beta:', be, '| 12:', 12)

```

```

[28]: print('===== Experiment Done! =====')

```

```

===== Experiment Done! =====

```

## iVoro on CIFAR-100 Dataset (20 Phases, 3rd Block Features)

```
[12]: import matplotlib.pyplot as plt
import os
import pickle
import numpy as np
import pandas as pd
import seaborn as sns
import time
import sys
sys.path.append('../')
sys.path.append('../analysis/')
import copy
import platform
import json
import pickle
import random

import torch
from scipy.stats import mode
```

```
[77]: from ResNet import resnet18_cbam

data_name      = 'CIFAR100' # 'Subset' # 'Tiny' # 'CIFAR100' # 'MNIST'
total_nc       = 100 # 200 # 100 # 10
fg_nc          = 40 # 100 # 40 # 50 # 4
task_num       = 20 # 20 # 5 # 10 # 2

# constant params
class_set      = list(range(total_nc))
ROTATION       = True
EMB2D         = False
DESIGN        = True
virtual_class  = 4*total_nc if ROTATION else total_nc
suffix         = 'voro' # 'prob' 'voro'
assert (total_nc - fg_nc)%task_num == 0
task_size      = int((total_nc - fg_nc)/task_num)
file_name      =
    ↳data_name+'_'+str(fg_nc)+'_'+str(task_num)+'x'+str(task_size)+suffix
```

```
print(file_name)

brother      = False # True False
```

CIFAR100\_40\_20x3voro

```
[78]: save_path = '../checkpoints/'
path   = save_path + file_name + '/'
filename = path + '%d_model.pkl' % (fg_nc+0) # +5
model   = torch.load(filename)
model.eval()
print('> loaded base phase model from:', filename)
```

> loaded base phase model from: ../checkpoints/CIFAR100\_40\_20x3voro/40\_model.pkl

```
[79]: from voro_helper import num_param, t2n, \
        load_feat, sanity_check, \
        id2emb_, num_samp, merge_sc, funbtch

num_param(model)

# voronoi centers:
vcenter = t2n(model.module.classifier.weight.data / 2.)
print(vcenter.shape)
```

```
module.classifier.weight      torch.Size([160, 512])  81920    True
total: 81920
(160, 512)
```

```
[80]: '''
CIFAR:
    'CIFAR100_50_5x10_test.pkl'
    'CIFAR100_50_5x10_train.pkl'
    'CIFAR100_40_20x3_test.pkl'
    'CIFAR100_40_20x3_train.pkl'
more CIFAR:
    'CIFAR100_40_12x5_test.pkl'
    'CIFAR100_40_12x5_train.pkl'
    'CIFAR100_30_14x5_test.pkl'
    'CIFAR100_30_14x5_train.pkl'
    'CIFAR100_20_16x5_test.pkl'
    'CIFAR100_20_16x5_train.pkl'
    'CIFAR100_10_18x5_test.pkl'
    'CIFAR100_10_18x5_train.pkl'
Tiny:
    'Tiny_100_20x5_test.pkl'
    'Tiny_100_20x5_train.pkl'
TinyL3:
    'Tiny_100_5x20_test.pkl'
```

```

        'Tiny_100_5x20_train.pkl'
Subset:
        'Subset_50_10x5_test.pkl'
        'Subset_50_10x5_train.pkl'
'''
ffile = '../embedding/probL3/' + 'CIFAR100_40_20x3_test.pkl' # prob probL3
data_phas, last_tsk = load_feat(ffile)

labs, embeds, outputs = data_phas[last_tsk][last_tsk]
false_id, pred_ = sanity_check(labs, embeds, outputs)

```

```

feature file: ../embedding/probL3/CIFAR100_40_20x3_test.pkl
> loaded tasks: dict_keys([20])
> classes: [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18,
19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38,
39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58,
59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78,
79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98,
99]
> samples: 10000
> embedding: 256
> classification: 400
~ acc (single): 48.88%
~ acc (quadruple): 38.52%

```

```

[81]: ffile = '../embedding/probL3/' + 'CIFAR100_40_20x3_train.pkl' # prob probL3
data_phas, last_tsk = load_feat(ffile)

labst, embedst, outputst = data_phas[last_tsk][last_tsk]
false_id, pred_ = sanity_check(labst, embedst, outputst)

```

```

feature file: ../embedding/probL3/CIFAR100_40_20x3_train.pkl
> loaded tasks: dict_keys([20])
> classes: [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18,
19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38,
39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58,
59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78,
79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98,
99]
> samples: 50000
> embedding: 256
> classification: 400
~ acc (single): 51.90%
~ acc (quadruple): 40.77%

```

```

[82]: embs = id2emb_(labs, embeds, brother=brother)
embst = id2emb_(labst, embedst, brother=brother)

```



```
sam_max, sam_min = num_samp(embst)
print('> loading data done!')
```

```
0 500,1 500,2 500,3 500,4 500,5 500,6 500,7 500,8 500,9 500,10 500,11 500,12
500,13 500,14 500,15 500,16 500,17 500,18 500,19 500,20 500,21 500,22 500,23
500,24 500,25 500,26 500,27 500,28 500,29 500,30 500,31 500,32 500,33 500,34
500,35 500,36 500,37 500,38 500,39 500,40 500,41 500,42 500,43 500,44 500,45
500,46 500,47 500,48 500,49 500,50 500,51 500,52 500,53 500,54 500,55 500,56
500,57 500,58 500,59 500,60 500,61 500,62 500,63 500,64 500,65 500,66 500,67
500,68 500,69 500,70 500,71 500,72 500,73 500,74 500,75 500,76 500,77 500,78
500,79 500,80 500,81 500,82 500,83 500,84 500,85 500,86 500,87 500,88 500,89
500,90 500,91 500,92 500,93 500,94 500,95 500,96 500,97 500,98 500,99 500,
max samples: 500
min samples: 500
> loading data done!
```

```
[83]: for k,v in embst.items():
        if v.shape[0] < sam_max:
            rid = np.random.choice(v.shape[0], sam_max-v.shape[0], replace=False)
            print('filling', sam_max-v.shape[0], 'samples')
            embst[k] = np.vstack((v, v[rid]))
```

```
[84]: from voro_helper import get_task_data, feat_trans, NC_o, tsk_cls, fun, \
        ↪acc_brother, forgetting

i = task_num
support_data_, support_label_, query_data_, query_label_, n_ways_, n_shot_, _ = \
    get_task_data(embst, embs, i, fg_nc, class_set, task_size, brother=brother)
```

```
##### current_task: 20 #####
current classes [97, 98, 99]
[output] all classes 0 -> 99
```

```
[85]: #%% =====
        ↪=====
be      = 1. # 1.
l2      = False # False True
protots = np.mean(feat_trans(support_data_, beta=be, l2=l2), axis=1)
```

```
[87]: i = 0
support_data, support_label, query_data, query_label, n_ways, n_shot, classes = \
    get_task_data(embst, embs, i, fg_nc, class_set, task_size, brother=brother)
acc, _, nn_pre = NC_o(support_data, support_label,
                      query_data, query_label,
                      n_ways, n_shot,
                      beta = be, l2 = l2,
                      given_cen = protots[classes], given_only = True,
```

```
brother = brother)
```

```
##### current_task: 0 #####
current classes [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17,
18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37,
38, 39]
[output] all classes 0 -> 39
0.5075
```

```
[88]: local      = False # True / False
nn_acc   = []
savefile = path+'NN3' if brother else None # NN / NNp / NN3 / only saved NN
→results!
savefil2 = path+'NN3'
forget    = True # True False # calculate forgetting
class_ladder = []
a         = []
for i in range(task_num + 1):
    support_data, support_label, query_data, query_label, n_ways, n_shot,
→classes = \
        get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                        local = local, brother = brother) # False
    if forget:
        class_ladder.append(classes)
    acc, _, nn_pre = NC_o(support_data, support_label,
                           query_data, query_label,
                           n_ways, n_shot,
                           beta = be, l2 = l2,
                           given_cen = protots[classes] if local else protots[:
→classes[-1]+1],
                           given_only = True,
                           brother = brother,
                           savefile = savefile+'_'+str(i) if brother else None,
                           savefile2 = None, # savefil2+'_'+str(i), # None, #
                           weights = [0.7, 0.3],
                           class_ladder = class_ladder,
                           acc_all = a
                           )
    nn_acc.append(acc)
    # if all classes up2now: local = False, and protots[:classes[-1]+1]
print('local:', local, '| beta:', be, '| l2:', l2)
if brother:
    for accs in nn_acc:
        print('\t'.join([str(i) for i in accs]))
else:
    print('\n'.join([str(i) for i in nn_acc]))
```

```
if forget:
    avgf = forgetting(a, task_num)
    print(avgf)
```

```
##### current_task: 0 #####
current classes [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17,
18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37,
38, 39]
[output] all classes 0 -> 39
0.5075
```

```
##### current_task: 1 #####
current classes [40, 41, 42]
[output] all classes 0 -> 42
0.4898
```

```
##### current_task: 2 #####
current classes [43, 44, 45]
[output] all classes 0 -> 45
0.4726
```

```
##### current_task: 3 #####
current classes [46, 47, 48]
[output] all classes 0 -> 48
0.4735
```

```
##### current_task: 4 #####
current classes [49, 50, 51]
[output] all classes 0 -> 51
0.4631
```

```
##### current_task: 5 #####
current classes [52, 53, 54]
[output] all classes 0 -> 54
0.4613
```

```
##### current_task: 6 #####
current classes [55, 56, 57]
[output] all classes 0 -> 57
0.4460
```

```
##### current_task: 7 #####
current classes [58, 59, 60]
[output] all classes 0 -> 60
0.4407
```

```
##### current_task: 8 #####
```

current classes [61, 62, 63]  
[output] all classes 0 -> 63  
0.4344

##### current\_task: 9 #####  
current classes [64, 65, 66]  
[output] all classes 0 -> 66  
0.4176

##### current\_task: 10 #####  
current classes [67, 68, 69]  
[output] all classes 0 -> 69  
0.4147

##### current\_task: 11 #####  
current classes [70, 71, 72]  
[output] all classes 0 -> 72  
0.4058

##### current\_task: 12 #####  
current classes [73, 74, 75]  
[output] all classes 0 -> 75  
0.3921

##### current\_task: 13 #####  
current classes [76, 77, 78]  
[output] all classes 0 -> 78  
0.3848

##### current\_task: 14 #####  
current classes [79, 80, 81]  
[output] all classes 0 -> 81  
0.3755

##### current\_task: 15 #####  
current classes [82, 83, 84]  
[output] all classes 0 -> 84  
0.3701

##### current\_task: 16 #####  
current classes [85, 86, 87]  
[output] all classes 0 -> 87  
0.3700

##### current\_task: 17 #####  
current classes [88, 89, 90]  
[output] all classes 0 -> 90  
0.3659

```
##### current_task: 18 #####
current classes [91, 92, 93]
[output] all classes 0 -> 93
0.3573
```

```
##### current_task: 19 #####
current classes [94, 95, 96]
[output] all classes 0 -> 96
0.3549
```

```
##### current_task: 20 #####
current classes [97, 98, 99]
[output] all classes 0 -> 99
0.3477
```

```
local: False | beta: 1.0 | l2: False
0.5075
```

```
0.4897674418604651
0.4726086956521739
0.47346938775510206
0.46307692307692305
0.4612727272727273
0.4460344827586207
0.44065573770491806
0.434375
0.41761194029850746
0.4147142857142857
0.4057534246575342
0.39210526315789473
0.3848101265822785
0.3754878048780488
0.37011764705882355
0.37
0.3659340659340659
0.3573404255319149
0.35494845360824745
0.3477
```

```
[0.5075    0.        0.        0.        0.        0.
 0.        0.        0.        0.        0.        0.
 0.        0.        0.        0.        0.        0.
 0.        0.        0.        ]
[0.49125   0.47       0.        0.        0.        0.
 0.        0.        0.        0.        0.        0.
 0.        0.        0.        0.        0.        0.
 0.        0.        0.        ]
[0.4815    0.46333333 0.36333333 0.        0.        0.
 0.        0.        0.        0.        0.        0.
 0.        0.        0.        0.        0.        0.]
```

0.	0.	0.	]		
[0.4735	0.45333333	0.36333333	0.60333333	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	]		
[0.46875	0.45	0.36333333	0.6	0.36333333	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	]		
[0.45875	0.44666667	0.36	0.49	0.36	0.68333333
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	]		
[0.45275	0.44666667	0.36	0.48	0.36	0.65333333
0.28666667	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	]		
[0.44325	0.44	0.36	0.47	0.34333333	0.62
0.26333333	0.55333333	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	]		
[0.43125	0.43333333	0.35333333	0.47	0.34	0.62
0.26	0.55333333	0.48666667	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	]		
[0.4275	0.42666667	0.34666667	0.47	0.33666667	0.62
0.25333333	0.55333333	0.48666667	0.13333333	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	]		
[0.421	0.4	0.34666667	0.47	0.32333333	0.62
0.25	0.54666667	0.48333333	0.13333333	0.49	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	]		
[0.41625	0.4	0.34666667	0.47	0.32333333	0.6
0.23333333	0.49666667	0.46333333	0.13	0.46	0.4
0.	0.	0.	0.	0.	0.
0.	0.	0.	]		
[0.41	0.39666667	0.34	0.47	0.32	0.6
0.23333333	0.49666667	0.44666667	0.12666667	0.39333333	0.39666667
0.24666667	0.	0.	0.	0.	0.
0.	0.	0.	]		
[0.409	0.39666667	0.34	0.47	0.30666667	0.6
0.22666667	0.49666667	0.44333333	0.12	0.39	0.39666667
0.24666667	0.24666667	0.	0.	0.	0.
0.	0.	0.	]		
[0.40325	0.39666667	0.33666667	0.47	0.30666667	0.6
0.22666667	0.49666667	0.43666667	0.11666667	0.39	0.39666667
0.24666667	0.24666667	0.22	0.	0.	0.

```

0.      0.      0.      ]
[0.396      0.39333333 0.33666667 0.47      0.30666667 0.58666667
 0.22333333 0.49666667 0.41      0.11666667 0.39      0.38333333
 0.24666667 0.24666667 0.22      0.38      0.      0.
 0.      0.      0.      ]
[0.38825     0.37333333 0.33666667 0.46333333 0.30666667 0.58333333
 0.22333333 0.49666667 0.40666667 0.11666667 0.39      0.38333333
 0.24666667 0.24666667 0.21333333 0.38      0.51      0.
 0.      0.      0.      ]
[0.38225     0.37      0.31666667 0.46      0.30333333 0.58333333
 0.22      0.47666667 0.40666667 0.11666667 0.38666667 0.38333333
 0.24333333 0.24666667 0.19333333 0.37      0.49      0.43666667
 0.      0.      0.      ]
[0.38075     0.37      0.31333333 0.46      0.3      0.56333333
 0.21666667 0.47666667 0.39666667 0.11666667 0.37666667 0.36666667
 0.24      0.24666667 0.19333333 0.35333333 0.49      0.43666667
 0.20333333 0.      0.      ]
[0.375      0.37      0.31333333 0.44666667 0.29      0.54
 0.21666667 0.47      0.39333333 0.11666667 0.37      0.36666667
 0.22666667 0.24666667 0.19333333 0.35333333 0.46666667 0.43666667
 0.20333333 0.45666667 0.      ]
[0.37      0.36      0.30666667 0.42666667 0.28666667 0.54
 0.21333333 0.47      0.38333333 0.05      0.37      0.36666667
 0.22      0.24333333 0.18      0.35333333 0.46666667 0.43333333
 0.20333333 0.45666667 0.32666667]]
[0, 1.6249999999999931, 1.6333333333333331, 1.6888888888888888, 1.5520833333333333,
 3.8416666666666677, 3.9680555555555572, 4.82261904761905, 4.6197916666666666,
 4.407407407407407, 4.5650000000000001, 5.465909090909092, 5.9236111111111125,
 5.732051282051283, 5.458928571428572, 5.543333333333334, 5.4953125000000001,
 5.854411764705882, 6.0189814814814815, 6.258771929824561, 6.704166666666667]

```

```

[14]: def predict(model, x, voro=True):
        x = torch.from_numpy(x.astype(np.float32)).cuda()
        with torch.no_grad():
            predi = model.module.classifier(x)
        if voro:
            predi += - torch.sum((model.module.classifier.weight/2.)**2, dim=1)
        return predi

classes_all = []
test_share = []
paccS = []
for i in range(task_num + 1):
    support_data, support_label, query_data, query_label, n_ways, n_shot, \
    →classes = \
        get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                        local = True, brother = brother)

```

```

# load model:
if brother:
    cls_01 = classes[-1]+1
    assert cls_01 % 4 == 0
    filename = path + '%d_model.pkl' % (int(cls_01/4))
else:
    filename = path + '%d_model.pkl' % (classes[-1]+1)
model = torch.load(filename)
model.eval()
print('> loaded base phase model from:', filename)
num_param(model)
# do prediction:
min_cls = min(classes)
if brother:
    pred = predict(model, query_data)
else:
    pred = predict(model, query_data)[:,:,:4]
pmax = torch.max(pred, dim=1)[1]
pacc = np.mean(t2n(pmax) == query_label - min_cls)
print(pacc)
if brother:
    accs = acc_brother(t2n(pred), t2n(pmax), query_label - min_cls,
→forLG=True)
    pacc = [pacc] + accs
    paccS.append(pacc)
    classes_all.append(classes)
    test_share.append(len(query_label))
print('all logistic locally:')
if brother:
    for accs in paccS:
        print('\t'.join([str(i) for i in accs]))
else:
    print('\n'.join([str(i) for i in paccS]))

```

```

[15]: for i in range(task_num + 1):
    support_data, support_label, query_data, query_label, n_ways, n_shot,
→classes = \
        get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                        local = True, brother = brother)
    pred_all = []
    for classes in classes_all:
        # load model:
        if brother:
            cls_01 = classes[-1]+1
            assert cls_01 % 4 == 0
            filename = path + '%d_model.pkl' % (int(cls_01/4))
        else:

```



```

        filename = path + '%d_model.pkl' % (classes[-1]+1)
        model = torch.load(filename)
        model.eval()
        print('> loaded base phase model from:', filename)
        num_param(model)
        # do prediction:
        min_cls = min(classes)
        if brother:
            pred = predict(model, query_data)
        else:
            pred = predict(model, query_data)[:,:,:4]
            pmax = torch.max(pred, dim=1)[1]
            # pacc = np.mean(t2n(pmax) == query_label - min_cls)
            # print(pacc)
            if brother:
                labs_01 = query_label[:4]//4
                acc_, sc_pre = merge_sc(t2n(pred), labs_01,
                                         mth='softmax', forLG=True, return_pre=True)
                min_cls = int(min_cls / 4)
                pred_all.append( (sc_pre + min_cls).tolist() )
            else:
                pred_all.append( (t2n(pmax) + min_cls).tolist() )
        pred_all = np.array(pred_all)
        print(pred_all.shape)

        if i == 0:
            pred_in_clique = copy.deepcopy(pred_all)
        else:
            pred_in_clique = np.hstack((pred_in_clique, pred_all))

```

```

[42]: print('cliques by test samples:', pred_in_clique.shape)

# compute prototypes
be = 0.6 # 1.
l2 = True # False True
bias = 0 # 0.05
protots = np.mean(feats_trans(support_data_, beta=be, l2=l2, bias=bias), axis=1)
query_pts = feats_trans(query_data_, beta=be, l2=l2, bias=bias)
# acenss = feats_trans(acens, beta=be, l2=l2, bias=bias)
if brother:
    dist = funbtch(query_pts, protots) # protots / acenss
else:
    dist = fun(query_pts, protots) # protots / acenss

test_splt = [sum(test_share[:t+1]) for t in range(len(test_share))]

```

```
[238]: dist_in_clique = np.zeros_like(pred_in_clique, dtype=np.float32)
for c_id, clique in enumerate(pred_in_clique):
    for s_id, samp in enumerate(clique):
        dist_in_clique[c_id][s_id] = dist[s_id][samp]
```

```
[253]: for i in range(task_num + 1):
        clique_dist = dist_in_clique[:i+1,:test_splt[i]]
        clique_pred = np.argmin(clique_dist, axis=0)
        merge_pred = [pred_in_clique[cli,s_id] for s_id, cli in
            →enumerate(clique_pred)]
        merge_acc = np.mean(merge_pred == query_label_[:test_splt[i]])
        print(merge_acc)
    print('DaC:', 'beta:', be, '| 12:', 12)
```

```
[28]: print('==== Experiment Done! ====')

===== Experiment Done! =====
```

## iVoro-AC/AI on CIFAR-100 Dataset (20 Phases, 3rd Block Features)

```
[12]: import matplotlib.pyplot as plt
import os
import pickle
import numpy as np
import pandas as pd
import seaborn as sns
import time
import sys
sys.path.append('../')
sys.path.append('../analysis/')
import copy
import platform
import json
import pickle
import random

import torch
from scipy.stats import mode
```

```
[89]: from ResNet import resnet18_cbam

data_name      = 'CIFAR100' # 'Subset' # 'Tiny' # 'CIFAR100' # 'MNIST'
total_nc       = 100 # 200 # 100 # 10
fg_nc          = 40 # 100 # 40 # 50 # 4
task_num       = 20 # 20 # 5 # 10 # 2

# constant params
class_set      = list(range(total_nc))
ROTATION       = True
EMB2D         = False
DESIGN         = True
virtual_class  = 4*total_nc if ROTATION else total_nc
suffix         = 'voro' # 'prob' 'voro'
assert (total_nc - fg_nc)%task_num == 0
task_size      = int((total_nc - fg_nc)/task_num)
```

```

file_name      =_
    ↳data_name+'_'+str(fg_nc)+'_'+str(task_num)+'x'+str(task_size)+suffix

print(file_name)

brother        = True # True False

```

CIFAR100\_40\_20x3voro

```

[90]: save_path = '../checkpoints/'
      path      = save_path + file_name + '/'
      filename   = path + '%d_model.pkl' % (fg_nc+0) # +5
      model      = torch.load(filename)
      model.eval()
      print('> loaded base phase model from:', filename)

```

> loaded base phase model from: ../checkpoints/CIFAR100\_40\_20x3voro/40\_model.pkl

```

[91]: from voro_helper import num_param, t2n, \
      load_feat, sanity_check, \
      id2emb_, num_samp, merge_sc, funbtch

num_param(model)

# voronoi centers:
vcenter = t2n(model.module.classifier.weight.data / 2.)
print(vcenter.shape)

```

```

module.classifier.weight      torch.Size([160, 512])  81920   True
total: 81920
(160, 512)

```

```

[92]: '''
      CIFAR:
          'CIFAR100_50_5x10_test.pkl'
          'CIFAR100_50_5x10_train.pkl'
          'CIFAR100_40_20x3_test.pkl'
          'CIFAR100_40_20x3_train.pkl'
      more CIFAR:
          'CIFAR100_40_12x5_test.pkl'
          'CIFAR100_40_12x5_train.pkl'
          'CIFAR100_30_14x5_test.pkl'
          'CIFAR100_30_14x5_train.pkl'
          'CIFAR100_20_16x5_test.pkl'
          'CIFAR100_20_16x5_train.pkl'
          'CIFAR100_10_18x5_test.pkl'
          'CIFAR100_10_18x5_train.pkl'
      Tiny:

```

```

        'Tiny_100_20x5_test.pkl'
        'Tiny_100_20x5_train.pkl'
TinyL3:
        'Tiny_100_5x20_test.pkl'
        'Tiny_100_5x20_train.pkl'
Subset:
        'Subset_50_10x5_test.pkl'
        'Subset_50_10x5_train.pkl'
'''
ffile = '../embedding/probL3/' + 'CIFAR100_40_20x3_test.pkl' # prob probL3
data_phas, last_tsk = load_feat(ffile)

labs, embeds, outputs = data_phas[last_tsk][last_tsk]
false_id, pred_ = sanity_check(labs, embeds, outputs)

```

```

feature file: ../embedding/probL3/CIFAR100_40_20x3_test.pkl
> loaded tasks: dict_keys([20])
> classes: [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18,
19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38,
39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58,
59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78,
79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98,
99]
> samples: 10000
> embedding: 256
> classification: 400
~ acc (single): 48.88%
~ acc (quadruple): 38.52%

```

```

[93]: ffile = '../embedding/probL3/' + 'CIFAR100_40_20x3_train.pkl' # prob probL3
data_phas, last_tsk = load_feat(ffile)

labst, embedst, outputst = data_phas[last_tsk][last_tsk]
false_id, pred_ = sanity_check(labst, embedst, outputst)

```

```

feature file: ../embedding/probL3/CIFAR100_40_20x3_train.pkl
> loaded tasks: dict_keys([20])
> classes: [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18,
19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38,
39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58,
59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78,
79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98,
99]
> samples: 50000
> embedding: 256
> classification: 400
~ acc (single): 51.90%
~ acc (quadruple): 40.77%

```

```
[94]: embs = id2emb_(labs, embeds, brother=brother)
      embst = id2emb_(labst, embedst, brother=brother)

      sam_max, sam_min = num_samp(embst)
      print('> loading data done!')
```

```
0 500,1 500,2 500,3 500,4 500,5 500,6 500,7 500,8 500,9 500,10 500,11 500,12
500,13 500,14 500,15 500,16 500,17 500,18 500,19 500,20 500,21 500,22 500,23
500,24 500,25 500,26 500,27 500,28 500,29 500,30 500,31 500,32 500,33 500,34
500,35 500,36 500,37 500,38 500,39 500,40 500,41 500,42 500,43 500,44 500,45
500,46 500,47 500,48 500,49 500,50 500,51 500,52 500,53 500,54 500,55 500,56
500,57 500,58 500,59 500,60 500,61 500,62 500,63 500,64 500,65 500,66 500,67
500,68 500,69 500,70 500,71 500,72 500,73 500,74 500,75 500,76 500,77 500,78
500,79 500,80 500,81 500,82 500,83 500,84 500,85 500,86 500,87 500,88 500,89
500,90 500,91 500,92 500,93 500,94 500,95 500,96 500,97 500,98 500,99 500,100
500,101 500,102 500,103 500,104 500,105 500,106 500,107 500,108 500,109 500,110
500,111 500,112 500,113 500,114 500,115 500,116 500,117 500,118 500,119 500,120
500,121 500,122 500,123 500,124 500,125 500,126 500,127 500,128 500,129 500,130
500,131 500,132 500,133 500,134 500,135 500,136 500,137 500,138 500,139 500,140
500,141 500,142 500,143 500,144 500,145 500,146 500,147 500,148 500,149 500,150
500,151 500,152 500,153 500,154 500,155 500,156 500,157 500,158 500,159 500,160
500,161 500,162 500,163 500,164 500,165 500,166 500,167 500,168 500,169 500,170
500,171 500,172 500,173 500,174 500,175 500,176 500,177 500,178 500,179 500,180
500,181 500,182 500,183 500,184 500,185 500,186 500,187 500,188 500,189 500,190
500,191 500,192 500,193 500,194 500,195 500,196 500,197 500,198 500,199 500,200
500,201 500,202 500,203 500,204 500,205 500,206 500,207 500,208 500,209 500,210
500,211 500,212 500,213 500,214 500,215 500,216 500,217 500,218 500,219 500,220
500,221 500,222 500,223 500,224 500,225 500,226 500,227 500,228 500,229 500,230
500,231 500,232 500,233 500,234 500,235 500,236 500,237 500,238 500,239 500,240
500,241 500,242 500,243 500,244 500,245 500,246 500,247 500,248 500,249 500,250
500,251 500,252 500,253 500,254 500,255 500,256 500,257 500,258 500,259 500,260
500,261 500,262 500,263 500,264 500,265 500,266 500,267 500,268 500,269 500,270
500,271 500,272 500,273 500,274 500,275 500,276 500,277 500,278 500,279 500,280
500,281 500,282 500,283 500,284 500,285 500,286 500,287 500,288 500,289 500,290
500,291 500,292 500,293 500,294 500,295 500,296 500,297 500,298 500,299 500,300
500,301 500,302 500,303 500,304 500,305 500,306 500,307 500,308 500,309 500,310
500,311 500,312 500,313 500,314 500,315 500,316 500,317 500,318 500,319 500,320
500,321 500,322 500,323 500,324 500,325 500,326 500,327 500,328 500,329 500,330
500,331 500,332 500,333 500,334 500,335 500,336 500,337 500,338 500,339 500,340
500,341 500,342 500,343 500,344 500,345 500,346 500,347 500,348 500,349 500,350
500,351 500,352 500,353 500,354 500,355 500,356 500,357 500,358 500,359 500,360
500,361 500,362 500,363 500,364 500,365 500,366 500,367 500,368 500,369 500,370
500,371 500,372 500,373 500,374 500,375 500,376 500,377 500,378 500,379 500,380
500,381 500,382 500,383 500,384 500,385 500,386 500,387 500,388 500,389 500,390
500,391 500,392 500,393 500,394 500,395 500,396 500,397 500,398 500,399 500,
max samples: 500
min samples: 500
> loading data done!
```

```
[95]: for k,v in embst.items():
        if v.shape[0] < sam_max:
            rid = np.random.choice(v.shape[0], sam_max-v.shape[0], replace=False)
            print('filling', sam_max-v.shape[0], 'samples')
            embst[k] = np.vstack((v, v[rid]))
```

```
[96]: from voro_helper import get_task_data, feat_trans, NC_o, tsk_cls, fun,
        ↪acc_brother, forgetting

i = task_num
support_data_, support_label_, query_data_, query_label_, n_ways_, n_shot_, _ = \
    get_task_data(embst, embs, i, fg_nc, class_set, task_size, brother=brother)
```

```
##### current_task: 20 #####
current classes [388 389 390 391 392 393 394 395 396 397 398 399]
[output] all classes 0 -> 399
```

```
[97]: #%% =====
        ↪=====
be      = 1. # 1.
l2      = False # False True
protots = np.mean(feat_trans(support_data_, beta=be, l2=l2), axis=1)
```

```
[87]: i = 0
support_data, support_label, query_data, query_label, n_ways, n_shot, classes = \
    get_task_data(embst, embs, i, fg_nc, class_set, task_size, brother=brother)
acc, _, nn_pre = NC_o(support_data, support_label,
                      query_data, query_label,
                      n_ways, n_shot,
                      beta = be, l2 = l2,
                      given_cen = protots[classes], given_only = True,
                      brother = brother)
```

```
##### current_task: 0 #####
current classes [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17,
18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37,
38, 39]
[output] all classes 0 -> 39
0.5075
```

```
[98]: local      = False # True / False
nn_acc      = []
savefile = path+'NN3' if brother else None # NN / NNp / NN3 / only saved NN
        ↪results!
savefil12 = path+'NN3'
forget      = True # True False # calculate forgetting
```

```

class_ladder = []
a = []
for i in range(task_num + 1):
    support_data, support_label, query_data, query_label, n_ways, n_shot, \
    →classes = \
        get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                        local = local, brother = brother) # False
    if forget:
        class_ladder.append(classes)
    acc, _, nn_pre = NC_o(support_data, support_label,
                          query_data, query_label,
                          n_ways, n_shot,
                          beta = be, l2 = l2,
                          given_cen = protots[classes] if local else protots[:
    →classes[-1]+1],

                          given_only = True,
                          brother = brother,
                          savefile = savefile+'_'+str(i) if brother else None,
                          savefile2 = None, # savefile2+'_'+str(i), # None, #
                          weights = [0.7, 0.3],
                          class_ladder = class_ladder,
                          acc_all = a
                          )

    nn_acc.append(acc)
    # if all classes up2now: local = False, and protots[:classes[-1]+1]
print('local:', local, '| beta:', be, '| l2:', l2)
if brother:
    for accs in nn_acc:
        print('\t'.join([str(i) for i in accs]))
else:
    print('\n'.join([str(i) for i in nn_acc]))
if forget:
    avgf = forgetting(a, task_num)
    print(avgf)

```

##### current\_task: 0 #####

```

current classes [ 0  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15
16 17
18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35
36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53
54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71
72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89
90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107
108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125
126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143
144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159]

```



```

[output] all classes 0 -> 159
<<< loaded from: ../checkpoints/CIFAR100_40_20x3voro/NN3_0.npy
0.3791

##### current_task: 1 #####
current classes [160 161 162 163 164 165 166 167 168 169 170 171]
[output] all classes 0 -> 171
<<< loaded from: ../checkpoints/CIFAR100_40_20x3voro/NN3_1.npy
0.3638

##### current_task: 2 #####
current classes [172 173 174 175 176 177 178 179 180 181 182 183]
[output] all classes 0 -> 183
<<< loaded from: ../checkpoints/CIFAR100_40_20x3voro/NN3_2.npy
0.3444

##### current_task: 3 #####
current classes [184 185 186 187 188 189 190 191 192 193 194 195]
[output] all classes 0 -> 195
<<< loaded from: ../checkpoints/CIFAR100_40_20x3voro/NN3_3.npy
0.3511

##### current_task: 4 #####
current classes [196 197 198 199 200 201 202 203 204 205 206 207]
[output] all classes 0 -> 207
<<< loaded from: ../checkpoints/CIFAR100_40_20x3voro/NN3_4.npy
0.3433

##### current_task: 5 #####
current classes [208 209 210 211 212 213 214 215 216 217 218 219]
[output] all classes 0 -> 219
<<< loaded from: ../checkpoints/CIFAR100_40_20x3voro/NN3_5.npy
0.3425

##### current_task: 6 #####
current classes [220 221 222 223 224 225 226 227 228 229 230 231]
[output] all classes 0 -> 231
<<< loaded from: ../checkpoints/CIFAR100_40_20x3voro/NN3_6.npy
0.3333

##### current_task: 7 #####
current classes [232 233 234 235 236 237 238 239 240 241 242 243]
[output] all classes 0 -> 243
<<< loaded from: ../checkpoints/CIFAR100_40_20x3voro/NN3_7.npy
0.3336

##### current_task: 8 #####
current classes [244 245 246 247 248 249 250 251 252 253 254 255]

```

```

[output] all classes 0 -> 255
<<< loaded from: ../checkpoints/CIFAR100_40_20x3voro/NN3_8.npy
0.3255

##### current_task: 9 #####
current classes [256 257 258 259 260 261 262 263 264 265 266 267]
[output] all classes 0 -> 267
<<< loaded from: ../checkpoints/CIFAR100_40_20x3voro/NN3_9.npy
0.3126

##### current_task: 10 #####
current classes [268 269 270 271 272 273 274 275 276 277 278 279]
[output] all classes 0 -> 279
<<< loaded from: ../checkpoints/CIFAR100_40_20x3voro/NN3_10.npy
0.3131

##### current_task: 11 #####
current classes [280 281 282 283 284 285 286 287 288 289 290 291]
[output] all classes 0 -> 291
<<< loaded from: ../checkpoints/CIFAR100_40_20x3voro/NN3_11.npy
0.3079

##### current_task: 12 #####
current classes [292 293 294 295 296 297 298 299 300 301 302 303]
[output] all classes 0 -> 303
<<< loaded from: ../checkpoints/CIFAR100_40_20x3voro/NN3_12.npy
0.2988

##### current_task: 13 #####
current classes [304 305 306 307 308 309 310 311 312 313 314 315]
[output] all classes 0 -> 315
<<< loaded from: ../checkpoints/CIFAR100_40_20x3voro/NN3_13.npy
0.2944

##### current_task: 14 #####
current classes [316 317 318 319 320 321 322 323 324 325 326 327]
[output] all classes 0 -> 327
<<< loaded from: ../checkpoints/CIFAR100_40_20x3voro/NN3_14.npy
0.2878

##### current_task: 15 #####
current classes [328 329 330 331 332 333 334 335 336 337 338 339]
[output] all classes 0 -> 339
<<< loaded from: ../checkpoints/CIFAR100_40_20x3voro/NN3_15.npy
0.2813

##### current_task: 16 #####
current classes [340 341 342 343 344 345 346 347 348 349 350 351]

```

```

[output] all classes 0 -> 351
<<< loaded from: ../checkpoints/CIFAR100_40_20x3voro/NN3_16.npy
0.2784

##### current_task: 17 #####
current classes [352 353 354 355 356 357 358 359 360 361 362 363]
[output] all classes 0 -> 363
<<< loaded from: ../checkpoints/CIFAR100_40_20x3voro/NN3_17.npy
0.2754

##### current_task: 18 #####
current classes [364 365 366 367 368 369 370 371 372 373 374 375]
[output] all classes 0 -> 375
<<< loaded from: ../checkpoints/CIFAR100_40_20x3voro/NN3_18.npy
0.2696

##### current_task: 19 #####
current classes [376 377 378 379 380 381 382 383 384 385 386 387]
[output] all classes 0 -> 387
<<< loaded from: ../checkpoints/CIFAR100_40_20x3voro/NN3_19.npy
0.2681

##### current_task: 20 #####
current classes [388 389 390 391 392 393 394 395 396 397 398 399]
[output] all classes 0 -> 399
<<< loaded from: ../checkpoints/CIFAR100_40_20x3voro/NN3_20.npy
0.2613
local: False | beta: 1.0 | l2: False
0.379125      0.67975 0.74475 0.741   0.72575
0.3638372093023256      0.652093023255814      0.7190697674418605
0.718139534883721      0.7046511627906977
0.34440217391304345      0.6267391304347826      0.7115217391304348
0.7108695652173913      0.6969565217391305
0.3510714285714286      0.6289795918367347      0.7097959183673469
0.7089795918367346      0.6942857142857143
0.34326923076923077      0.6119230769230769      0.6946153846153846
0.6942307692307692      0.6796153846153846
0.34245454545454546      0.6176363636363637      0.7025454545454546
0.7018181818181818      0.6874545454545454
0.33327586206896553      0.6027586206896551      0.6963793103448276
0.6960344827586207      0.6803448275862068
0.3335655737704918      0.5981967213114754      0.6716393442622951
0.6737704918032786      0.6498360655737705
0.3255078125      0.59421875      0.6734375      0.67546875      0.65234375
0.3126492537313433      0.5691044776119403      0.654179104477612
0.6553731343283582      0.6343283582089553
0.31310714285714286      0.5674285714285714      0.6561428571428571
0.6561428571428571      0.6355714285714286

```

0.3079109589041096	0.5561643835616439	0.6404109589041096
0.640958904109589	0.6191780821917808	
0.2988486842105263	0.5373684210526316	0.6259210526315789
0.6259210526315789	0.6048684210526316	
0.29443037974683545	0.5282278481012658	0.6267088607594937
0.6267088607594937	0.6059493670886076	
0.28777439024390244	0.515609756097561	0.6140243902439024
0.614390243902439	0.5924390243902439	
0.2813235294117647	0.5076470588235295	0.6103529411764705
0.6111764705882353	0.5901176470588235	
0.2784375	0.5054545454545455	0.6115909090909091
0.6122727272727273	0.5906818181818182	
0.2754395604395604	0.4991208791208791	0.6064835164835165
0.6069230769230769	0.5842857142857143	
0.2695744680851064	0.4858510638297872	0.590531914893617
0.5914893617021276	0.5692553191489361	
0.2680670103092784	0.48536082474226805	0.5934020618556701
0.5952577319587629	0.5737113402061855	
0.261275	0.4784	0.5918 0.5936 0.5723
[0.379125	0.	0. 0. 0. 0.
0.	0.	0. 0. 0. 0.
0.	0.	0. 0. 0. 0.
0.	0.	0. ]
[0.3699375	0.2825	0. 0. 0. 0.
0.	0.	0. 0. 0. 0.
0.	0.	0. 0. 0. 0.
0.	0.	0. ]
[0.3609375	0.2775	0.19083333 0. 0. 0.
0.	0.	0. 0. 0. 0.
0.	0.	0. 0. 0. 0.
0.	0.	0. ]
[0.35575	0.26666667	0.19083333 0.53333333 0. 0.
0.	0.	0. 0. 0. 0.
0.	0.	0. 0. 0. 0.
0.	0.	0. ]
[0.351875	0.26583333	0.18583333 0.52916667 0.2775 0.
0.	0.	0. 0. 0. 0.
0.	0.	0. 0. 0. 0.
0.	0.	0. ]
[0.345	0.26416667	0.18333333 0.4175 0.27416667 0.53916667
0.	0.	0. 0. 0. 0.
0.	0.	0. 0. 0. 0.
0.	0.	0. ]
[0.3415625	0.26416667	0.18333333 0.41333333 0.27416667 0.52583333
0.22833333	0.	0. 0. 0. 0.
0.	0.	0. 0. 0. 0.
0.	0.	0. ]
[0.331875	0.26416667	0.18333333 0.40583333 0.26166667 0.5025

0.21583333	0.52416667	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	]		
[0.326	0.25583333	0.17916667	0.40333333	0.26083333	0.49833333
0.21583333	0.52416667	0.26	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	]		
[0.3233125	0.25416667	0.17666667	0.40333333	0.26	0.49833333
0.21333333	0.52416667	0.26	0.08166667	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	]		
[0.318875	0.25166667	0.17666667	0.40333333	0.25583333	0.4975
0.21	0.515	0.25916667	0.08166667	0.40333333	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	]		
[0.31575	0.25166667	0.17416667	0.4	0.25166667	0.49
0.2	0.46083333	0.24833333	0.07833333	0.3925	0.335
0.	0.	0.	0.	0.	0.
0.	0.	0.	]		
[0.3110625	0.25	0.17166667	0.39833333	0.24916667	0.49
0.2	0.46	0.23833333	0.0775	0.37416667	0.335
0.17916667	0.	0.	0.	0.	0.
0.	0.	0.	]		
[0.3105	0.24916667	0.17083333	0.39833333	0.24833333	0.49
0.19666667	0.46	0.23333333	0.07583333	0.37083333	0.335
0.17916667	0.20583333	0.	0.	0.	0.
0.	0.	0.	]		
[0.3051875	0.2475	0.16916667	0.39833333	0.24666667	0.49
0.195	0.46	0.23333333	0.075	0.37083333	0.335
0.17666667	0.20583333	0.19333333	0.	0.	0.
0.	0.	0.	]		
[0.3015625	0.24666667	0.16916667	0.395	0.24666667	0.48666667
0.19166667	0.46	0.2275	0.075	0.37083333	0.33
0.17666667	0.20583333	0.19	0.17833333	0.	0.
0.	0.	0.	]		
[0.295625	0.22916667	0.16916667	0.39333333	0.24666667	0.48583333
0.19083333	0.45666667	0.2225	0.07416667	0.36916667	0.33
0.17666667	0.20416667	0.18583333	0.1775	0.31416667	0.
0.	0.	0.	]		
[0.291125	0.2275	0.15583333	0.38833333	0.245	0.48583333
0.19	0.43583333	0.2225	0.0725	0.36833333	0.33
0.17166667	0.20083333	0.165	0.17416667	0.3025	0.3375
0.	0.	0.	]		
[0.2898125	0.2275	0.1525	0.3875	0.24	0.4725
0.18833333	0.43583333	0.2125	0.0725	0.36083333	0.32333333
0.17166667	0.1975	0.16416667	0.16583333	0.30166667	0.33666667
0.17166667	0.	0.	]		
[0.2840625	0.2275	0.1525	0.38333333	0.23083333	0.45416667

```

0.18583333 0.4325      0.2125      0.0725      0.355      0.3225
0.17083333 0.19583333 0.16333333 0.16583333 0.29166667 0.33666667
0.17166667 0.355      0.          ]
[0.2805625  0.22166667 0.14833333 0.36833333 0.23      0.45083333
0.18416667 0.4325      0.205      0.04083333 0.35416667 0.32
0.16666667 0.19416667 0.15916667 0.16583333 0.29166667 0.33583333
0.17166667 0.35416667 0.17333333]]
[0, 0.91875000000000015, 1.15937499999999958, 1.30694444444444431,
1.3270833333333333, 3.5825000000000001, 3.3343749999999996, 3.7940476190476207,
3.6432291666666665, 3.35162037037037, 3.2691666666666666, 3.9700757575757577,
3.9977430555555555, 3.8163461538461534, 3.653125, 3.6004166666666664,
3.6520833333333345, 3.99313725490196, 4.125810185185187, 4.241557017543859,
4.4719791666666666]

```

```

[14]: def predict(model, x, voro=True):
        x = torch.from_numpy(x.astype(np.float32)).cuda()
        with torch.no_grad():
            predi = model.module.classifier(x)
        if voro:
            predi += - torch.sum((model.module.classifier.weight/2.)**2, dim=1)
        return predi

classes_all = []
test_share = []
paccS = []
for i in range(task_num + 1):
    support_data, support_label, query_data, query_label, n_ways, n_shot, \
    classes = \
        get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                        local = True, brother = brother)

    # load model:
    if brother:
        cls_01 = classes[-1]+1
        assert cls_01 % 4 == 0
        filename = path + '%d_model.pkl' % (int(cls_01/4))
    else:
        filename = path + '%d_model.pkl' % (classes[-1]+1)
    model = torch.load(filename)
    model.eval()
    print('> loaded base phase model from:', filename)
    num_param(model)
    # do prediction:
    min_cls = min(classes)
    if brother:
        pred = predict(model, query_data)
    else:
        pred = predict(model, query_data)[:,:,:4]

```

```

pmax = torch.max(pred, dim=1)[1]
pacc = np.mean(t2n(pmax) == query_label - min_cls)
print(pacc)
if brother:
    accs = acc_brother(t2n(pred), t2n(pmax), query_label - min_cls,
→forLG=True)
    pacc = [pacc] + accs
    paccS.append(pacc)
    classes_all.append(classes)
    test_share.append(len(query_label))
print('all logistic locally:')
if brother:
    for accs in paccS:
        print('\t'.join([str(i) for i in accs]))
else:
    print('\n'.join([str(i) for i in paccS]))

```

```

[15]: for i in range(task_num + 1):
    support_data, support_label, query_data, query_label, n_ways, n_shot,
→classes = \
        get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                        local = True, brother = brother)
    pred_all = []
    for classes in classes_all:
        # load model:
        if brother:
            cls_01 = classes[-1]+1
            assert cls_01 % 4 == 0
            filename = path + '%d_model.pkl' % (int(cls_01/4))
        else:
            filename = path + '%d_model.pkl' % (classes[-1]+1)
        model = torch.load(filename)
        model.eval()
        print('> loaded base phase model from:', filename)
        num_param(model)
        # do prediction:
        min_cls = min(classes)
        if brother:
            pred = predict(model, query_data)
        else:
            pred = predict(model, query_data)[:,:4]
        pmax = torch.max(pred, dim=1)[1]
        # pacc = np.mean(t2n(pmax) == query_label - min_cls)
        # print(pacc)
        if brother:
            labs_01 = query_label[:4]//4
            acc_, sc_pre = merge_sc(t2n(pred), labs_01,

```

```

                                mth='softmax', forLG=True, return_pre=True)
    min_cls = int(min_cls / 4)
    pred_all.append( (sc_pre + min_cls).tolist() )
    else:
        pred_all.append( (t2n(pmax) + min_cls).tolist() )
    pred_all = np.array(pred_all)
    print(pred_all.shape)

    if i == 0:
        pred_in_clique = copy.deepcopy(pred_all)
    else:
        pred_in_clique = np.hstack((pred_in_clique, pred_all))

```

```

[42]: print('cliques by test samples:', pred_in_clique.shape)

# compute prototypes
be      = 0.6 # 1.
l2      = True # False True
bias    = 0 # 0.05
protots = np.mean(feats_trans(support_data_, beta=be, l2=l2, bias=bias), axis=1)
query_pts = feats_trans(query_data_, beta=be, l2=l2, bias=bias)
# acenss = feats_trans(acens, beta=be, l2=l2, bias=bias)
if brother:
    dist = funbtch(query_pts, protots) # protots / acenss
else:
    dist = fun(query_pts, protots) # protots / acenss

test_splt = [sum(test_share[:t+1]) for t in range(len(test_share))]

```

```

[238]: dist_in_clique = np.zeros_like(pred_in_clique, dtype=np.float32)
for c_id, clique in enumerate(pred_in_clique):
    for s_id, samp in enumerate(clique):
        dist_in_clique[c_id][s_id] = dist[s_id][samp]

```

```

[253]: for i in range(task_num + 1):
        clique_dist = dist_in_clique[:i+1,:test_splt[i]]
        clique_pred = np.argmax(clique_dist, axis=0)
        merge_pred = [pred_in_clique[cli,s_id] for s_id, cli in
            ↪ enumerate(clique_pred)]
        merge_acc = np.mean(merge_pred == query_label_[:test_splt[i]])
        print(merge_acc)
    print('DaC:', 'beta:', be, '| l2:', l2)

```

```

[28]: print('===== Experiment Done! =====')

```

```

===== Experiment Done! =====

```



## iVoro on TinyImageNet Dataset (5 Phases, 3rd Block Features)

```
[1]: import matplotlib.pyplot as plt
import os
import pickle
import numpy as np
import pandas as pd
import seaborn as sns
import time
import sys
sys.path.append('../')
sys.path.append('../analysis/')
import copy
import platform
import json
import pickle
import random

import torch
from scipy.stats import mode
```

```
[2]: from ResNet import resnet18_cbam

data_name      = 'Tiny' # 'Subset' # 'Tiny' # 'CIFAR100' # 'MNIST'
total_nc       = 200 # 200 # 100 # 10
fg_nc          = 100 # 100 # 40 # 50 # 4
task_num       = 5 # 20 # 5 # 10 # 2

# constant params
class_set      = list(range(total_nc))
ROTATION       = True
EMB2D          = False
DESIGN         = True
virtual_class  = 4*total_nc if ROTATION else total_nc
suffix         = 'voron' # 'prob' 'voron'
assert (total_nc - fg_nc)%task_num == 0
task_size      = int((total_nc - fg_nc)/task_num)
file_name      =
    ↳data_name+'_'+str(fg_nc)+'_'+str(task_num)+'x'+str(task_size)+suffix
```

```
print(file_name)

brother      = False # True False
```

Tiny\_100\_5x20voro

```
[3]: save_path = '../checkpoints/'
      path     = save_path + file_name + '/'
      filename = path + '%d_model.pkl' % (fg_nc+0) # +5
      model    = torch.load(filename)
      model.eval()
      print('> loaded base phase model from:', filename)
```

> loaded base phase model from: ../checkpoints/Tiny\_100\_5x20voro/100\_model.pkl

```
[4]: from voro_helper import num_param, t2n, \
      load_feat, sanity_check, \
      id2emb_, num_samp, merge_sc, funbtch

      num_param(model)

      # voronoi centers:
      vcenter = t2n(model.module.classifier.weight.data / 2.)
      print(vcenter.shape)
```

```
module.classifier.weight      torch.Size([400, 512])  204800  True
total: 204800
(400, 512)
```

```
[5]: '''
      CIFAR:
          'CIFAR100_50_5x10_test.pkl'
          'CIFAR100_50_5x10_train.pkl'
          'CIFAR100_40_20x3_test.pkl'
          'CIFAR100_40_20x3_train.pkl'
      more CIFAR:
          'CIFAR100_40_12x5_test.pkl'
          'CIFAR100_40_12x5_train.pkl'
          'CIFAR100_30_14x5_test.pkl'
          'CIFAR100_30_14x5_train.pkl'
          'CIFAR100_20_16x5_test.pkl'
          'CIFAR100_20_16x5_train.pkl'
          'CIFAR100_10_18x5_test.pkl'
          'CIFAR100_10_18x5_train.pkl'
      Tiny:
          'Tiny_100_20x5_test.pkl'
          'Tiny_100_20x5_train.pkl'
      TinyL3:
```

```

        'Tiny_100_5x20_test.pkl'
        'Tiny_100_5x20_train.pkl'
Subset:
        'Subset_50_10x5_test.pkl'
        'Subset_50_10x5_train.pkl'
'''
ffile = '../embedding/probL3/' + 'Tiny_100_5x20_test.pkl' # prob probL3
data_phas, last_tsk = load_feat(ffile)

labs, embeds, outputs = data_phas[last_tsk][last_tsk]
false_id, pred_ = sanity_check(labs, embeds, outputs)

```

```

feature file: ../embedding/probL3/Tiny_100_5x20_test.pkl
> loaded tasks: dict_keys([5])
> classes: [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18,
19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38,
39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58,
59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78,
79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98,
99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114,
115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130,
131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146,
147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162,
163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178,
179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194,
195, 196, 197, 198, 199]
> samples: 10000
> embedding: 256
> classification: 800
~ acc (single): 33.29%
~ acc (quadruple): 26.04%

```

```

[6]: ffile = '../embedding/probL3/' + 'Tiny_100_5x20_train.pkl' # prob probL3
data_phas, last_tsk = load_feat(ffile)

labst, embedst, outputst = data_phas[last_tsk][last_tsk]
false_id, pred_ = sanity_check(labst, embedst, outputst)

```

```

feature file: ../embedding/probL3/Tiny_100_5x20_train.pkl
> loaded tasks: dict_keys([5])
> classes: [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18,
19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38,
39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58,
59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78,
79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98,
99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114,
115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130,
131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146,

```

```

147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162,
163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178,
179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194,
195, 196, 197, 198, 199]
> samples: 99968
> embedding: 256
> classification: 800
~ acc (single): 35.18%
~ acc (quadruple): 27.57%

```

```

[7]: embs = id2emb_(labs, embeds, brother=brother)
      embst = id2emb_(labst, embedst, brother=brother)

      sam_max, sam_min = num_samp(embst)
      print('> loading data done!')

```

```

0 499,1 500,2 499,3 500,4 500,5 500,6 500,7 500,8 500,9 500,10 500,11 500,12
500,13 500,14 499,15 500,16 500,17 499,18 499,19 500,20 499,21 500,22 500,23
500,24 500,25 500,26 500,27 499,28 500,29 500,30 500,31 499,32 500,33 500,34
499,35 500,36 499,37 500,38 500,39 499,40 500,41 500,42 500,43 500,44 499,45
500,46 500,47 500,48 500,49 500,50 500,51 500,52 500,53 500,54 500,55 500,56
500,57 500,58 500,59 499,60 499,61 499,62 500,63 500,64 500,65 500,66 500,67
500,68 500,69 500,70 500,71 500,72 499,73 500,74 500,75 500,76 500,77 500,78
500,79 500,80 500,81 500,82 500,83 500,84 498,85 500,86 500,87 499,88 500,89
500,90 500,91 500,92 500,93 500,94 500,95 500,96 500,97 500,98 500,99 500,100
500,101 500,102 500,103 500,104 500,105 500,106 500,107 500,108 500,109 500,110
500,111 499,112 500,113 500,114 500,115 500,116 499,117 500,118 500,119 500,120
500,121 500,122 500,123 500,124 500,125 499,126 500,127 500,128 500,129 500,130
500,131 500,132 500,133 500,134 500,135 499,136 500,137 500,138 500,139 500,140
500,141 500,142 500,143 500,144 499,145 499,146 500,147 500,148 500,149 500,150
499,151 500,152 500,153 499,154 500,155 500,156 500,157 500,158 500,159 500,160
500,161 500,162 500,163 500,164 500,165 500,166 500,167 500,168 500,169 500,170
500,171 500,172 499,173 500,174 500,175 500,176 500,177 499,178 500,179 500,180
500,181 500,182 500,183 500,184 500,185 500,186 500,187 499,188 500,189 500,190
500,191 500,192 500,193 500,194 498,195 500,196 500,197 500,198 500,199 500,
max samples: 500
min samples: 498
> loading data done!

```

```

[8]: for k,v in embst.items():
      if v.shape[0] < sam_max:
          rid = np.random.choice(v.shape[0], sam_max-v.shape[0], replace=False)
          print('filling', sam_max-v.shape[0], 'samples')
          embst[k] = np.vstack((v, v[rid]))

```

```

filling 1 samples
filling 1 samples
filling 1 samples
filling 1 samples

```

```

filling 1 samples
filling 1 samples
filling 1 samples
filling 1 samples
filling 1 samples
filling 1 samples
filling 1 samples
filling 1 samples
filling 1 samples
filling 1 samples
filling 1 samples
filling 2 samples
filling 1 samples
filling 1 samples
filling 1 samples
filling 1 samples
filling 1 samples
filling 1 samples
filling 1 samples
filling 1 samples
filling 1 samples
filling 1 samples
filling 1 samples
filling 2 samples

```

```

[9]: from voro_helper import get_task_data, feat_trans, NC_o, tsk_cls, fun, \
      ↪acc_brother, forgetting

i = task_num
support_data_, support_label_, query_data_, query_label_, n_ways_, n_shot_, _ = \
    get_task_data(embst, embs, i, fg_nc, class_set, task_size, brother=brother)

```

```

##### current_task: 5 #####
current classes [180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191,
192, 193, 194, 195, 196, 197, 198, 199]
[output] all classes 0 -> 199

```

```

[10]: #%% =====
      ↪=====

be      = 1. # 1.
l2      = False # False True
protots = np.mean(feat_trans(support_data_, beta=be, l2=l2), axis=1)

```

```

[11]: i = 0
      support_data, support_label, query_data, query_label, n_ways, n_shot, classes = \

```

```

    get_task_data(embst, embs, i, fg_nc, class_set, task_size, brother=brother)
acc, _, nn_pre = NC_o(support_data, support_label,
                      query_data, query_label,
                      n_ways, n_shot,
                      beta = be, l2 = l2,
                      given_cen = protots[classes], given_only = True,
                      brother = brother)

```

```

##### current_task: 0 #####
current classes [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17,
18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37,
38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57,
58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77,
78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97,
98, 99]
[output] all classes 0 -> 99
0.2536

```

```

[12]: local      = False # True / False
nn_acc      = []
savefile    = path+'NN3' if brother else None # NN / NNp / NN3 / only saved NN
           ↳results!
savefil2    = path+'NN3'
forget      = True # True False # calculate forgetting
class_ladder = []
a           = []
for i in range(task_num + 1):
    support_data, support_label, query_data, query_label, n_ways, n_shot,
    ↳classes = \
        get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                       local = local, brother = brother) # False
    if forget:
        class_ladder.append(classes)
    acc, _, nn_pre = NC_o(support_data, support_label,
                          query_data, query_label,
                          n_ways, n_shot,
                          beta = be, l2 = l2,
                          given_cen = protots[classes] if local else protots[:
    ↳classes[-1]+1],
                          given_only = True,
                          brother = brother,
                          savefile = savefile+'_'+str(i) if brother else None,
                          savefile2 = None, # savefil2+'_'+str(i), # None, #
                          weights = [0.7, 0.3],
                          class_ladder = class_ladder,
                          acc_all = a

```

```

        )
        nn_acc.append(acc)
        # if all classes up2now: local = False, and protots[:classes[-1]+1]
print('local:', local, '| beta:', be, '| l2:', l2)
if brother:
    for accs in nn_acc:
        print('\t'.join([str(i) for i in accs]))
else:
    print('\n'.join([str(i) for i in nn_acc]))
if forget:
    avgf = forgetting(a, task_num)
    print(avgf)

```

```

##### current_task: 0 #####
current classes [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17,
18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37,
38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57,
58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77,
78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97,
98, 99]
[output] all classes 0 -> 99
0.2536

```

```

##### current_task: 1 #####
current classes [100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111,
112, 113, 114, 115, 116, 117, 118, 119]
[output] all classes 0 -> 119
0.2367

```

```

##### current_task: 2 #####
current classes [120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131,
132, 133, 134, 135, 136, 137, 138, 139]
[output] all classes 0 -> 139
0.2317

```

```

##### current_task: 3 #####
current classes [140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151,
152, 153, 154, 155, 156, 157, 158, 159]
[output] all classes 0 -> 159
0.2112

```

```

##### current_task: 4 #####
current classes [160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171,
172, 173, 174, 175, 176, 177, 178, 179]
[output] all classes 0 -> 179
0.1989

```

```
##### current_task: 5 #####
current classes [180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191,
192, 193, 194, 195, 196, 197, 198, 199]
[output] all classes 0 -> 199
0.1870
local: False | beta: 1.0 | l2: False
0.2536
0.23666666666666666
0.2317142857142857
0.21125
0.19888888888888889
0.187
[[0.2536 0.      0.      0.      0.      0.      ]
 [0.2296 0.272  0.      0.      0.      0.      ]
 [0.2136 0.256  0.298  0.      0.      0.      ]
 [0.1958 0.244  0.279  0.188  0.      0.      ]
 [0.1838 0.232  0.27   0.176  0.193  0.      ]
 [0.1776 0.229  0.262  0.167  0.19   0.134 ]]
[0, 2.3999999999999995, 2.8, 3.4933333333333323, 3.744999999999997,
3.579999999999999]
```

```
[14]: def predict(model, x, voro=True):
        x = torch.from_numpy(x.astype(np.float32)).cuda()
        with torch.no_grad():
            predi = model.module.classifier(x)
        if voro:
            predi += - torch.sum((model.module.classifier.weight/2.)**2, dim=1)
        return predi

classes_all = []
test_share = []
paccS = []
for i in range(task_num + 1):
    support_data, support_label, query_data, query_label, n_ways, n_shot, \
    classes = \
        get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                        local = True, brother = brother)

    # load model:
    if brother:
        cls_01 = classes[-1]+1
        assert cls_01 % 4 == 0
        filename = path + '%d_model.pkl' % (int(cls_01/4))
    else:
        filename = path + '%d_model.pkl' % (classes[-1]+1)
    model = torch.load(filename)
    model.eval()
    print('> loaded base phase model from:', filename)
```



```

num_param(model)
# do prediction:
min_cls = min(classes)
if brother:
    pred = predict(model, query_data)
else:
    pred = predict(model, query_data)[:,:,:4]
pmax = torch.max(pred, dim=1)[1]
pacc = np.mean(t2n(pmax) == query_label - min_cls)
print(pacc)
if brother:
    accs = acc_brother(t2n(pred), t2n(pmax), query_label - min_cls,
→forLG=True)
    pacc = [pacc] + accs
    paccS.append(pacc)
    classes_all.append(classes)
    test_share.append(len(query_label))
print('all logistic locally:')
if brother:
    for accs in paccS:
        print('\t'.join([str(i) for i in accs]))
else:
    print('\n'.join([str(i) for i in paccS]))

```

```

[15]: for i in range(task_num + 1):
    support_data, support_label, query_data, query_label, n_ways, n_shot,
→classes = \
        get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                        local = True, brother = brother)
    pred_all = []
    for classes in classes_all:
        # load model:
        if brother:
            cls_01 = classes[-1]+1
            assert cls_01 % 4 == 0
            filename = path + '%d_model.pkl' % (int(cls_01/4))
        else:
            filename = path + '%d_model.pkl' % (classes[-1]+1)
        model = torch.load(filename)
        model.eval()
        print('> loaded base phase model from:', filename)
        num_param(model)
        # do prediction:
        min_cls = min(classes)
        if brother:
            pred = predict(model, query_data)
        else:

```

```

        pred = predict(model, query_data)[:,:,:4]
    pmax = torch.max(pred, dim=1)[1]
    # pacc = np.mean(t2n(pmax) == query_label - min_cls)
    # print(pacc)
    if brother:
        labs_01 = query_label[:4]//4
        acc_, sc_pre = merge_sc(t2n(pred), labs_01,
                                mth='softmax', forLG=True, return_pre=True)
        min_cls = int(min_cls / 4)
        pred_all.append( (sc_pre + min_cls).tolist() )
    else:
        pred_all.append( (t2n(pmax) + min_cls).tolist() )
    pred_all = np.array(pred_all)
    print(pred_all.shape)

    if i == 0:
        pred_in_clique = copy.deepcopy(pred_all)
    else:
        pred_in_clique = np.hstack((pred_in_clique, pred_all))

```

```

[42]: print('cliques by test samples:', pred_in_clique.shape)

# compute prototypes
be      = 0.6 # 1.
l2      = True # False True
bias    = 0 # 0.05
protots = np.mean(feats_trans(support_data_, beta=be, l2=l2, bias=bias), axis=1)
query_pts = feats_trans(query_data_, beta=be, l2=l2, bias=bias)
# acenss = feats_trans(acens, beta=be, l2=l2, bias=bias)
if brother:
    dist = funbtch(query_pts, protots) # protots / acenss
else:
    dist = fun(query_pts, protots) # protots / acenss

test_splt = [sum(test_share[:t+1]) for t in range(len(test_share))]

```

```

[238]: dist_in_clique = np.zeros_like(pred_in_clique, dtype=np.float32)
for c_id, clique in enumerate(pred_in_clique):
    for s_id, samp in enumerate(clique):
        dist_in_clique[c_id][s_id] = dist[s_id][samp]

```

```

[253]: for i in range(task_num + 1):
        clique_dist = dist_in_clique[:i+1,:test_splt[i]]
        clique_pred = np.argmax(clique_dist, axis=0)
        merge_pred = [pred_in_clique[cli,s_id] for s_id, cli in
            →enumerate(clique_pred)]
        merge_acc = np.mean(merge_pred == query_label[:test_splt[i]])

```

```
print(merge_acc)
print('DaC:', 'beta:', be, '| 12:', 12)
```

```
[28]: print('===== Experiment Done! =====')
```

```
===== Experiment Done! =====
```

## iVoro-AC/AI on TinyImageNet Dataset (5 Phases, 3rd Block Features)

```
[1]: import matplotlib.pyplot as plt
import os
import pickle
import numpy as np
import pandas as pd
import seaborn as sns
import time
import sys
sys.path.append('../')
sys.path.append('../analysis/')
import copy
import platform
import json
import pickle
import random

import torch
from scipy.stats import mode
```

```
[16]: from ResNet import resnet18_cbam

data_name      = 'Tiny' # 'Subset' # 'Tiny' # 'CIFAR100' # 'MNIST'
total_nc       = 200 # 200 # 100 # 10
fg_nc          = 100 # 100 # 40 # 50 # 4
task_num       = 5 # 20 # 5 # 10 # 2

# constant params
class_set      = list(range(total_nc))
ROTATION       = True
EMB2D          = False
DESIGN         = True
virtual_class  = 4*total_nc if ROTATION else total_nc
suffix         = 'voro' # 'prob' 'voro'
assert (total_nc - fg_nc)%task_num == 0
task_size      = int((total_nc - fg_nc)/task_num)
```

```

file_name      =_
    ↳data_name+'_'+str(fg_nc)+'_'+str(task_num)+'x'+str(task_size)+suffix

print(file_name)

brother        = True # True False

```

Tiny\_100\_5x20voro

```

[17]: save_path = '../checkpoints/'
      path      = save_path + file_name + '/'
      filename   = path + '%d_model.pkl' % (fg_nc+0) # +5
      model      = torch.load(filename)
      model.eval()
      print('> loaded base phase model from:', filename)

```

> loaded base phase model from: ../checkpoints/Tiny\_100\_5x20voro/100\_model.pkl

```

[18]: from voro_helper import num_param, t2n, \
      load_feat, sanity_check, \
      id2emb_, num_samp, merge_sc, funbtch

num_param(model)

# voronoi centers:
vcenter = t2n(model.module.classifier.weight.data / 2.)
print(vcenter.shape)

```

```

module.classifier.weight      torch.Size([400, 512])  204800  True
total: 204800
(400, 512)

```

```

[19]: '''
      CIFAR:
          'CIFAR100_50_5x10_test.pkl'
          'CIFAR100_50_5x10_train.pkl'
          'CIFAR100_40_20x3_test.pkl'
          'CIFAR100_40_20x3_train.pkl'
      more CIFAR:
          'CIFAR100_40_12x5_test.pkl'
          'CIFAR100_40_12x5_train.pkl'
          'CIFAR100_30_14x5_test.pkl'
          'CIFAR100_30_14x5_train.pkl'
          'CIFAR100_20_16x5_test.pkl'
          'CIFAR100_20_16x5_train.pkl'
          'CIFAR100_10_18x5_test.pkl'
          'CIFAR100_10_18x5_train.pkl'
      Tiny:

```

```

    'Tiny_100_20x5_test.pkl'
    'Tiny_100_20x5_train.pkl'
TinyL3:
    'Tiny_100_5x20_test.pkl'
    'Tiny_100_5x20_train.pkl'
Subset:
    'Subset_50_10x5_test.pkl'
    'Subset_50_10x5_train.pkl'
'''
ffile = '../embedding/probL3/' + 'Tiny_100_5x20_test.pkl' # prob probL3
dataphas, last_tsk = load_feat(ffile)

labs, embeds, outputs = dataphas[last_tsk][last_tsk]
false_id, pred_ = sanity_check(labs, embeds, outputs)

```

```

feature file: ../embedding/probL3/Tiny_100_5x20_test.pkl
> loaded tasks: dict_keys([5])
> classes: [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18,
19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38,
39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58,
59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78,
79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98,
99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114,
115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130,
131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146,
147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162,
163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178,
179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194,
195, 196, 197, 198, 199]
> samples: 10000
> embedding: 256
> classification: 800
~ acc (single): 33.29%
~ acc (quadruple): 26.04%

```

```

[20]: ffile = '../embedding/probL3/' + 'Tiny_100_5x20_train.pkl' # prob probL3
dataphas, last_tsk = load_feat(ffile)

labst, embedst, outputst = dataphas[last_tsk][last_tsk]
false_id, pred_ = sanity_check(labst, embedst, outputst)

```

```

feature file: ../embedding/probL3/Tiny_100_5x20_train.pkl
> loaded tasks: dict_keys([5])
> classes: [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18,
19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38,
39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58,
59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78,
79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98,

```

```

99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114,
115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130,
131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146,
147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162,
163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178,
179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194,
195, 196, 197, 198, 199]
> samples: 99968
> embedding: 256
> classification: 800
~ acc (single): 35.18%
~ acc (quadruple): 27.57%

```

```

[21]: embs = id2emb_(labs, embeds, brother=brother)
      embst = id2emb_(labst, embedst, brother=brother)

      sam_max, sam_min = num_samp(embst)
      print('> loading data done!')

```

```

0 499,1 499,2 499,3 499,4 500,5 500,6 500,7 500,8 499,9 499,10 499,11 499,12
500,13 500,14 500,15 500,16 500,17 500,18 500,19 500,20 500,21 500,22 500,23
500,24 500,25 500,26 500,27 500,28 500,29 500,30 500,31 500,32 500,33 500,34
500,35 500,36 500,37 500,38 500,39 500,40 500,41 500,42 500,43 500,44 500,45
500,46 500,47 500,48 500,49 500,50 500,51 500,52 500,53 500,54 500,55 500,56
499,57 499,58 499,59 499,60 500,61 500,62 500,63 500,64 500,65 500,66 500,67
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499,751 499,752 500,753 500,754 500,755 500,756 500,757 500,758 500,759 500,760  
500,761 500,762 500,763 500,764 500,765 500,766 500,767 500,768 500,769 500,770  
500,771 500,772 500,773 500,774 500,775 500,776 498,777 498,778 498,779 498,780



```
500,781 500,782 500,783 500,784 500,785 500,786 500,787 500,788 500,789 500,790
500,791 500,792 500,793 500,794 500,795 500,796 500,797 500,798 500,799 500,
max samples: 500
min samples: 498
> loading data done!
```

```
[22]: for k,v in embst.items():
      if v.shape[0] < sam_max:
          rid = np.random.choice(v.shape[0], sam_max-v.shape[0], replace=False)
          print('filling', sam_max-v.shape[0], 'samples')
          embst[k] = np.vstack((v, v[rid]))
```

[illegible]

[illegible]

[illegible]

```
[23]: from voro_helper import get_task_data, feat_trans, NC_o, tsk_cls, fun, \
      ↪ acc_brother, forgetting

      i = task_num
      support_data_, support_label_, query_data_, query_label_, n_ways_, n_shot_, _ = \
          get_task_data(embst, embs, i, fg_nc, class_set, task_size, brother=brother)
```

```
##### current_task: 5 #####
current classes [720 721 722 723 724 725 726 727 728 729 730 731 732 733 734 735
736 737
```

```

738 739 740 741 742 743 744 745 746 747 748 749 750 751 752 753 754 755
756 757 758 759 760 761 762 763 764 765 766 767 768 769 770 771 772 773
774 775 776 777 778 779 780 781 782 783 784 785 786 787 788 789 790 791
792 793 794 795 796 797 798 799]

```

[output] all classes 0 -> 799

```

[24]: #####
      ↳=====
be      = 1. # 1.
l2      = False # False True
protots = np.mean(feat_trans(support_data_, beta=be, l2=l2), axis=1)

```

```

[11]: i = 0
support_data, support_label, query_data, query_label, n_ways, n_shot, classes = \
    get_task_data(embst, embs, i, fg_nc, class_set, task_size, brother=brother)
acc, _, nn_pre = NC_o(support_data, support_label,
                      query_data, query_label,
                      n_ways, n_shot,
                      beta = be, l2 = l2,
                      given_cen = protots[classes], given_only = True,
                      brother = brother)

```

```

##### current_task: 0 #####
current classes [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17,
18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37,
38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57,
58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77,
78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97,
98, 99]
[output] all classes 0 -> 99
0.2536

```

```

[25]: local      = False # True / False
nn_acc      = []
savefile = path+'NN3' if brother else None # NN / NNp / NN3 / only saved NN
      ↳results!
savefil2 = path+'NN3'
forget      = True # True False # calculate forgetting
class_ladder = []
a           = []
for i in range(task_num + 1):
    support_data, support_label, query_data, query_label, n_ways, n_shot,
    ↳classes = \
        get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                        local = local, brother = brother) # False
    if forget:
        class_ladder.append(classes)

```

```

acc, _, nn_pre = NC_o(support_data, support_label,
                      query_data, query_label,
                      n_ways, n_shot,
                      beta = be, l2 = l2,
                      given_cen = protots[classes] if local else protots[:
→classes[-1]+1],
                      given_only = True,
                      brother = brother,
                      savefile = savefile+'_'+str(i) if brother else None,
                      savefile2 = None, # savefil2+'_'+str(i), # None, #
                      weights = [0.7, 0.3],
                      class_ladder = class_ladder,
                      acc_all = a
                      )

nn_acc.append(acc)
# if all classes up2now: local = False, and protots[:classes[-1]+1]
print('local:', local, '| beta:', be, '| l2:', l2)
if brother:
    for accs in nn_acc:
        print('\t'.join([str(i) for i in accs]))
else:
    print('\n'.join([str(i) for i in nn_acc]))
if forget:
    avgf = forgetting(a, task_num)
    print(avgf)

```

##### current\_task: 0 #####

```

current classes [ 0  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15
16 17
 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35
 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53
 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71
 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89
 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107
108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125
126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143
144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161
162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179
180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197
198 199 200 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215
216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233
234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250 251
252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269
270 271 272 273 274 275 276 277 278 279 280 281 282 283 284 285 286 287
288 289 290 291 292 293 294 295 296 297 298 299 300 301 302 303 304 305
306 307 308 309 310 311 312 313 314 315 316 317 318 319 320 321 322 323
324 325 326 327 328 329 330 331 332 333 334 335 336 337 338 339 340 341

```

```

342 343 344 345 346 347 348 349 350 351 352 353 354 355 356 357 358 359
360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375 376 377
378 379 380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395
396 397 398 399]
[output] all classes 0 -> 399
<<< loaded from: ../checkpoints/Tiny_100_5x20voro/NN3_0.npy
0.1633

##### current_task: 1 #####
current classes [400 401 402 403 404 405 406 407 408 409 410 411 412 413 414 415
416 417
418 419 420 421 422 423 424 425 426 427 428 429 430 431 432 433 434 435
436 437 438 439 440 441 442 443 444 445 446 447 448 449 450 451 452 453
454 455 456 457 458 459 460 461 462 463 464 465 466 467 468 469 470 471
472 473 474 475 476 477 478 479]
[output] all classes 0 -> 479
<<< loaded from: ../checkpoints/Tiny_100_5x20voro/NN3_1.npy
0.1557

##### current_task: 2 #####
current classes [480 481 482 483 484 485 486 487 488 489 490 491 492 493 494 495
496 497
498 499 500 501 502 503 504 505 506 507 508 509 510 511 512 513 514 515
516 517 518 519 520 521 522 523 524 525 526 527 528 529 530 531 532 533
534 535 536 537 538 539 540 541 542 543 544 545 546 547 548 549 550 551
552 553 554 555 556 557 558 559]
[output] all classes 0 -> 559
<<< loaded from: ../checkpoints/Tiny_100_5x20voro/NN3_2.npy
0.1512

##### current_task: 3 #####
current classes [560 561 562 563 564 565 566 567 568 569 570 571 572 573 574 575
576 577
578 579 580 581 582 583 584 585 586 587 588 589 590 591 592 593 594 595
596 597 598 599 600 601 602 603 604 605 606 607 608 609 610 611 612 613
614 615 616 617 618 619 620 621 622 623 624 625 626 627 628 629 630 631
632 633 634 635 636 637 638 639]
[output] all classes 0 -> 639
<<< loaded from: ../checkpoints/Tiny_100_5x20voro/NN3_3.npy
0.1398

##### current_task: 4 #####
current classes [640 641 642 643 644 645 646 647 648 649 650 651 652 653 654 655
656 657
658 659 660 661 662 663 664 665 666 667 668 669 670 671 672 673 674 675
676 677 678 679 680 681 682 683 684 685 686 687 688 689 690 691 692 693
694 695 696 697 698 699 700 701 702 703 704 705 706 707 708 709 710 711
712 713 714 715 716 717 718 719]

```

```

[output] all classes 0 -> 719
<<< loaded from: ../checkpoints/Tiny_100_5x20voro/NN3_4.npy
0.1320

##### current_task: 5 #####
current classes [720 721 722 723 724 725 726 727 728 729 730 731 732 733 734 735
736 737
738 739 740 741 742 743 744 745 746 747 748 749 750 751 752 753 754 755
756 757 758 759 760 761 762 763 764 765 766 767 768 769 770 771 772 773
774 775 776 777 778 779 780 781 782 783 784 785 786 787 788 789 790 791
792 793 794 795 796 797 798 799]
[output] all classes 0 -> 799
<<< loaded from: ../checkpoints/Tiny_100_5x20voro/NN3_5.npy
0.1246
local: False | beta: 1.0 | l2: False
0.16335 0.3314 0.502 0.4926 0.493
0.15575 0.3065 0.4841666666666667 0.475 0.471
0.15125 0.30142857142857143 0.4774285714285714 0.468
0.4667142857142857
0.13984375 0.28125 0.461875 0.453625 0.4495
0.13202777777777777 0.263 0.4418888888888889 0.433
0.4301111111111111
0.12465 0.2445 0.4203 0.4126 0.408
[[0.16335 0. 0. 0. 0. 0. ]
[0.1482 0.1935 0. 0. 0. 0. ]
[0.1372 0.184 0.18875 0. 0. 0. ]
[0.12615 0.177 0.1775 0.1335 0. 0. ]
[0.11965 0.16625 0.17525 0.12725 0.12125 0. ]
[0.1154 0.163 0.16775 0.1225 0.1175 0.09875]]
[0, 1.5149999999999997, 1.7825000000000006, 2.165, 2.2675, 2.284]

```

```

[14]: def predict(model, x, voro=True):
    x = torch.from_numpy(x.astype(np.float32)).cuda()
    with torch.no_grad():
        predi = model.module.classifier(x)
    if voro:
        predi += - torch.sum((model.module.classifier.weight/2.)**2, dim=1)
    return predi

classes_all = []
test_share = []
paccS = []
for i in range(task_num + 1):
    support_data, support_label, query_data, query_label, n_ways, n_shot, \
    classes = \
        get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                      local = True, brother = brother)

```

```

# load model:
if brother:
    cls_01 = classes[-1]+1
    assert cls_01 % 4 == 0
    filename = path + '%d_model.pkl' % (int(cls_01/4))
else:
    filename = path + '%d_model.pkl' % (classes[-1]+1)
model = torch.load(filename)
model.eval()
print('> loaded base phase model from:', filename)
num_param(model)
# do prediction:
min_cls = min(classes)
if brother:
    pred = predict(model, query_data)
else:
    pred = predict(model, query_data)[:,:,:4]
pmax = torch.max(pred, dim=1)[1]
pacc = np.mean(t2n(pmax) == query_label - min_cls)
print(pacc)
if brother:
    accs = acc_brother(t2n(pred), t2n(pmax), query_label - min_cls,
→forLG=True)
    pacc = [pacc] + accs
    paccS.append(pacc)
    classes_all.append(classes)
    test_share.append(len(query_label))
print('all logistic locally:')
if brother:
    for accs in paccS:
        print('\t'.join([str(i) for i in accs]))
else:
    print('\n'.join([str(i) for i in paccS]))

```

```

[15]: for i in range(task_num + 1):
    support_data, support_label, query_data, query_label, n_ways, n_shot,
→classes = \
        get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                        local = True, brother = brother)
    pred_all = []
    for classes in classes_all:
        # load model:
        if brother:
            cls_01 = classes[-1]+1
            assert cls_01 % 4 == 0
            filename = path + '%d_model.pkl' % (int(cls_01/4))
        else:

```



```

        filename = path + '%d_model.pkl' % (classes[-1]+1)
        model = torch.load(filename)
        model.eval()
        print('> loaded base phase model from:', filename)
        num_param(model)
        # do prediction:
        min_cls = min(classes)
        if brother:
            pred = predict(model, query_data)
        else:
            pred = predict(model, query_data)[:,:,:4]
            pmax = torch.max(pred, dim=1)[1]
            # pacc = np.mean(t2n(pmax) == query_label - min_cls)
            # print(pacc)
            if brother:
                labs_01 = query_label[:4]//4
                acc_, sc_pre = merge_sc(t2n(pred), labs_01,
                                         mth='softmax', forLG=True, return_pre=True)
                min_cls = int(min_cls / 4)
                pred_all.append( (sc_pre + min_cls).tolist() )
            else:
                pred_all.append( (t2n(pmax) + min_cls).tolist() )
        pred_all = np.array(pred_all)
        print(pred_all.shape)

        if i == 0:
            pred_in_clique = copy.deepcopy(pred_all)
        else:
            pred_in_clique = np.hstack((pred_in_clique, pred_all))

```

```

[42]: print('cliques by test samples:', pred_in_clique.shape)

# compute prototypes
be = 0.6 # 1.
l2 = True # False True
bias = 0 # 0.05
protots = np.mean(feats_trans(support_data_, beta=be, l2=l2, bias=bias), axis=1)
query_pts = feats_trans(query_data_, beta=be, l2=l2, bias=bias)
# acenss = feats_trans(acens, beta=be, l2=l2, bias=bias)
if brother:
    dist = funbtch(query_pts, protots) # protots / acenss
else:
    dist = fun(query_pts, protots) # protots / acenss

test_splt = [sum(test_share[:t+1]) for t in range(len(test_share))]

```

```
[238]: dist_in_clique = np.zeros_like(pred_in_clique, dtype=np.float32)
for c_id, clique in enumerate(pred_in_clique):
    for s_id, samp in enumerate(clique):
        dist_in_clique[c_id][s_id] = dist[s_id][samp]
```

```
[253]: for i in range(task_num + 1):
        clique_dist = dist_in_clique[:i+1,:test_splt[i]]
        clique_pred = np.argmin(clique_dist, axis=0)
        merge_pred = [pred_in_clique[cli,s_id] for s_id, cli in
        →enumerate(clique_pred)]
        merge_acc = np.mean(merge_pred == query_label_[:test_splt[i]])
        print(merge_acc)
    print('DaC:', 'beta:', be, '| 12:', 12)
```

```
[28]: print('===== Experiment Done! =====')
```

```
===== Experiment Done! =====
```

## iVoro on TinyImageNet Dataset (10 Phases, 3rd Block Features)

```
[1]: import matplotlib.pyplot as plt
import os
import pickle
import numpy as np
import pandas as pd
import seaborn as sns
import time
import sys
sys.path.append('../')
sys.path.append('../analysis/')
import copy
import platform
import json
import pickle
import random

import torch
from scipy.stats import mode
```

```
[26]: from ResNet import resnet18_cbam

data_name      = 'Tiny' # 'Subset' # 'Tiny' # 'CIFAR100' # 'MNIST'
total_nc       = 200 # 200 # 100 # 10
fg_nc          = 100 # 100 # 40 # 50 # 4
task_num       = 10 # 20 # 5 # 10 # 2

# constant params
class_set      = list(range(total_nc))
ROTATION       = True
EMB2D          = False
DESIGN         = True
virtual_class  = 4*total_nc if ROTATION else total_nc
suffix         = 'voro' # 'prob' 'voro'
assert (total_nc - fg_nc)%task_num == 0
task_size      = int((total_nc - fg_nc)/task_num)
```

```

file_name      =_
    ↳data_name+'_'+str(fg_nc)+'_'+str(task_num)+'x'+str(task_size)+suffix

print(file_name)

brother        = False # True False

```

Tiny\_100\_10x10voro

```

[27]: save_path = '../checkpoints/'
      path      = save_path + file_name + '/'
      filename   = path + '%d_model.pkl' % (fg_nc+0) # +5
      model      = torch.load(filename)
      model.eval()
      print('> loaded base phase model from:', filename)

```

> loaded base phase model from: ../checkpoints/Tiny\_100\_10x10voro/100\_model.pkl

```

[28]: from voro_helper import num_param, t2n, \
      load_feat, sanity_check, \
      id2emb_, num_samp, merge_sc, funbtch

num_param(model)

# voronoi centers:
vcenter = t2n(model.module.classifier.weight.data / 2.)
print(vcenter.shape)

```

```

module.classifier.weight      torch.Size([400, 512])  204800  True
total: 204800
(400, 512)

```

```

[29]: '''
      CIFAR:
          'CIFAR100_50_5x10_test.pkl'
          'CIFAR100_50_5x10_train.pkl'
          'CIFAR100_40_20x3_test.pkl'
          'CIFAR100_40_20x3_train.pkl'
      more CIFAR:
          'CIFAR100_40_12x5_test.pkl'
          'CIFAR100_40_12x5_train.pkl'
          'CIFAR100_30_14x5_test.pkl'
          'CIFAR100_30_14x5_train.pkl'
          'CIFAR100_20_16x5_test.pkl'
          'CIFAR100_20_16x5_train.pkl'
          'CIFAR100_10_18x5_test.pkl'
          'CIFAR100_10_18x5_train.pkl'
      Tiny:

```

```

        'Tiny_100_20x5_test.pkl'
        'Tiny_100_20x5_train.pkl'
TinyL3:
        'Tiny_100_5x20_test.pkl'
        'Tiny_100_5x20_train.pkl'
Subset:
        'Subset_50_10x5_test.pkl'
        'Subset_50_10x5_train.pkl'
'''
ffile = '../embedding/probL3/' + 'Tiny_100_5x20_test.pkl' # prob probL3
dataphas, last_tsk = load_feat(ffile)

labs, embeds, outputs = dataphas[last_tsk][last_tsk]
false_id, pred_ = sanity_check(labs, embeds, outputs)

```

```

feature file: ../embedding/probL3/Tiny_100_5x20_test.pkl
> loaded tasks: dict_keys([5])
> classes: [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18,
19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38,
39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58,
59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78,
79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98,
99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114,
115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130,
131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146,
147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162,
163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178,
179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194,
195, 196, 197, 198, 199]
> samples: 10000
> embedding: 256
> classification: 800
~ acc (single): 33.29%
~ acc (quadruple): 26.04%

```

```

[30]: ffile = '../embedding/probL3/' + 'Tiny_100_5x20_train.pkl' # prob probL3
dataphas, last_tsk = load_feat(ffile)

labst, embedst, outputst = dataphas[last_tsk][last_tsk]
false_id, pred_ = sanity_check(labst, embedst, outputst)

```

```

feature file: ../embedding/probL3/Tiny_100_5x20_train.pkl
> loaded tasks: dict_keys([5])
> classes: [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18,
19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38,
39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58,
59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78,
79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98,

```

```

99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114,
115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130,
131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146,
147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162,
163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178,
179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194,
195, 196, 197, 198, 199]
> samples: 99968
> embedding: 256
> classification: 800
~ acc (single): 35.18%
~ acc (quadruple): 27.57%

```

```

[31]: embs = id2emb_(labs, embeds, brother=brother)
      embst = id2emb_(labst, embedst, brother=brother)

      sam_max, sam_min = num_samp(embst)
      print('> loading data done!')

```

```

0 499,1 500,2 499,3 500,4 500,5 500,6 500,7 500,8 500,9 500,10 500,11 500,12
500,13 500,14 499,15 500,16 500,17 499,18 499,19 500,20 499,21 500,22 500,23
500,24 500,25 500,26 500,27 499,28 500,29 500,30 500,31 499,32 500,33 500,34
499,35 500,36 499,37 500,38 500,39 499,40 500,41 500,42 500,43 500,44 499,45
500,46 500,47 500,48 500,49 500,50 500,51 500,52 500,53 500,54 500,55 500,56
500,57 500,58 500,59 499,60 499,61 499,62 500,63 500,64 500,65 500,66 500,67
500,68 500,69 500,70 500,71 500,72 499,73 500,74 500,75 500,76 500,77 500,78
500,79 500,80 500,81 500,82 500,83 500,84 498,85 500,86 500,87 499,88 500,89
500,90 500,91 500,92 500,93 500,94 500,95 500,96 500,97 500,98 500,99 500,100
500,101 500,102 500,103 500,104 500,105 500,106 500,107 500,108 500,109 500,110
500,111 499,112 500,113 500,114 500,115 500,116 499,117 500,118 500,119 500,120
500,121 500,122 500,123 500,124 500,125 499,126 500,127 500,128 500,129 500,130
500,131 500,132 500,133 500,134 500,135 499,136 500,137 500,138 500,139 500,140
500,141 500,142 500,143 500,144 499,145 499,146 500,147 500,148 500,149 500,150
499,151 500,152 500,153 499,154 500,155 500,156 500,157 500,158 500,159 500,160
500,161 500,162 500,163 500,164 500,165 500,166 500,167 500,168 500,169 500,170
500,171 500,172 499,173 500,174 500,175 500,176 500,177 499,178 500,179 500,180
500,181 500,182 500,183 500,184 500,185 500,186 500,187 499,188 500,189 500,190
500,191 500,192 500,193 500,194 498,195 500,196 500,197 500,198 500,199 500,
max samples: 500
min samples: 498
> loading data done!

```

```

[32]: for k,v in embst.items():
      if v.shape[0] < sam_max:
          rid = np.random.choice(v.shape[0], sam_max-v.shape[0], replace=False)
          print('filling', sam_max-v.shape[0], 'samples')
          embst[k] = np.vstack((v, v[rid]))

```

filling 1 samples

[illegible]

```
[33]: from voro_helper import get_task_data, feat_trans, NC_o, tsk_cls, fun, \
      ↪ acc_brother, forgetting

      i = task_num
      support_data_, support_label_, query_data_, query_label_, n_ways_, n_shot_, _ = \
          get_task_data(embst, embs, i, fg_nc, class_set, task_size, brother=brother)
```

```
##### current_task: 10 #####
current classes [190, 191, 192, 193, 194, 195, 196, 197, 198, 199]
[output] all classes 0 -> 199
```

```
[34]: #####  
      ↪=====  
be      = 1. # 1.  
l2      = False # False True  
protots = np.mean(feats_trans(support_data_, beta=be, l2=l2), axis=1)
```

```
[35]: i = 0
support_data, support_label, query_data, query_label, n_ways, n_shot, classes = \
    get_task_data(embst, embs, i, fg_nc, class_set, task_size, brother=brother)
acc, _, nn_pre = NC_o(support_data, support_label,
                      query_data, query_label,
                      n_ways, n_shot,
                      beta = be, l2 = l2,
                      given_cen = protots[classes], given_only = True,
                      brother = brother)
```

```
##### current_task: 0 #####
current classes [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17,
18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37,
38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57,
58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77,
78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97,
98, 99]
[output] all classes 0 -> 99
0.2538
```

```
[36]: local      = False # True / False
nn_acc      = []
savefile    = path+'NN3' if brother else None # NN / NNp / NN3 / only saved NN
           →results!
savefil2    = path+'NN3'
forget      = True # True False # calculate forgetting
class_ladder = []
a           = []
for i in range(task_num + 1):
    support_data, support_label, query_data, query_label, n_ways, n_shot,
    →classes = \
        get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                      local = local, brother = brother) # False
    if forget:
        class_ladder.append(classes)
    acc, _, nn_pre = NC_o(support_data, support_label,
                          query_data, query_label,
                          n_ways, n_shot,
                          beta = be, l2 = l2,
                          given_cen = protots[classes] if local else protots[
    →classes[-1]+1],
                          given_only = True,
                          brother = brother,
                          savefile = savefile+'_'+str(i) if brother else None,
                          savefile2 = None, # savefil2+'_'+str(i), # None, #
                          weights = [0.7, 0.3],
```



```

        class_ladder = class_ladder,
        acc_all = a
    )

    nn_acc.append(acc)
    # if all classes up2now: local = False, and protots[:classes[-1]+1]
print('local:', local, '| beta:', be, '| l2:', l2)
if brother:
    for accs in nn_acc:
        print('\t'.join([str(i) for i in accs]))
else:
    print('\n'.join([str(i) for i in nn_acc]))
if forget:
    avgf = forgetting(a, task_num)
    print(avgf)

```

```

##### current_task: 0 #####
current classes [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17,
18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37,
38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57,
58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77,
78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97,
98, 99]

```

```

[output] all classes 0 -> 99
0.2538

```

```

##### current_task: 1 #####
current classes [100, 101, 102, 103, 104, 105, 106, 107, 108, 109]
[output] all classes 0 -> 109
0.2453

```

```

##### current_task: 2 #####
current classes [110, 111, 112, 113, 114, 115, 116, 117, 118, 119]
[output] all classes 0 -> 119
0.2367

```

```

##### current_task: 3 #####
current classes [120, 121, 122, 123, 124, 125, 126, 127, 128, 129]
[output] all classes 0 -> 129
0.2269

```

```

##### current_task: 4 #####
current classes [130, 131, 132, 133, 134, 135, 136, 137, 138, 139]
[output] all classes 0 -> 139
0.2317

```

```

##### current_task: 5 #####
current classes [140, 141, 142, 143, 144, 145, 146, 147, 148, 149]

```

```

[output] all classes 0 -> 149
0.2207

##### current_task: 6 #####
current classes [150, 151, 152, 153, 154, 155, 156, 157, 158, 159]
[output] all classes 0 -> 159
0.2114

##### current_task: 7 #####
current classes [160, 161, 162, 163, 164, 165, 166, 167, 168, 169]
[output] all classes 0 -> 169
0.2068

##### current_task: 8 #####
current classes [170, 171, 172, 173, 174, 175, 176, 177, 178, 179]
[output] all classes 0 -> 179
0.1992

##### current_task: 9 #####
current classes [180, 181, 182, 183, 184, 185, 186, 187, 188, 189]
[output] all classes 0 -> 189
0.1941

##### current_task: 10 #####
current classes [190, 191, 192, 193, 194, 195, 196, 197, 198, 199]
[output] all classes 0 -> 199
0.1873
local: False | beta: 1.0 | l2: False
0.2538
0.24527272727272728
0.23666666666666666
0.22692307692307692
0.2317142857142857
0.22066666666666668
0.211375
0.2068235294117647
0.19922222222222222
0.19410526315789473
0.1873
[[0.2538 0.      0.      0.      0.      0.      0.      0.      0.
  0.      ]
 [0.2388 0.31   0.      0.      0.      0.      0.      0.      0.
  0.      ]
 [0.2296 0.294  0.25   0.      0.      0.      0.      0.      0.
  0.      ]
 [0.2224 0.288  0.246  0.192  0.      0.      0.      0.      0.
  0.      ]
 [0.2138 0.27   0.24   0.188  0.408  0.      0.      0.      0.
  0.      ]

```

```

0.    ]
[0.2048 0.262  0.236  0.18  0.396  0.188  0.    0.    0.    0.
0.    ]
[0.1956 0.258  0.23  0.176  0.382  0.186  0.194  0.    0.    0.
0.    ]
[0.1874 0.246  0.228  0.172  0.372  0.174  0.184  0.266  0.    0.
0.    ]
[0.184  0.24  0.224  0.17  0.37  0.174  0.182  0.264  0.122  0.
0.    ]
[0.1796 0.238  0.22  0.164  0.366  0.166  0.18  0.262  0.12  0.176
0.    ]
[0.1778 0.238  0.22  0.158  0.366  0.16  0.178  0.262  0.118  0.17
0.098 ]]
[0, 1.50000000000000013, 2.0100000000000002, 1.9133333333333353,
2.35000000000000005, 2.6999999999999997, 2.9033333333333333, 3.32,
3.17250000000000003, 3.2022222222222223, 3.1200000000000006]

```

```

[14]: def predict(model, x, voro=True):
        x = torch.from_numpy(x.astype(np.float32)).cuda()
        with torch.no_grad():
            predi = model.module.classifier(x)
        if voro:
            predi += - torch.sum((model.module.classifier.weight/2.)**2, dim=1)
        return predi

classes_all = []
test_share = []
paccS = []
for i in range(task_num + 1):
    support_data, support_label, query_data, query_label, n_ways, n_shot, \
    classes = \
        get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                      local = True, brother = brother)

    # load model:
    if brother:
        cls_01 = classes[-1]+1
        assert cls_01 % 4 == 0
        filename = path + '%d_model.pkl' % (int(cls_01/4))
    else:
        filename = path + '%d_model.pkl' % (classes[-1]+1)
    model = torch.load(filename)
    model.eval()
    print('> loaded base phase model from:', filename)
    num_param(model)
    # do prediction:
    min_cls = min(classes)
    if brother:

```

```

        pred = predict(model, query_data)
    else:
        pred = predict(model, query_data)[:,:,:4]
    pmax = torch.max(pred, dim=1)[1]
    pacc = np.mean(t2n(pmax) == query_label - min_cls)
    print(pacc)
    if brother:
        accs = acc_brother(t2n(pred), t2n(pmax), query_label - min_cls,
→forLG=True)
        pacc = [pacc] + accs
        paccS.append(pacc)
        classes_all.append(classes)
        test_share.append(len(query_label))
print('all logistic locally:')
if brother:
    for accs in paccS:
        print('\t'.join([str(i) for i in accs]))
else:
    print('\n'.join([str(i) for i in paccS]))

```

```

[15]: for i in range(task_num + 1):
        support_data, support_label, query_data, query_label, n_ways, n_shot,
→classes = \
            get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                           local = True, brother = brother)
    pred_all = []
    for classes in classes_all:
        # load model:
        if brother:
            cls_01 = classes[-1]+1
            assert cls_01 % 4 == 0
            filename = path + '%d_model.pkl' % (int(cls_01/4))
        else:
            filename = path + '%d_model.pkl' % (classes[-1]+1)
        model = torch.load(filename)
        model.eval()
        print('> loaded base phase model from:', filename)
        num_param(model)
        # do prediction:
        min_cls = min(classes)
        if brother:
            pred = predict(model, query_data)
        else:
            pred = predict(model, query_data)[:,:,:4]
        pmax = torch.max(pred, dim=1)[1]
        # pacc = np.mean(t2n(pmax) == query_label - min_cls)
        # print(pacc)

```

```

    if brother:
        labs_01 = query_label[:,4]//4
        acc_, sc_pre = merge_sc(t2n(pred), labs_01,
                                mth='softmax', forLG=True, return_pre=True)
        min_cls = int(min_cls / 4)
        pred_all.append( (sc_pre + min_cls).tolist() )
    else:
        pred_all.append( (t2n(pmax) + min_cls).tolist() )
pred_all = np.array(pred_all)
print(pred_all.shape)

if i == 0:
    pred_in_clique = copy.deepcopy(pred_all)
else:
    pred_in_clique = np.hstack((pred_in_clique, pred_all))

```

```

[42]: print('cliques by test samples:', pred_in_clique.shape)

# compute prototypes
be      = 0.6 # 1.
l2      = True # False True
bias    = 0 # 0.05
protots = np.mean(feats_trans(support_data_, beta=be, l2=l2, bias=bias), axis=1)
query_pts = feats_trans(query_data_, beta=be, l2=l2, bias=bias)
# acenss  = feats_trans(acens, beta=be, l2=l2, bias=bias)
if brother:
    dist      = funbtch(query_pts, protots) # protots / acenss
else:
    dist      = fun(query_pts, protots) # protots / acenss

test_splt = [sum(test_share[:t+1]) for t in range(len(test_share))]

```

```

[238]: dist_in_clique = np.zeros_like(pred_in_clique, dtype=np.float32)
for c_id, clique in enumerate(pred_in_clique):
    for s_id, samp in enumerate(clique):
        dist_in_clique[c_id][s_id] = dist[s_id][samp]

```

```

[253]: for i in range(task_num + 1):
        clique_dist = dist_in_clique[:,i+1,:test_splt[i]]
        clique_pred = np.argmax(clique_dist, axis=0)
        merge_pred = [pred_in_clique[cli,s_id] for s_id, cli in
            →enumerate(clique_pred)]
        merge_acc = np.mean(merge_pred == query_label_[:test_splt[i]])
        print(merge_acc)
print('DaC:', 'beta:', be, '| l2:', l2)

```

```

[28]: print('===== Experiment Done! =====')

```

===== Experiment Done! =====

## iVoro-AC/ AI on TinyImageNet Dataset (10 Phases, 3rd Block Features)

```
[1]: import matplotlib.pyplot as plt
import os
import pickle
import numpy as np
import pandas as pd
import seaborn as sns
import time
import sys
sys.path.append('../')
sys.path.append('../analysis/')
import copy
import platform
import json
import pickle
import random

import torch
from scipy.stats import mode
```

```
[37]: from ResNet import resnet18_cbam

data_name      = 'Tiny' # 'Subset' # 'Tiny' # 'CIFAR100' # 'MNIST'
total_nc       = 200 # 200 # 100 # 10
fg_nc          = 100 # 100 # 40 # 50 # 4
task_num       = 10 # 20 # 5 # 10 # 2

# constant params
class_set      = list(range(total_nc))
ROTATION       = True
EMB2D          = False
DESIGN         = True
virtual_class  = 4*total_nc if ROTATION else total_nc
suffix         = 'voro' # 'prob' 'voro'
assert (total_nc - fg_nc)%task_num == 0
task_size      = int((total_nc - fg_nc)/task_num)
```

```

file_name      =_
    ↳data_name+'_'+str(fg_nc)+'_'+str(task_num)+'x'+str(task_size)+suffix

print(file_name)

brother        = True # True False

```

Tiny\_100\_10x10voro

```

[38]: save_path = '../checkpoints/'
      path      = save_path + file_name + '/'
      filename   = path + '%d_model.pkl' % (fg_nc+0) # +5
      model      = torch.load(filename)
      model.eval()
      print('> loaded base phase model from:', filename)

```

> loaded base phase model from: ../checkpoints/Tiny\_100\_10x10voro/100\_model.pkl

```

[39]: from voro_helper import num_param, t2n, \
      load_feat, sanity_check, \
      id2emb_, num_samp, merge_sc, funbtch

num_param(model)

# voronoi centers:
vcenter = t2n(model.module.classifier.weight.data / 2.)
print(vcenter.shape)

```

```

module.classifier.weight      torch.Size([400, 512])  204800  True
total: 204800
(400, 512)

```

```

[40]: '''
      CIFAR:
          'CIFAR100_50_5x10_test.pkl'
          'CIFAR100_50_5x10_train.pkl'
          'CIFAR100_40_20x3_test.pkl'
          'CIFAR100_40_20x3_train.pkl'
      more CIFAR:
          'CIFAR100_40_12x5_test.pkl'
          'CIFAR100_40_12x5_train.pkl'
          'CIFAR100_30_14x5_test.pkl'
          'CIFAR100_30_14x5_train.pkl'
          'CIFAR100_20_16x5_test.pkl'
          'CIFAR100_20_16x5_train.pkl'
          'CIFAR100_10_18x5_test.pkl'
          'CIFAR100_10_18x5_train.pkl'
      Tiny:

```



```

        'Tiny_100_20x5_test.pkl'
        'Tiny_100_20x5_train.pkl'
TinyL3:
        'Tiny_100_5x20_test.pkl'
        'Tiny_100_5x20_train.pkl'
Subset:
        'Subset_50_10x5_test.pkl'
        'Subset_50_10x5_train.pkl'
'''
ffile = '../embedding/probL3/' + 'Tiny_100_5x20_test.pkl' # prob probL3
dataphas, last_tsk = load_feat(ffile)

labs, embeds, outputs = dataphas[last_tsk][last_tsk]
false_id, pred_ = sanity_check(labs, embeds, outputs)

```

```

feature file: ../embedding/probL3/Tiny_100_5x20_test.pkl
> loaded tasks: dict_keys([5])
> classes: [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18,
19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38,
39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58,
59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78,
79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98,
99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114,
115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130,
131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146,
147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162,
163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178,
179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194,
195, 196, 197, 198, 199]
> samples: 10000
> embedding: 256
> classification: 800
~ acc (single): 33.29%
~ acc (quadruple): 26.04%

```

```

[41]: ffile = '../embedding/probL3/' + 'Tiny_100_5x20_train.pkl' # prob probL3
dataphas, last_tsk = load_feat(ffile)

labst, embedst, outputst = dataphas[last_tsk][last_tsk]
false_id, pred_ = sanity_check(labst, embedst, outputst)

```

```

feature file: ../embedding/probL3/Tiny_100_5x20_train.pkl
> loaded tasks: dict_keys([5])
> classes: [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18,
19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38,
39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58,
59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78,
79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98,

```

```

99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114,
115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130,
131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146,
147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162,
163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178,
179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194,
195, 196, 197, 198, 199]
> samples: 99968
> embedding: 256
> classification: 800
~ acc (single): 35.18%
~ acc (quadruple): 27.57%

```

```

[42]: embs = id2emb_(labs, embeds, brother=brother)
      embst = id2emb_(labst, embedst, brother=brother)

      sam_max, sam_min = num_samp(embst)
      print('> loading data done!')

```

```

0 499,1 499,2 499,3 499,4 500,5 500,6 500,7 500,8 499,9 499,10 499,11 499,12
500,13 500,14 500,15 500,16 500,17 500,18 500,19 500,20 500,21 500,22 500,23
500,24 500,25 500,26 500,27 500,28 500,29 500,30 500,31 500,32 500,33 500,34
500,35 500,36 500,37 500,38 500,39 500,40 500,41 500,42 500,43 500,44 500,45
500,46 500,47 500,48 500,49 500,50 500,51 500,52 500,53 500,54 500,55 500,56
499,57 499,58 499,59 499,60 500,61 500,62 500,63 500,64 500,65 500,66 500,67
500,68 499,69 499,70 499,71 499,72 499,73 499,74 499,75 499,76 500,77 500,78
500,79 500,80 499,81 499,82 499,83 499,84 500,85 500,86 500,87 500,88 500,89
500,90 500,91 500,92 500,93 500,94 500,95 500,96 500,97 500,98 500,99 500,100
500,101 500,102 500,103 500,104 500,105 500,106 500,107 500,108 499,109 499,110
499,111 499,112 500,113 500,114 500,115 500,116 500,117 500,118 500,119 500,120
500,121 500,122 500,123 500,124 499,125 499,126 499,127 499,128 500,129 500,130
500,131 500,132 500,133 500,134 500,135 500,136 499,137 499,138 499,139 499,140
500,141 500,142 500,143 500,144 499,145 499,146 499,147 499,148 500,149 500,150
500,151 500,152 500,153 500,154 500,155 500,156 499,157 499,158 499,159 499,160
500,161 500,162 500,163 500,164 500,165 500,166 500,167 500,168 500,169 500,170
500,171 500,172 500,173 500,174 500,175 500,176 499,177 499,178 499,179 499,180
500,181 500,182 500,183 500,184 500,185 500,186 500,187 500,188 500,189 500,190
500,191 500,192 500,193 500,194 500,195 500,196 500,197 500,198 500,199 500,200
500,201 500,202 500,203 500,204 500,205 500,206 500,207 500,208 500,209 500,210
500,211 500,212 500,213 500,214 500,215 500,216 500,217 500,218 500,219 500,220
500,221 500,222 500,223 500,224 500,225 500,226 500,227 500,228 500,229 500,230
500,231 500,232 500,233 500,234 500,235 500,236 499,237 499,238 499,239 499,240
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500,261 500,262 500,263 500,264 500,265 500,266 500,267 500,268 500,269 500,270
500,271 500,272 500,273 500,274 500,275 500,276 500,277 500,278 500,279 500,280
500,281 500,282 500,283 500,284 500,285 500,286 500,287 500,288 499,289 499,290
499,291 499,292 500,293 500,294 500,295 500,296 500,297 500,298 500,299 500,300

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500,301 500,302 500,303 500,304 500,305 500,306 500,307 500,308 500,309 500,310  
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500,331 500,332 500,333 500,334 500,335 500,336 498,337 498,338 498,339 498,340  
500,341 500,342 500,343 500,344 500,345 500,346 500,347 500,348 499,349 499,350  
499,351 499,352 500,353 500,354 500,355 500,356 500,357 500,358 500,359 500,360  
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500,371 500,372 500,373 500,374 500,375 500,376 500,377 500,378 500,379 500,380  
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499,501 499,502 499,503 499,504 500,505 500,506 500,507 500,508 500,509 500,510  
500,511 500,512 500,513 500,514 500,515 500,516 500,517 500,518 500,519 500,520  
500,521 500,522 500,523 500,524 500,525 500,526 500,527 500,528 500,529 500,530  
500,531 500,532 500,533 500,534 500,535 500,536 500,537 500,538 500,539 500,540  
499,541 499,542 499,543 499,544 500,545 500,546 500,547 500,548 500,549 500,550  
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500,561 500,562 500,563 500,564 500,565 500,566 500,567 500,568 500,569 500,570  
500,571 500,572 500,573 500,574 500,575 500,576 499,577 499,578 499,579 499,580  
499,581 499,582 499,583 499,584 500,585 500,586 500,587 500,588 500,589 500,590  
500,591 500,592 500,593 500,594 500,595 500,596 500,597 500,598 500,599 500,600  
499,601 499,602 499,603 499,604 500,605 500,606 500,607 500,608 500,609 500,610  
500,611 500,612 499,613 499,614 499,615 499,616 500,617 500,618 500,619 500,620  
500,621 500,622 500,623 500,624 500,625 500,626 500,627 500,628 500,629 500,630  
500,631 500,632 500,633 500,634 500,635 500,636 500,637 500,638 500,639 500,640  
500,641 500,642 500,643 500,644 500,645 500,646 500,647 500,648 500,649 500,650  
500,651 500,652 500,653 500,654 500,655 500,656 500,657 500,658 500,659 500,660  
500,661 500,662 500,663 500,664 500,665 500,666 500,667 500,668 500,669 500,670  
500,671 500,672 500,673 500,674 500,675 500,676 500,677 500,678 500,679 500,680  
500,681 500,682 500,683 500,684 500,685 500,686 500,687 500,688 499,689 499,690  
499,691 499,692 500,693 500,694 500,695 500,696 500,697 500,698 500,699 500,700  
500,701 500,702 500,703 500,704 500,705 500,706 500,707 500,708 499,709 499,710  
499,711 499,712 500,713 500,714 500,715 500,716 500,717 500,718 500,719 500,720  
500,721 500,722 500,723 500,724 500,725 500,726 500,727 500,728 500,729 500,730  
500,731 500,732 500,733 500,734 500,735 500,736 500,737 500,738 500,739 500,740  
500,741 500,742 500,743 500,744 500,745 500,746 500,747 500,748 499,749 499,750  
499,751 499,752 500,753 500,754 500,755 500,756 500,757 500,758 500,759 500,760  
500,761 500,762 500,763 500,764 500,765 500,766 500,767 500,768 500,769 500,770  
500,771 500,772 500,773 500,774 500,775 500,776 498,777 498,778 498,779 498,780

```
500,781 500,782 500,783 500,784 500,785 500,786 500,787 500,788 500,789 500,790
500,791 500,792 500,793 500,794 500,795 500,796 500,797 500,798 500,799 500,
max samples: 500
min samples: 498
> loading data done!
```

```
[43]: for k,v in embst.items():
      if v.shape[0] < sam_max:
          rid = np.random.choice(v.shape[0], sam_max-v.shape[0], replace=False)
          print('filling', sam_max-v.shape[0], 'samples')
          embst[k] = np.vstack((v, v[rid]))
```

[illegible]

[illegible]

[illegible]

```
[44]: from voro_helper import get_task_data, feat_trans, NC_o, tsk_cls, fun, \
      ↪ acc_brother, forgetting

      i = task_num
      support_data_, support_label_, query_data_, query_label_, n_ways_, n_shot_, _ = \
          get_task_data(embst, embs, i, fg_nc, class_set, task_size, brother=brother)
```

```
##### current_task: 10 #####
current classes [760 761 762 763 764 765 766 767 768 769 770 771 772 773 774 775
776 777
```

```

778 779 780 781 782 783 784 785 786 787 788 789 790 791 792 793 794 795
796 797 798 799]
[output] all classes 0 -> 799

```

```

[45]: ##### =====
      ->=====
be      = 1. # 1.
l2      = False # False True
protots = np.mean(feats_trans(support_data_, beta=be, l2=l2), axis=1)

```

```

[35]: i = 0
support_data, support_label, query_data, query_label, n_ways, n_shot, classes = \
    get_task_data(embst, embs, i, fg_nc, class_set, task_size, brother=brother)
acc, _, nn_pre = NC_o(support_data, support_label,
                      query_data, query_label,
                      n_ways, n_shot,
                      beta = be, l2 = l2,
                      given_cen = protots[classes], given_only = True,
                      brother = brother)

```

```

##### current_task: 0 #####
current classes [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17,
18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37,
38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57,
58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77,
78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97,
98, 99]
[output] all classes 0 -> 99
0.2538

```

```

[46]: local      = False # True / False
nn_acc      = []
savefile = path+'NN3' if brother else None # NN / NNp / NN3 / only saved NN
      ->results!
savefil2 = path+'NN3'
forget      = True # True False # calculate forgetting
class_ladder = []
a           = []
for i in range(task_num + 1):
    support_data, support_label, query_data, query_label, n_ways, n_shot,
    ->classes = \
        get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                      local = local, brother = brother) # False
    if forget:
        class_ladder.append(classes)
    acc, _, nn_pre = NC_o(support_data, support_label,
                          query_data, query_label,

```

```

        n_ways, n_shot,
        beta = be, l2 = l2,
        given_cen = protots[classes] if local else protots[:
→classes[-1]+1],

        given_only = True,
        brother = brother,
        savefile = savefile+'_'+str(i) if brother else None,
        savefile2 = None, # savefile2+'_'+str(i), # None, #
        weights = [0.7, 0.3],
        class_ladder = class_ladder,
        acc_all = a
    )

    nn_acc.append(acc)
    # if all classes up2now: local = False, and protots[:classes[-1]+1]
print('local:', local, '| beta:', be, '| l2:', l2)
if brother:
    for accs in nn_acc:
        print('\t'.join([str(i) for i in accs]))
else:
    print('\n'.join([str(i) for i in nn_acc]))
if forget:
    avgf = forgetting(a, task_num)
    print(avgf)

```

##### current\_task: 0 #####

```

current classes [ 0  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15
16 17
    18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35
    36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53
    54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71
    72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89
    90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107
    108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125
    126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143
    144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161
    162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179
    180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197
    198 199 200 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215
    216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233
    234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250 251
    252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269
    270 271 272 273 274 275 276 277 278 279 280 281 282 283 284 285 286 287
    288 289 290 291 292 293 294 295 296 297 298 299 300 301 302 303 304 305
    306 307 308 309 310 311 312 313 314 315 316 317 318 319 320 321 322 323
    324 325 326 327 328 329 330 331 332 333 334 335 336 337 338 339 340 341
    342 343 344 345 346 347 348 349 350 351 352 353 354 355 356 357 358 359
    360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375 376 377

```



```

378 379 380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395
396 397 398 399]
[output] all classes 0 -> 399
<<< loaded from: ../checkpoints/Tiny_100_10x10voro/NN3_0.npy
0.1636

##### current_task: 1 #####
current classes [400 401 402 403 404 405 406 407 408 409 410 411 412 413 414 415
416 417
418 419 420 421 422 423 424 425 426 427 428 429 430 431 432 433 434 435
436 437 438 439]
[output] all classes 0 -> 439
<<< loaded from: ../checkpoints/Tiny_100_10x10voro/NN3_1.npy
0.1608

##### current_task: 2 #####
current classes [440 441 442 443 444 445 446 447 448 449 450 451 452 453 454 455
456 457
458 459 460 461 462 463 464 465 466 467 468 469 470 471 472 473 474 475
476 477 478 479]
[output] all classes 0 -> 479
<<< loaded from: ../checkpoints/Tiny_100_10x10voro/NN3_2.npy
0.1559

##### current_task: 3 #####
current classes [480 481 482 483 484 485 486 487 488 489 490 491 492 493 494 495
496 497
498 499 500 501 502 503 504 505 506 507 508 509 510 511 512 513 514 515
516 517 518 519]
[output] all classes 0 -> 519
<<< loaded from: ../checkpoints/Tiny_100_10x10voro/NN3_3.npy
0.1491

##### current_task: 4 #####
current classes [520 521 522 523 524 525 526 527 528 529 530 531 532 533 534 535
536 537
538 539 540 541 542 543 544 545 546 547 548 549 550 551 552 553 554 555
556 557 558 559]
[output] all classes 0 -> 559
<<< loaded from: ../checkpoints/Tiny_100_10x10voro/NN3_4.npy
0.1514

##### current_task: 5 #####
current classes [560 561 562 563 564 565 566 567 568 569 570 571 572 573 574 575
576 577
578 579 580 581 582 583 584 585 586 587 588 589 590 591 592 593 594 595
596 597 598 599]
[output] all classes 0 -> 599

```

```

<<< loaded from: ../checkpoints/Tiny_100_10x10voro/NN3_5.npy
0.1451

##### current_task: 6 #####
current classes [600 601 602 603 604 605 606 607 608 609 610 611 612 613 614 615
616 617
618 619 620 621 622 623 624 625 626 627 628 629 630 631 632 633 634 635
636 637 638 639]
[output] all classes 0 -> 639
<<< loaded from: ../checkpoints/Tiny_100_10x10voro/NN3_6.npy
0.1400

##### current_task: 7 #####
current classes [640 641 642 643 644 645 646 647 648 649 650 651 652 653 654 655
656 657
658 659 660 661 662 663 664 665 666 667 668 669 670 671 672 673 674 675
676 677 678 679]
[output] all classes 0 -> 679
<<< loaded from: ../checkpoints/Tiny_100_10x10voro/NN3_7.npy
0.1364

##### current_task: 8 #####
current classes [680 681 682 683 684 685 686 687 688 689 690 691 692 693 694 695
696 697
698 699 700 701 702 703 704 705 706 707 708 709 710 711 712 713 714 715
716 717 718 719]
[output] all classes 0 -> 719
<<< loaded from: ../checkpoints/Tiny_100_10x10voro/NN3_8.npy
0.1321

##### current_task: 9 #####
current classes [720 721 722 723 724 725 726 727 728 729 730 731 732 733 734 735
736 737
738 739 740 741 742 743 744 745 746 747 748 749 750 751 752 753 754 755
756 757 758 759]
[output] all classes 0 -> 759
<<< loaded from: ../checkpoints/Tiny_100_10x10voro/NN3_9.npy
0.1298

##### current_task: 10 #####
current classes [760 761 762 763 764 765 766 767 768 769 770 771 772 773 774 775
776 777
778 779 780 781 782 783 784 785 786 787 788 789 790 791 792 793 794 795
796 797 798 799]
[output] all classes 0 -> 799
<<< loaded from: ../checkpoints/Tiny_100_10x10voro/NN3_10.npy
0.1248
local: False | beta: 1.0 | l2: False

```

```

0.1636 0.3312 0.502 0.4926 0.493
0.1608181818181818 0.32127272727272727 0.49254545454545456
0.48454545454545456 0.48145454545454547
0.155875 0.30666666666666664 0.48416666666666667 0.475
0.4708333333333333
0.14911538461538462 0.2969230769230769 0.47507692307692306
0.46615384615384614 0.46507692307692305
0.15142857142857144 0.3017142857142857 0.4774285714285714 0.468
0.4665714285714286
0.14506666666666668 0.28986666666666666 0.46666666666666667
0.45706666666666667 0.45386666666666664
0.14 0.28125 0.462125 0.453625 0.449375
0.1363529411764706 0.27305882352941174 0.4536470588235294
0.4445882352941177 0.4408235294117647
0.13213888888888889 0.26288888888888889 0.442 0.43333333333333335
0.43
0.12976315789473683 0.25526315789473686 0.42726315789473684
0.41936842105263156 0.41410526315789475
0.1248 0.2441 0.4203 0.4129 0.4081
[[0.1636 0. 0. 0. 0. 0. 0. 0. 0.
 0. 0. ]
[0.15475 0.2215 0. 0. 0. 0. 0. 0. 0.
 0. 0. ]
[0.1484 0.21 0.1765 0. 0. 0. 0. 0. 0.
 0. 0. ]
[0.14355 0.2045 0.1725 0.126 0. 0. 0. 0. 0.
 0. 0. ]
[0.1375 0.1965 0.171 0.1225 0.255 0. 0. 0. 0.
 0. 0. ]
[0.13095 0.1895 0.1655 0.1195 0.243 0.149 0. 0. 0.
 0. 0. ]
[0.12635 0.1875 0.1655 0.118 0.2365 0.1475 0.1215 0. 0.
 0. 0. ]
[0.12155 0.173 0.164 0.117 0.2345 0.139 0.12 0.155 0.
 0. 0. ]
[0.1198 0.1695 0.162 0.1155 0.2345 0.139 0.1175 0.1545 0.088
 0. 0. ]
[0.11705 0.1665 0.1615 0.1115 0.232 0.1365 0.1175 0.152 0.086
 0.1315 0. ]
[0.11565 0.1655 0.1595 0.106 0.229 0.1315 0.1155 0.152 0.083
 0.1285 0.069 ]]
[0, 0.8849999999999997, 1.335, 1.3683333333333334, 1.5024999999999999,
1.8829999999999996, 1.8375000000000004, 2.0578571428571424, 1.9474999999999996,
1.9505555555555555, 2.0144999999999995]

```

```

[14]: def predict(model, x, voro=True):
      x = torch.from_numpy(x.astype(np.float32)).cuda()

```

```

with torch.no_grad():
    predi = model.module.classifier(x)
if voro:
    predi += - torch.sum((model.module.classifier.weight/2.)**2, dim=1)
return predi

classes_all = []
test_share = []
paccS = []
for i in range(task_num + 1):
    support_data, support_label, query_data, query_label, n_ways, n_shot, \
    →classes = \
        get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                        local = True, brother = brother)

    # load model:
    if brother:
        cls_01 = classes[-1]+1
        assert cls_01 % 4 == 0
        filename = path + '%d_model.pkl' % (int(cls_01/4))
    else:
        filename = path + '%d_model.pkl' % (classes[-1]+1)
    model = torch.load(filename)
    model.eval()
    print('> loaded base phase model from:', filename)
    num_param(model)
    # do prediction:
    min_cls = min(classes)
    if brother:
        pred = predict(model, query_data)
    else:
        pred = predict(model, query_data)[:,:,:4]
    pmax = torch.max(pred, dim=1)[1]
    pacc = np.mean(t2n(pmax) == query_label - min_cls)
    print(pacc)
    if brother:
        accs = acc_brother(t2n(pred), t2n(pmax), query_label - min_cls, \
    →forLG=True)
        pacc = [pacc] + accs
    paccS.append(pacc)
    classes_all.append(classes)
    test_share.append(len(query_label))
print('all logistic locally:')
if brother:
    for accs in paccS:
        print('\t'.join([str(i) for i in accs]))
else:
    print('\n'.join([str(i) for i in paccS]))

```

```

[15]: for i in range(task_num + 1):
        support_data, support_label, query_data, query_label, n_ways, n_shot, \
        classes = \
            get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                           local = True, brother = brother)

        pred_all = []
        for classes in classes_all:
            # load model:
            if brother:
                cls_01 = classes[-1]+1
                assert cls_01 % 4 == 0
                filename = path + '%d_model.pkl' % (int(cls_01/4))
            else:
                filename = path + '%d_model.pkl' % (classes[-1]+1)
            model = torch.load(filename)
            model.eval()
            print('> loaded base phase model from:', filename)
            num_param(model)
            # do prediction:
            min_cls = min(classes)
            if brother:
                pred = predict(model, query_data)
            else:
                pred = predict(model, query_data)[:,:,:4]
            pmax = torch.max(pred, dim=1)[1]
            # pacc = np.mean(t2n(pmax) == query_label - min_cls)
            # print(pacc)
            if brother:
                labs_01 = query_label[:4]//4
                acc_, sc_pre = merge_sc(t2n(pred), labs_01,
                                         mth='softmax', forLG=True, return_pre=True)
                min_cls = int(min_cls / 4)
                pred_all.append( (sc_pre + min_cls).tolist() )
            else:
                pred_all.append( (t2n(pmax) + min_cls).tolist() )
        pred_all = np.array(pred_all)
        print(pred_all.shape)

        if i == 0:
            pred_in_clique = copy.deepcopy(pred_all)
        else:
            pred_in_clique = np.hstack((pred_in_clique, pred_all))

[42]: print('cliques by test samples:', pred_in_clique.shape)

        # compute prototypes
        be = 0.6 # 1.

```

```

l2      = True # False True
bias    = 0 # 0.05
protots = np.mean(feats_trans(support_data_, beta=be, l2=l2, bias=bias), axis=1)
query_pts = feats_trans(query_data_, beta=be, l2=l2, bias=bias)
# acenss = feats_trans(acens, beta=be, l2=l2, bias=bias)
if brother:
    dist = funbtch(query_pts, protots) # protots / acenss
else:
    dist = fun(query_pts, protots) # protots / acenss

test_splt = [sum(test_share[:t+1]) for t in range(len(test_share))]

```

```

[238]: dist_in_clique = np.zeros_like(pred_in_clique, dtype=np.float32)
for c_id, clique in enumerate(pred_in_clique):
    for s_id, samp in enumerate(clique):
        dist_in_clique[c_id][s_id] = dist[s_id][samp]

```

```

[253]: for i in range(task_num + 1):
        clique_dist = dist_in_clique[:i+1,:test_splt[i]]
        clique_pred = np.argmax(clique_dist, axis=0)
        merge_pred = [pred_in_clique[cli,s_id] for s_id, cli in
            →enumerate(clique_pred)]
        merge_acc = np.mean(merge_pred == query_label_[:test_splt[i]])
        print(merge_acc)
print('DaC:', 'beta:', be, '| l2:', l2)

```

```

[28]: print('==== Experiment Done! =====')

```

```

===== Experiment Done! =====

```

## iVoro on TinyImageNet Dataset (20 Phases, 3rd Block Features)

```
[3]: import matplotlib.pyplot as plt
import os
import pickle
import numpy as np
import pandas as pd
import seaborn as sns
import time
import sys
sys.path.append('../')
sys.path.append('../analysis/')
import copy
import platform
import json
import pickle
import random

import torch
from scipy.stats import mode
```

```
[4]: from ResNet import resnet18_cbam

data_name      = 'Tiny' # 'Subset' # 'Tiny' # 'CIFAR100' # 'MNIST'
total_nc       = 200 # 200 # 100 # 10
fg_nc          = 100 # 100 # 40 # 50 # 4
task_num       = 20 # 20 # 5 # 10 # 2

# constant params
class_set      = list(range(total_nc))
ROTATION       = True
EMB2D          = False
DESIGN         = True
virtual_class  = 4*total_nc if ROTATION else total_nc
suffix         = 'voro' # 'prob' 'voro'
assert (total_nc - fg_nc)%task_num == 0
task_size      = int((total_nc - fg_nc)/task_num)
```

```

file_name      =_
    ↳data_name+'_'+str(fg_nc)+'_'+str(task_num)+'x'+str(task_size)+suffix

print(file_name)

brother        = False # True False

```

Tiny\_100\_20x5voro

```

[5]: save_path = '../checkpoints/'
path   = save_path + file_name + '/'
filename = path + '%d_model.pkl' % (fg_nc+0) # +5
model   = torch.load(filename)
model.eval()
print('> loaded base phase model from:', filename)

```

> loaded base phase model from: ../checkpoints/Tiny\_100\_20x5voro/100\_model.pkl

```

[6]: from voro_helper import num_param, t2n, \
        load_feat, sanity_check, \
        id2emb_, num_samp, merge_sc, funbtch

num_param(model)

# voronoi centers:
vcenter = t2n(model.module.classifier.weight.data / 2.)
print(vcenter.shape)

```

```

module.classifier.weight      torch.Size([400, 512])  204800  True
total: 204800
(400, 512)

```

```

[7]: '''
CIFAR:
    'CIFAR100_50_5x10_test.pkl'
    'CIFAR100_50_5x10_train.pkl'
    'CIFAR100_40_20x3_test.pkl'
    'CIFAR100_40_20x3_train.pkl'
more CIFAR:
    'CIFAR100_40_12x5_test.pkl'
    'CIFAR100_40_12x5_train.pkl'
    'CIFAR100_30_14x5_test.pkl'
    'CIFAR100_30_14x5_train.pkl'
    'CIFAR100_20_16x5_test.pkl'
    'CIFAR100_20_16x5_train.pkl'
    'CIFAR100_10_18x5_test.pkl'
    'CIFAR100_10_18x5_train.pkl'
Tiny:

```



```

        'Tiny_100_20x5_test.pkl'
        'Tiny_100_20x5_train.pkl'
TinyL3:
        'Tiny_100_5x20_test.pkl'
        'Tiny_100_5x20_train.pkl'
Subset:
        'Subset_50_10x5_test.pkl'
        'Subset_50_10x5_train.pkl'
'''
ffile = '../embedding/probL3/' + 'Tiny_100_5x20_test.pkl' # prob probL3
dataphas, last_tsk = load_feat(ffile)

labs, embeds, outputs = dataphas[last_tsk][last_tsk]
false_id, pred_ = sanity_check(labs, embeds, outputs)

```

```

feature file: ../embedding/probL3/Tiny_100_5x20_test.pkl
> loaded tasks: dict_keys([5])
> classes: [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18,
19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38,
39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58,
59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78,
79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98,
99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114,
115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130,
131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146,
147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162,
163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178,
179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194,
195, 196, 197, 198, 199]
> samples: 10000
> embedding: 256
> classification: 800
~ acc (single): 33.29%
~ acc (quadruple): 26.04%

```

```

[8]: ffile = '../embedding/probL3/' + 'Tiny_100_5x20_train.pkl' # prob probL3
dataphas, last_tsk = load_feat(ffile)

labst, embedst, outputst = dataphas[last_tsk][last_tsk]
false_id, pred_ = sanity_check(labst, embedst, outputst)

```

```

feature file: ../embedding/probL3/Tiny_100_5x20_train.pkl
> loaded tasks: dict_keys([5])
> classes: [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18,
19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38,
39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58,
59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78,
79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98,

```

```

99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114,
115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130,
131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146,
147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162,
163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178,
179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194,
195, 196, 197, 198, 199]
> samples: 99968
> embedding: 256
> classification: 800
~ acc (single): 35.18%
~ acc (quadruple): 27.57%

```

```

[9]: embs = id2emb_(labs, embeds, brother=brother)
      embst = id2emb_(labst, embedst, brother=brother)

      sam_max, sam_min = num_samp(embst)
      print('> loading data done!')

```

```

0 499,1 500,2 499,3 500,4 500,5 500,6 500,7 500,8 500,9 500,10 500,11 500,12
500,13 500,14 499,15 500,16 500,17 499,18 499,19 500,20 499,21 500,22 500,23
500,24 500,25 500,26 500,27 499,28 500,29 500,30 500,31 499,32 500,33 500,34
499,35 500,36 499,37 500,38 500,39 499,40 500,41 500,42 500,43 500,44 499,45
500,46 500,47 500,48 500,49 500,50 500,51 500,52 500,53 500,54 500,55 500,56
500,57 500,58 500,59 499,60 499,61 499,62 500,63 500,64 500,65 500,66 500,67
500,68 500,69 500,70 500,71 500,72 499,73 500,74 500,75 500,76 500,77 500,78
500,79 500,80 500,81 500,82 500,83 500,84 498,85 500,86 500,87 499,88 500,89
500,90 500,91 500,92 500,93 500,94 500,95 500,96 500,97 500,98 500,99 500,100
500,101 500,102 500,103 500,104 500,105 500,106 500,107 500,108 500,109 500,110
500,111 499,112 500,113 500,114 500,115 500,116 499,117 500,118 500,119 500,120
500,121 500,122 500,123 500,124 500,125 499,126 500,127 500,128 500,129 500,130
500,131 500,132 500,133 500,134 500,135 499,136 500,137 500,138 500,139 500,140
500,141 500,142 500,143 500,144 499,145 499,146 500,147 500,148 500,149 500,150
499,151 500,152 500,153 499,154 500,155 500,156 500,157 500,158 500,159 500,160
500,161 500,162 500,163 500,164 500,165 500,166 500,167 500,168 500,169 500,170
500,171 500,172 499,173 500,174 500,175 500,176 500,177 499,178 500,179 500,180
500,181 500,182 500,183 500,184 500,185 500,186 500,187 499,188 500,189 500,190
500,191 500,192 500,193 500,194 498,195 500,196 500,197 500,198 500,199 500,
max samples: 500
min samples: 498
> loading data done!

```

```

[10]: for k,v in embst.items():
      if v.shape[0] < sam_max:
          rid = np.random.choice(v.shape[0], sam_max-v.shape[0], replace=False)
          print('filling', sam_max-v.shape[0], 'samples')
          embst[k] = np.vstack((v, v[rid]))

```

filling 1 samples

[illegible]

```
[11]: from voro_helper import get_task_data, feat_trans, NC_o, tsk_cls, fun, \
      ↪ acc_brother, forgetting

      i = task_num
      support_data_, support_label_, query_data_, query_label_, n_ways_, n_shot_, _ = \
          get_task_data(embst, embs, i, fg_nc, class_set, task_size, brother=brother)
```

```
##### current_task: 20 #####
current classes [195, 196, 197, 198, 199]
[output] all classes 0 -> 199
```

```
[12]: #####  
      ↪=====  
be      = 1. # 1.  
l2      = False # False True  
protots = np.mean(feats_trans(support_data_, beta=be, l2=l2), axis=1)
```

```
[13]: i = 0
support_data, support_label, query_data, query_label, n_ways, n_shot, classes = \
    get_task_data(embst, embs, i, fg_nc, class_set, task_size, brother=brother)
acc, _, nn_pre = NC_o(support_data, support_label,
                      query_data, query_label,
                      n_ways, n_shot,
                      beta = be, l2 = l2,
                      given_cen = protots[classes], given_only = True,
                      brother = brother)
```

```
##### current_task: 0 #####
current classes [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17,
18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37,
38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57,
58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77,
78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97,
98, 99]
[output] all classes 0 -> 99
0.2538
```

```
[14]: local      = False # True / False
nn_acc      = []
savefile    = path+'NN3' if brother else None # NN / NNp / NN3 / only saved NN
           →results!
savefil2    = path+'NN3'
forget      = True # True False # calculate forgetting
class_ladder = []
a           = []
for i in range(task_num + 1):
    support_data, support_label, query_data, query_label, n_ways, n_shot,
    →classes = \
        get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                      local = local, brother = brother) # False
    if forget:
        class_ladder.append(classes)
    acc, _, nn_pre = NC_o(support_data, support_label,
                          query_data, query_label,
                          n_ways, n_shot,
                          beta = be, l2 = l2,
                          given_cen = protots[classes] if local else protots[:
    →classes[-1]+1],
                          given_only = True,
                          brother = brother,
                          savefile = savefile+'_'+str(i) if brother else None,
                          savefile2 = None, # savefil2+'_'+str(i), # None, #
                          weights = [0.7, 0.3],
```

```

        class_ladder = class_ladder,
        acc_all = a
    )

    nn_acc.append(acc)
    # if all classes up2now: local = False, and protots[:classes[-1]+1]
print('local:', local, '| beta:', be, '| 12:', 12)
if brother:
    for accs in nn_acc:
        print('\t'.join([str(i) for i in accs]))
else:
    print('\n'.join([str(i) for i in nn_acc]))
if forget:
    avgf = forgetting(a, task_num)
    print(avgf)

```

```

##### current_task: 0 #####
current classes [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17,
18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37,
38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57,
58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77,
78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97,
98, 99]

```

```

[output] all classes 0 -> 99
0.2538

```

```

##### current_task: 1 #####
current classes [100, 101, 102, 103, 104]
[output] all classes 0 -> 104
0.2474

```

```

##### current_task: 2 #####
current classes [105, 106, 107, 108, 109]
[output] all classes 0 -> 109
0.2453

```

```

##### current_task: 3 #####
current classes [110, 111, 112, 113, 114]
[output] all classes 0 -> 114
0.2414

```

```

##### current_task: 4 #####
current classes [115, 116, 117, 118, 119]
[output] all classes 0 -> 119
0.2367

```

```

##### current_task: 5 #####
current classes [120, 121, 122, 123, 124]

```

```

[output] all classes 0 -> 124
0.2325

##### current_task: 6 #####
current classes [125, 126, 127, 128, 129]
[output] all classes 0 -> 129
0.2271

##### current_task: 7 #####
current classes [130, 131, 132, 133, 134]
[output] all classes 0 -> 134
0.2305

##### current_task: 8 #####
current classes [135, 136, 137, 138, 139]
[output] all classes 0 -> 139
0.2319

##### current_task: 9 #####
current classes [140, 141, 142, 143, 144]
[output] all classes 0 -> 144
0.2259

##### current_task: 10 #####
current classes [145, 146, 147, 148, 149]
[output] all classes 0 -> 149
0.2207

##### current_task: 11 #####
current classes [150, 151, 152, 153, 154]
[output] all classes 0 -> 154
0.2150

##### current_task: 12 #####
current classes [155, 156, 157, 158, 159]
[output] all classes 0 -> 159
0.2115

##### current_task: 13 #####
current classes [160, 161, 162, 163, 164]
[output] all classes 0 -> 164
0.2073

##### current_task: 14 #####
current classes [165, 166, 167, 168, 169]
[output] all classes 0 -> 169
0.2069

```

```

##### current_task: 15 #####
current classes [170, 171, 172, 173, 174]
[output] all classes 0 -> 174
0.2022

##### current_task: 16 #####
current classes [175, 176, 177, 178, 179]
[output] all classes 0 -> 179
0.1991

##### current_task: 17 #####
current classes [180, 181, 182, 183, 184]
[output] all classes 0 -> 184
0.1975

##### current_task: 18 #####
current classes [185, 186, 187, 188, 189]
[output] all classes 0 -> 189
0.1940

##### current_task: 19 #####
current classes [190, 191, 192, 193, 194]
[output] all classes 0 -> 194
0.1912

##### current_task: 20 #####
current classes [195, 196, 197, 198, 199]
[output] all classes 0 -> 199
0.1873
local: False | beta: 1.0 | l2: False
0.2538
0.24742857142857144
0.24527272727272728
0.24139130434782607
0.23666666666666666
0.23248
0.22707692307692307
0.2305185185185185
0.23185714285714284
0.2259310344827586
0.22066666666666668
0.21496774193548387
0.2115
0.20727272727272728
0.20694117647058824
0.20217142857142859
0.19911111111111111
0.1975135135135135

```

0.194

0.19117948717948718

0.1873

```
[0.2538 0.      0.      0.      0.      0.      0.      0.      0.      0.
 0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
 0.      ]
[0.2454 0.288 0.      0.      0.      0.      0.      0.      0.      0.
 0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
 0.      ]
[0.2388 0.288 0.332 0.      0.      0.      0.      0.      0.      0.
 0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
 0.      ]
[0.2346 0.28  0.328 0.252 0.      0.      0.      0.      0.      0.
 0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
 0.      ]
[0.2296 0.272 0.316 0.244 0.256 0.      0.      0.      0.      0.
 0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
 0.      ]
[0.2256 0.272 0.308 0.24  0.256 0.224 0.      0.      0.      0.
 0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
 0.      ]
[0.2224 0.268 0.308 0.24  0.256 0.212 0.172 0.      0.      0.
 0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
 0.      ]
[0.219  0.236 0.304 0.236 0.248 0.212 0.172 0.436 0.      0.
 0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
 0.      ]
[0.2138 0.236 0.304 0.236 0.248 0.208 0.168 0.436 0.38  0.
 0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
 0.      ]
[0.2084 0.228 0.296 0.232 0.248 0.208 0.164 0.416 0.38  0.212
 0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
 0.      ]
[0.2048 0.228 0.296 0.224 0.248 0.204 0.156 0.416 0.376 0.212
 0.164 0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
 0.      ]
[0.1998 0.228 0.288 0.224 0.244 0.204 0.156 0.412 0.352 0.212
 0.164 0.184 0.      0.      0.      0.      0.      0.      0.      0.
 0.      ]
[0.196  0.228 0.288 0.22  0.24  0.204 0.148 0.412 0.352 0.212
 0.16  0.184 0.2   0.      0.      0.      0.      0.      0.      0.
 0.      ]
[0.1926 0.228 0.288 0.22  0.24  0.204 0.144 0.412 0.352 0.212
 0.16  0.184 0.2   0.144 0.      0.      0.      0.      0.      0.
 0.      ]
[0.1878 0.22  0.272 0.22  0.236 0.2   0.144 0.404 0.34  0.188
 0.16  0.184 0.18  0.144 0.388 0.      0.      0.      0.      0.
 0.      ]
```



```

[0.1854 0.216 0.272 0.216 0.236 0.196 0.144 0.404 0.34 0.188
 0.16 0.184 0.176 0.14 0.388 0.108 0. 0. 0. 0.
 0. ]
[0.184 0.212 0.268 0.212 0.236 0.196 0.144 0.4 0.34 0.188
 0.16 0.184 0.176 0.14 0.388 0.104 0.14 0. 0. 0.
 0. ]
[0.182 0.212 0.268 0.212 0.236 0.188 0.144 0.396 0.336 0.18
 0.152 0.184 0.176 0.14 0.384 0.104 0.14 0.216 0. 0.
 0. ]
[0.1796 0.212 0.264 0.212 0.228 0.188 0.14 0.396 0.336 0.18
 0.152 0.18 0.176 0.14 0.384 0.1 0.14 0.216 0.136 0.
 0. ]
[0.1784 0.212 0.264 0.212 0.228 0.188 0.14 0.396 0.336 0.18
 0.14 0.18 0.176 0.14 0.384 0.1 0.14 0.216 0.136 0.12
 0. ]
[0.178 0.212 0.264 0.212 0.228 0.184 0.132 0.396 0.336 0.18
 0.14 0.18 0.172 0.14 0.384 0.1 0.136 0.212 0.128 0.12
 0.076 ]]
[0, 0.84000000000000019, 0.75000000000000007, 1.0399999999999991,
1.60500000000000002, 1.60400000000000005, 1.6566666666666674, 2.1542857142857152,
2.05000000000000007, 2.3711111111111114, 2.41, 2.6000000000000001,
2.581666666666667, 2.44000000000000013, 2.9857142857142858, 2.936,
2.8862500000000004, 2.9400000000000001, 2.9233333333333333, 2.838947368421053,
2.8590000000000004]

```

```

[14]: def predict(model, x, voro=True):
        x = torch.from_numpy(x.astype(np.float32)).cuda()
        with torch.no_grad():
            predi = model.module.classifier(x)
            if voro:
                predi += - torch.sum((model.module.classifier.weight/2.)**2, dim=1)
            return predi

classes_all = []
test_share = []
paccS = []
for i in range(task_num + 1):
    support_data, support_label, query_data, query_label, n_ways, n_shot, \
    →classes = \
        get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                        local = True, brother = brother)

    # load model:
    if brother:
        cls_01 = classes[-1]+1
        assert cls_01 % 4 == 0
        filename = path + '%d_model.pkl' % (int(cls_01/4))
    else:

```

```

        filename = path + '%d_model.pkl' % (classes[-1]+1)
        model = torch.load(filename)
        model.eval()
        print('> loaded base phase model from:', filename)
        num_param(model)
        # do prediction:
        min_cls = min(classes)
        if brother:
            pred = predict(model, query_data)
        else:
            pred = predict(model, query_data)[:,:,:4]
            pmax = torch.max(pred, dim=1)[1]
            pacc = np.mean(t2n(pmax) == query_label - min_cls)
        print(pacc)
        if brother:
            accs = acc_brother(t2n(pred), t2n(pmax), query_label - min_cls,
→forLG=True)
            pacc = [pacc] + accs
            paccS.append(pacc)
            classes_all.append(classes)
            test_share.append(len(query_label))
    print('all logistic locally:')
    if brother:
        for accs in paccS:
            print('\t'.join([str(i) for i in accs]))
    else:
        print('\n'.join([str(i) for i in paccS]))

```

```

[15]: for i in range(task_num + 1):
        support_data, support_label, query_data, query_label, n_ways, n_shot,
→classes = \
            get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                           local = True, brother = brother)
        pred_all = []
        for classes in classes_all:
            # load model:
            if brother:
                cls_01 = classes[-1]+1
                assert cls_01 % 4 == 0
                filename = path + '%d_model.pkl' % (int(cls_01/4))
            else:
                filename = path + '%d_model.pkl' % (classes[-1]+1)
            model = torch.load(filename)
            model.eval()
            print('> loaded base phase model from:', filename)
            num_param(model)
            # do prediction:

```

```

min_cls = min(classes)
if brother:
    pred = predict(model, query_data)
else:
    pred = predict(model, query_data)[:,:,:4]
pmax = torch.max(pred, dim=1)[1]
# pacc = np.mean(t2n(pmax) == query_label - min_cls)
# print(pacc)
if brother:
    labs_01 = query_label[:4]//4
    acc_, sc_pre = merge_sc(t2n(pred), labs_01,
                           mth='softmax', forLG=True, return_pre=True)
    min_cls = int(min_cls / 4)
    pred_all.append( (sc_pre + min_cls).tolist() )
else:
    pred_all.append( (t2n(pmax) + min_cls).tolist() )
pred_all = np.array(pred_all)
print(pred_all.shape)

if i == 0:
    pred_in_clique = copy.deepcopy(pred_all)
else:
    pred_in_clique = np.hstack((pred_in_clique, pred_all))

```

```

[42]: print('cliques by test samples:', pred_in_clique.shape)

# compute prototypes
be      = 0.6 # 1.
l2      = True # False True
bias    = 0 # 0.05
protots = np.mean(feats_trans(support_data_, beta=be, l2=l2, bias=bias), axis=1)
query_pts = feats_trans(query_data_, beta=be, l2=l2, bias=bias)
# acenss = feats_trans(acens, beta=be, l2=l2, bias=bias)
if brother:
    dist = funbtch(query_pts, protots) # protots / acenss
else:
    dist = fun(query_pts, protots) # protots / acenss

test_splt = [sum(test_share[:t+1]) for t in range(len(test_share))]

```

```

[238]: dist_in_clique = np.zeros_like(pred_in_clique, dtype=np.float32)
for c_id, clique in enumerate(pred_in_clique):
    for s_id, samp in enumerate(clique):
        dist_in_clique[c_id][s_id] = dist[s_id][samp]

```

```

[253]: for i in range(task_num + 1):
        clique_dist = dist_in_clique[:i+1,:test_splt[i]]

```

```

    clique_pred = np.argmin(clique_dist, axis=0)
    merge_pred = [pred_in_clique[cli,s_id] for s_id, cli in
→enumerate(clique_pred)]
    merge_acc = np.mean(merge_pred == query_label_[:test_splt[i]])
    print(merge_acc)
print('DaC:', 'beta:', be, '| 12:', 12)

```

```

[28]: print('===== Experiment Done! =====')

```

```

===== Experiment Done! =====

```

## iVoro-AC/AI on TinyImageNet Dataset (20 Phases, 3rd Block Features)

```
[1]: import matplotlib.pyplot as plt
import os
import pickle
import numpy as np
import pandas as pd
import seaborn as sns
import time
import sys
sys.path.append('../')
sys.path.append('../analysis/')
import copy
import platform
import json
import pickle
import random

import torch
from scipy.stats import mode
```

```
[2]: from ResNet import resnet18_cbam

data_name      = 'Tiny' # 'Subset' # 'Tiny' # 'CIFAR100' # 'MNIST'
total_nc       = 200 # 200 # 100 # 10
fg_nc          = 100 # 100 # 40 # 50 # 4
task_num       = 20 # 20 # 5 # 10 # 2

# constant params
class_set      = list(range(total_nc))
ROTATION       = True
EMB2D         = False
DESIGN        = True
virtual_class  = 4*total_nc if ROTATION else total_nc
suffix         = 'voro' # 'prob' 'voro'
assert (total_nc - fg_nc)%task_num == 0
task_size      = int((total_nc - fg_nc)/task_num)
```

```

file_name      =_
    ↳data_name+'_'+str(fg_nc)+'_'+str(task_num)+'x'+str(task_size)+suffix

print(file_name)

brother        = True # True False

```

Tiny\_100\_20x5voro

```

[3]: save_path = '../checkpoints/'
path   = save_path + file_name + '/'
filename = path + '%d_model.pkl' % (fg_nc+0) # +5
model   = torch.load(filename)
model.eval()
print('> loaded base phase model from:', filename)

```

> loaded base phase model from: ../checkpoints/Tiny\_100\_20x5voro/100\_model.pkl

```

[4]: from voro_helper import num_param, t2n, \
        load_feat, sanity_check, \
        id2emb_, num_samp, merge_sc, funbtch

num_param(model)

# voronoi centers:
vcenter = t2n(model.module.classifier.weight.data / 2.)
print(vcenter.shape)

```

```

module.classifier.weight      torch.Size([400, 512])  204800  True
total: 204800
(400, 512)

```

```

[5]: '''
CIFAR:
    'CIFAR100_50_5x10_test.pkl'
    'CIFAR100_50_5x10_train.pkl'
    'CIFAR100_40_20x3_test.pkl'
    'CIFAR100_40_20x3_train.pkl'
more CIFAR:
    'CIFAR100_40_12x5_test.pkl'
    'CIFAR100_40_12x5_train.pkl'
    'CIFAR100_30_14x5_test.pkl'
    'CIFAR100_30_14x5_train.pkl'
    'CIFAR100_20_16x5_test.pkl'
    'CIFAR100_20_16x5_train.pkl'
    'CIFAR100_10_18x5_test.pkl'
    'CIFAR100_10_18x5_train.pkl'
Tiny:

```

```

        'Tiny_100_20x5_test.pkl'
        'Tiny_100_20x5_train.pkl'
TinyL3:
        'Tiny_100_5x20_test.pkl'
        'Tiny_100_5x20_train.pkl'
Subset:
        'Subset_50_10x5_test.pkl'
        'Subset_50_10x5_train.pkl'
'''
ffile = '../embedding/probL3/' + 'Tiny_100_5x20_test.pkl' # prob probL3
dataphas, last_tsk = load_feat(ffile)

labs, embeds, outputs = dataphas[last_tsk][last_tsk]
false_id, pred_ = sanity_check(labs, embeds, outputs)

```

```

feature file: ../embedding/probL3/Tiny_100_5x20_test.pkl
> loaded tasks: dict_keys([5])
> classes: [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18,
19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38,
39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58,
59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78,
79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98,
99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114,
115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130,
131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146,
147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162,
163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178,
179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194,
195, 196, 197, 198, 199]
> samples: 10000
> embedding: 256
> classification: 800
~ acc (single): 33.29%
~ acc (quadruple): 26.04%

```

```

[6]: ffile = '../embedding/probL3/' + 'Tiny_100_5x20_train.pkl' # prob probL3
dataphas, last_tsk = load_feat(ffile)

labst, embedst, outputst = dataphas[last_tsk][last_tsk]
false_id, pred_ = sanity_check(labst, embedst, outputst)

```

```

feature file: ../embedding/probL3/Tiny_100_5x20_train.pkl
> loaded tasks: dict_keys([5])
> classes: [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18,
19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38,
39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58,
59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78,
79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98,

```

```

99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114,
115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130,
131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146,
147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162,
163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178,
179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194,
195, 196, 197, 198, 199]
> samples: 99968
> embedding: 256
> classification: 800
~ acc (single): 35.18%
~ acc (quadruple): 27.57%

```

```

[7]: embs = id2emb_(labs, embeds, brother=brother)
      embst = id2emb_(labst, embedst, brother=brother)

      sam_max, sam_min = num_samp(embst)
      print('> loading data done!')

```

```

0 499,1 499,2 499,3 499,4 500,5 500,6 500,7 500,8 499,9 499,10 499,11 499,12
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499,751 499,752 500,753 500,754 500,755 500,756 500,757 500,758 500,759 500,760  
500,761 500,762 500,763 500,764 500,765 500,766 500,767 500,768 500,769 500,770  
500,771 500,772 500,773 500,774 500,775 500,776 498,777 498,778 498,779 498,780

```
500,781 500,782 500,783 500,784 500,785 500,786 500,787 500,788 500,789 500,790
500,791 500,792 500,793 500,794 500,795 500,796 500,797 500,798 500,799 500,
max samples: 500
min samples: 498
> loading data done!
```

```
[8]: for k,v in embst.items():
      if v.shape[0] < sam_max:
          rid = np.random.choice(v.shape[0], sam_max-v.shape[0], replace=False)
          print('filling', sam_max-v.shape[0], 'samples')
          embst[k] = np.vstack((v, v[rid]))
```

[illegible]

[illegible]

[illegible]

```
[9]: from voro_helper import get_task_data, feat_trans, NC_o, tsk_cls, fun, \
      ↪ acc_brother, forgetting

i = task_num
support_data_, support_label_, query_data_, query_label_, n_ways_, n_shot_, _ = \
    get_task_data(embst, embs, i, fg_nc, class_set, task_size, brother=brother)
```

```
##### current_task: 20 #####
current classes [780 781 782 783 784 785 786 787 788 789 790 791 792 793 794 795
796 797
```

798 799]  
[output] all classes 0 -> 799

```
[10]: ##### =====
      <->=====
      be          = 1. # 1.
      l2          = False # False True
      protots     = np.mean(feats_trans(support_data_, beta=be, l2=l2), axis=1)
```

```
[13]: i = 0
      support_data, support_label, query_data, query_label, n_ways, n_shot, classes = \
          get_task_data(embst, embs, i, fg_nc, class_set, task_size, brother=brother)
      acc, _, nn_pre = NC_o(support_data, support_label,
                           query_data, query_label,
                           n_ways, n_shot,
                           beta = be, l2 = l2,
                           given_cen = protots[classes], given_only = True,
                           brother = brother)
```

```
##### current_task: 0 #####
current classes [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17,
18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37,
38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57,
58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77,
78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97,
98, 99]
[output] all classes 0 -> 99
0.2538
```

```
[11]: local      = False # True / False
      nn_acc     = []
      savefile   = path+'NN3' if brother else None # NN / NNp / NN3 / only saved NN
      <->results!
      savefil2   = path+'NN3'
      forget     = True # True False # calculate forgetting
      class_ladder = []
      a          = []
      for i in range(task_num + 1):
          support_data, support_label, query_data, query_label, n_ways, n_shot,
          <->classes = \
              get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                           local = local, brother = brother) # False
          if forget:
              class_ladder.append(classes)
          acc, _, nn_pre = NC_o(support_data, support_label,
                               query_data, query_label,
                               n_ways, n_shot,
```

```

        beta = be, l2 = l2,
        given_cen = protots[classes] if local else protots[:
→classes[-1]+1],

        given_only = True,
        brother = brother,
        savefile = savefile+'_'+str(i) if brother else None,
        savefile2 = None, # savefil2+'_'+str(i), # None, #
        weights = [0.7, 0.3],
        class_ladder = class_ladder,
        acc_all = a
    )

    nn_acc.append(acc)
    # if all classes up2now: local = False, and protots[:classes[-1]+1]
print('local:', local, '| beta:', be, '| l2:', l2)
if brother:
    for accs in nn_acc:
        print('\t'.join([str(i) for i in accs]))
else:
    print('\n'.join([str(i) for i in nn_acc]))
if forget:
    avgf = forgetting(a, task_num)
    print(avgf)

```

##### current\_task: 0 #####

```

current classes [ 0  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15
16 17
 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35
 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53
 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71
 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89
 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107
108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125
126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143
144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161
162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179
180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197
198 199 200 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215
216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233
234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250 251
252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269
270 271 272 273 274 275 276 277 278 279 280 281 282 283 284 285 286 287
288 289 290 291 292 293 294 295 296 297 298 299 300 301 302 303 304 305
306 307 308 309 310 311 312 313 314 315 316 317 318 319 320 321 322 323
324 325 326 327 328 329 330 331 332 333 334 335 336 337 338 339 340 341
342 343 344 345 346 347 348 349 350 351 352 353 354 355 356 357 358 359
360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375 376 377
378 379 380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395

```

```

396 397 398 399]
[output] all classes 0 -> 399
<<< loaded from: ../checkpoints/Tiny_100_20x5voro/NN3_0.npy
0.1631

##### current_task: 1 #####
current classes [400 401 402 403 404 405 406 407 408 409 410 411 412 413 414 415
416 417
418 419]
[output] all classes 0 -> 419
<<< loaded from: ../checkpoints/Tiny_100_20x5voro/NN3_1.npy
0.1587

##### current_task: 2 #####
current classes [420 421 422 423 424 425 426 427 428 429 430 431 432 433 434 435
436 437
438 439]
[output] all classes 0 -> 439
<<< loaded from: ../checkpoints/Tiny_100_20x5voro/NN3_2.npy
0.1606

##### current_task: 3 #####
current classes [440 441 442 443 444 445 446 447 448 449 450 451 452 453 454 455
456 457
458 459]
[output] all classes 0 -> 459
<<< loaded from: ../checkpoints/Tiny_100_20x5voro/NN3_3.npy
0.1597

##### current_task: 4 #####
current classes [460 461 462 463 464 465 466 467 468 469 470 471 472 473 474 475
476 477
478 479]
[output] all classes 0 -> 479
<<< loaded from: ../checkpoints/Tiny_100_20x5voro/NN3_4.npy
0.1557

##### current_task: 5 #####
current classes [480 481 482 483 484 485 486 487 488 489 490 491 492 493 494 495
496 497
498 499]
[output] all classes 0 -> 499
<<< loaded from: ../checkpoints/Tiny_100_20x5voro/NN3_5.npy
0.1527

##### current_task: 6 #####
current classes [500 501 502 503 504 505 506 507 508 509 510 511 512 513 514 515
516 517

```

```

518 519]
[output] all classes 0 -> 519
<<< loaded from: ../checkpoints/Tiny_100_20x5voro/NN3_6.npy
0.1490

##### current_task: 7 #####
current classes [520 521 522 523 524 525 526 527 528 529 530 531 532 533 534 535
536 537
538 539]
[output] all classes 0 -> 539
<<< loaded from: ../checkpoints/Tiny_100_20x5voro/NN3_7.npy
0.1512

##### current_task: 8 #####
current classes [540 541 542 543 544 545 546 547 548 549 550 551 552 553 554 555
556 557
558 559]
[output] all classes 0 -> 559
<<< loaded from: ../checkpoints/Tiny_100_20x5voro/NN3_8.npy
0.1513

##### current_task: 9 #####
current classes [560 561 562 563 564 565 566 567 568 569 570 571 572 573 574 575
576 577
578 579]
[output] all classes 0 -> 579
<<< loaded from: ../checkpoints/Tiny_100_20x5voro/NN3_9.npy
0.1481

##### current_task: 10 #####
current classes [580 581 582 583 584 585 586 587 588 589 590 591 592 593 594 595
596 597
598 599]
[output] all classes 0 -> 599
<<< loaded from: ../checkpoints/Tiny_100_20x5voro/NN3_10.npy
0.1449

##### current_task: 11 #####
current classes [600 601 602 603 604 605 606 607 608 609 610 611 612 613 614 615
616 617
618 619]
[output] all classes 0 -> 619
<<< loaded from: ../checkpoints/Tiny_100_20x5voro/NN3_11.npy
0.1424

##### current_task: 12 #####
current classes [620 621 622 623 624 625 626 627 628 629 630 631 632 633 634 635
636 637

```



```

638 639]
[output] all classes 0 -> 639
<<< loaded from: ../checkpoints/Tiny_100_20x5voro/NN3_12.npy
0.1399

##### current_task: 13 #####
current classes [640 641 642 643 644 645 646 647 648 649 650 651 652 653 654 655
656 657
658 659]
[output] all classes 0 -> 659
<<< loaded from: ../checkpoints/Tiny_100_20x5voro/NN3_13.npy
0.1368

##### current_task: 14 #####
current classes [660 661 662 663 664 665 666 667 668 669 670 671 672 673 674 675
676 677
678 679]
[output] all classes 0 -> 679
<<< loaded from: ../checkpoints/Tiny_100_20x5voro/NN3_14.npy
0.1362

##### current_task: 15 #####
current classes [680 681 682 683 684 685 686 687 688 689 690 691 692 693 694 695
696 697
698 699]
[output] all classes 0 -> 699
<<< loaded from: ../checkpoints/Tiny_100_20x5voro/NN3_15.npy
0.1334

##### current_task: 16 #####
current classes [700 701 702 703 704 705 706 707 708 709 710 711 712 713 714 715
716 717
718 719]
[output] all classes 0 -> 719
<<< loaded from: ../checkpoints/Tiny_100_20x5voro/NN3_16.npy
0.1320

##### current_task: 17 #####
current classes [720 721 722 723 724 725 726 727 728 729 730 731 732 733 734 735
736 737
738 739]
[output] all classes 0 -> 739
<<< loaded from: ../checkpoints/Tiny_100_20x5voro/NN3_17.npy
0.1319

##### current_task: 18 #####
current classes [740 741 742 743 744 745 746 747 748 749 750 751 752 753 754 755
756 757

```

```

758 759]
[output] all classes 0 -> 759
<<< loaded from: ../checkpoints/Tiny_100_20x5voro/NN3_18.npy
0.1296

##### current_task: 19 #####
current classes [760 761 762 763 764 765 766 767 768 769 770 771 772 773 774 775
776 777
778 779]
[output] all classes 0 -> 779
<<< loaded from: ../checkpoints/Tiny_100_20x5voro/NN3_19.npy
0.1272

##### current_task: 20 #####
current classes [780 781 782 783 784 785 786 787 788 789 790 791 792 793 794 795
796 797
798 799]
[output] all classes 0 -> 799
<<< loaded from: ../checkpoints/Tiny_100_20x5voro/NN3_20.npy
0.1246
local: False | beta: 1.0 | l2: False
0.16315 0.3312 0.5022 0.4928 0.4932
0.15871428571428572 0.32457142857142857 0.49142857142857144
0.48438095238095236 0.4815238095238095
0.16063636363636363 0.32127272727272727 0.49272727272727274
0.48472727272727273 0.48145454545454547
0.1597391304347826 0.3163478260869565 0.4876521739130435
0.47947826086956524 0.47391304347826085
0.15575 0.30666666666666664 0.48433333333333334 0.4755 0.471
0.15272 0.3056 0.48224 0.47376 0.46928
0.149 0.2967692307692308 0.47523076923076923 0.4666153846153846
0.4652307692307692
0.15122222222222223 0.30044444444444446 0.4682962962962963
0.45985185185185184 0.457037037037037
0.15128571428571427 0.3017142857142857 0.4775714285714286
0.4684285714285714 0.4665714285714286
0.14806896551724139 0.29517241379310344 0.46827586206896554
0.45848275862068966 0.45641379310344826
0.14493333333333333 0.29 0.4666666666666667 0.45693333333333336
0.4544
0.1423548387096774 0.28619354838709676 0.4641290322580645
0.45548387096774196 0.45225806451612904
0.139875 0.281125 0.461875 0.453625 0.450125
0.13678787878787878 0.27321212121212124 0.46036363636363636
0.45078787878787878 0.44751515151515153
0.13623529411764707 0.27305882352941174 0.45341176470588235
0.4444705882352941 0.4411764705882353
0.13337142857142859 0.26662857142857144 0.44754285714285713

```

0.4390857142857143	0.4357714285714286	
0.1320277777777777	0.262888888888889	0.441888888888889
0.432888888888889	0.4303333333333335	
0.13194594594594594	0.26151351351351354	0.43513513513513513
0.42648648648648646	0.4235675675675676	
0.12963157894736843	0.25526315789473686	0.42726315789473684
0.4191578947368421	0.4142105263157895	
0.12723076923076923	0.25015384615384617	0.4242051282051282
0.4155897435897436	0.4112820512820513	
0.12465 0.2442 0.4203	0.4123 0.4081	
[0.16315 0. 0. 0. 0. 0. 0. 0. 0.]		
0. 0. 0. 0. 0. 0. 0. 0. 0.]		
0. 0. 0. ]		
[0.1581 0.171 0. 0. 0. 0. 0. 0. 0.]		
0. 0. 0. 0. 0. 0. 0. 0. 0.]		
0. 0. 0. ]		
[0.15455 0.168 0.275 0. 0. 0. 0. 0. 0.]		
0. 0. 0. 0. 0. 0. 0. 0. 0.]		
0. 0. 0. ]		
[0.15215 0.167 0.274 0.19 0. 0. 0. 0. 0.]		
0. 0. 0. 0. 0. 0. 0. 0. 0.]		
0. 0. 0. ]		
[0.14815 0.165 0.255 0.187 0.168 0. 0. 0. 0.]		
0. 0. 0. 0. 0. 0. 0. 0. 0.]		
0. 0. 0. ]		
[0.14505 0.165 0.251 0.179 0.168 0.154 0. 0. 0.]		
0. 0. 0. 0. 0. 0. 0. 0. 0.]		
0. 0. 0. ]		
[0.1433 0.164 0.245 0.179 0.168 0.146 0.106 0. 0.]		
0. 0. 0. 0. 0. 0. 0. 0. 0.]		
0. 0. 0. ]		
[0.1406 0.155 0.243 0.179 0.165 0.146 0.105 0.278 0.]		
0. 0. 0. 0. 0. 0. 0. 0. 0.]		
0. 0. 0. ]		
[0.13715 0.153 0.24 0.179 0.165 0.14 0.105 0.277 0.234]		
0. 0. 0. 0. 0. 0. 0. 0. 0.]		
0. 0. 0. ]		
[0.1327 0.148 0.231 0.178 0.165 0.14 0.104 0.256 0.232]		
0.186 0. 0. 0. 0. 0. 0. 0. 0.]		
0. 0. 0. ]		
[0.1306 0.148 0.231 0.171 0.162 0.136 0.104 0.256 0.231]		
0.186 0.111 0. 0. 0. 0. 0. 0. 0.]		
0. 0. 0. ]		
[0.12795 0.148 0.229 0.171 0.162 0.136 0.104 0.253 0.221]		
0.186 0.111 0.133 0. 0. 0. 0. 0. 0.]		
0. 0. 0. ]		
[0.126 0.148 0.228 0.171 0.162 0.136 0.101 0.253 0.221]		
0.186 0.108 0.133 0.109 0. 0. 0. 0. 0.]		

```

0.      0.      0.      ]
[0.12425 0.148  0.227  0.171  0.162  0.136  0.1   0.253  0.221
 0.186  0.108  0.133  0.109  0.075  0.      0.      0.      0.
 0.      0.      0.      ]
[0.1212  0.14   0.207  0.171  0.159  0.135  0.1   0.252  0.218
 0.169  0.108  0.133  0.106  0.075  0.235  0.      0.      0.
 0.      0.      0.      ]
[0.12005 0.14   0.207  0.171  0.159  0.132  0.1   0.252  0.218
 0.169  0.108  0.132  0.103  0.075  0.234  0.067  0.      0.
 0.      0.      0.      ]
[0.11945 0.137  0.203  0.168  0.158  0.132  0.1   0.252  0.218
 0.169  0.108  0.132  0.102  0.075  0.234  0.065  0.111  0.
 0.      0.      0.      ]
[0.11815 0.135  0.202  0.168  0.158  0.127  0.1   0.248  0.217
 0.164  0.108  0.132  0.102  0.075  0.229  0.063  0.111  0.18
 0.      0.      0.      ]
[0.11665 0.135  0.199  0.168  0.157  0.127  0.097  0.248  0.217
 0.164  0.108  0.132  0.102  0.075  0.229  0.061  0.111  0.18
 0.083  0.      0.      ]
[0.11575 0.133  0.199  0.168  0.156  0.127  0.097  0.248  0.211
 0.16   0.102  0.132  0.102  0.075  0.229  0.06   0.111  0.18
 0.083  0.074  0.      ]
[0.1152  0.133  0.199  0.168  0.153  0.125  0.088  0.248  0.211
 0.16   0.102  0.132  0.098  0.075  0.229  0.06   0.106  0.18
 0.077  0.074  0.064 ]]
[0, 0.5049999999999999, 0.58, 0.5333333333333329, 1.1000000000000003,
1.1820000000000002, 1.2641666666666667, 1.3364285714285722, 1.3625000000000005,
1.6938888888888892, 1.6955000000000005, 1.7018181818181821, 1.6345833333333337,
1.5376923076923077, 1.8496428571428574, 1.7873333333333334, 1.7668750000000004,
1.8176470588235298, 1.7750000000000001, 1.7915789473684212, 1.8497500000000007]

```

```

[14]: def predict(model, x, voro=True):
        x = torch.from_numpy(x.astype(np.float32)).cuda()
        with torch.no_grad():
            predi = model.module.classifier(x)
        if voro:
            predi += - torch.sum((model.module.classifier.weight/2.)**2, dim=1)
        return predi

classes_all = []
test_share = []
paccS = []
for i in range(task_num + 1):
    support_data, support_label, query_data, query_label, n_ways, n_shot, \
    →classes = \
        get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                      local = True, brother = brother)

```

```

# load model:
if brother:
    cls_01 = classes[-1]+1
    assert cls_01 % 4 == 0
    filename = path + '%d_model.pkl' % (int(cls_01/4))
else:
    filename = path + '%d_model.pkl' % (classes[-1]+1)
model = torch.load(filename)
model.eval()
print('> loaded base phase model from:', filename)
num_param(model)
# do prediction:
min_cls = min(classes)
if brother:
    pred = predict(model, query_data)
else:
    pred = predict(model, query_data)[:,:,:4]
pmax = torch.max(pred, dim=1)[1]
pacc = np.mean(t2n(pmax) == query_label - min_cls)
print(pacc)
if brother:
    accs = acc_brother(t2n(pred), t2n(pmax), query_label - min_cls,
→forLG=True)
    pacc = [pacc] + accs
    paccS.append(pacc)
    classes_all.append(classes)
    test_share.append(len(query_label))
print('all logistic locally:')
if brother:
    for accs in paccS:
        print('\t'.join([str(i) for i in accs]))
else:
    print('\n'.join([str(i) for i in paccS]))

```

```

[15]: for i in range(task_num + 1):
    support_data, support_label, query_data, query_label, n_ways, n_shot,
→classes = \
        get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                        local = True, brother = brother)
    pred_all = []
    for classes in classes_all:
        # load model:
        if brother:
            cls_01 = classes[-1]+1
            assert cls_01 % 4 == 0
            filename = path + '%d_model.pkl' % (int(cls_01/4))
        else:

```

```

        filename = path + '%d_model.pkl' % (classes[-1]+1)
        model = torch.load(filename)
        model.eval()
        print('> loaded base phase model from:', filename)
        num_param(model)
        # do prediction:
        min_cls = min(classes)
        if brother:
            pred = predict(model, query_data)
        else:
            pred = predict(model, query_data)[:,:,:4]
            pmax = torch.max(pred, dim=1)[1]
            # pacc = np.mean(t2n(pmax) == query_label - min_cls)
            # print(pacc)
            if brother:
                labs_01 = query_label[:4]//4
                acc_, sc_pre = merge_sc(t2n(pred), labs_01,
                                         mth='softmax', forLG=True, return_pre=True)
                min_cls = int(min_cls / 4)
                pred_all.append( (sc_pre + min_cls).tolist() )
            else:
                pred_all.append( (t2n(pmax) + min_cls).tolist() )
        pred_all = np.array(pred_all)
        print(pred_all.shape)

        if i == 0:
            pred_in_clique = copy.deepcopy(pred_all)
        else:
            pred_in_clique = np.hstack((pred_in_clique, pred_all))

```

```

[42]: print('cliques by test samples:', pred_in_clique.shape)

# compute prototypes
be = 0.6 # 1.
l2 = True # False True
bias = 0 # 0.05
protots = np.mean(feats_trans(support_data_, beta=be, l2=l2, bias=bias), axis=1)
query_pts = feats_trans(query_data_, beta=be, l2=l2, bias=bias)
# acenss = feats_trans(acens, beta=be, l2=l2, bias=bias)
if brother:
    dist = funbtch(query_pts, protots) # protots / acenss
else:
    dist = fun(query_pts, protots) # protots / acenss

test_splt = [sum(test_share[:t+1]) for t in range(len(test_share))]

```

```
[238]: dist_in_clique = np.zeros_like(pred_in_clique, dtype=np.float32)
for c_id, clique in enumerate(pred_in_clique):
    for s_id, samp in enumerate(clique):
        dist_in_clique[c_id][s_id] = dist[s_id][samp]
```

```
[253]: for i in range(task_num + 1):
        clique_dist = dist_in_clique[:i+1,:test_splt[i]]
        clique_pred = np.argmin(clique_dist, axis=0)
        merge_pred = [pred_in_clique[cli,s_id] for s_id, cli in
            ↪enumerate(clique_pred)]
        merge_acc = np.mean(merge_pred == query_label_[:test_splt[i]])
        print(merge_acc)
    print('DaC:', 'beta:', be, '| 12:', 12)
```

```
[28]: print('===== Experiment Done! =====')

===== Experiment Done! =====
```

## iVoro on ImageNet-Subset Dataset, 3rd Block Features

```
[12]: import matplotlib.pyplot as plt
import os
import pickle
import numpy as np
import pandas as pd
import seaborn as sns
import time
import sys
sys.path.append('../')
sys.path.append('../analysis/')
import copy
import platform
import json
import pickle
import random

import torch
from scipy.stats import mode
```

```
[13]: from ResNet import resnet18_cbam

data_name      = 'Subset' # 'Subset' # 'Tiny' # 'CIFAR100' # 'MNIST'
total_nc       = 100 # 200 # 100 # 10
fg_nc          = 50 # 100 # 40 # 50 # 4
task_num       = 10 # 20 # 5 # 10 # 2

# constant params
class_set      = list(range(total_nc))
ROTATION       = True
EMB2D         = False
DESIGN        = True
virtual_class  = 4*total_nc if ROTATION else total_nc
suffix         = 'voro' # 'prob' 'voro'
assert (total_nc - fg_nc)%task_num == 0
task_size      = int((total_nc - fg_nc)/task_num)
file_name      = _
    ↳data_name+'_'+str(fg_nc)+'_'+str(task_num)+'x'+str(task_size)+suffix
```



```
print(file_name)

brother      = False # True False
```

Subset\_50\_10x5voro

```
[14]: save_path = '../checkpoints/'
      path      = save_path + file_name + '/'
      filename   = path + '%d_model.pkl' % (fg_nc+0) # +5
      model      = torch.load(filename)
      model.eval()
      print('> loaded base phase model from:', filename)
```

> loaded base phase model from: ../checkpoints/Subset\_50\_10x5voro/50\_model.pkl

```
[15]: from voro_helper import num_param, t2n, \
      load_feat, sanity_check, \
      id2emb_, num_samp, merge_sc, funbtch

      num_param(model)

      # voronoi centers:
      vcenter = t2n(model.module.classifier.weight.data / 2.)
      print(vcenter.shape)
```

```
module.classifier.weight      torch.Size([200, 512])  102400  True
total: 102400
(200, 512)
```

```
[16]: '''
      CIFAR:
          'CIFAR100_50_5x10_test.pkl'
          'CIFAR100_50_5x10_train.pkl'
          'CIFAR100_40_20x3_test.pkl'
          'CIFAR100_40_20x3_train.pkl'
      more CIFAR:
          'CIFAR100_40_12x5_test.pkl'
          'CIFAR100_40_12x5_train.pkl'
          'CIFAR100_30_14x5_test.pkl'
          'CIFAR100_30_14x5_train.pkl'
          'CIFAR100_20_16x5_test.pkl'
          'CIFAR100_20_16x5_train.pkl'
          'CIFAR100_10_18x5_test.pkl'
          'CIFAR100_10_18x5_train.pkl'
      Tiny:
          'Tiny_100_20x5_test.pkl'
          'Tiny_100_20x5_train.pkl'
      TinyL3:
```

```

        'Tiny_100_5x20_test.pkl'
        'Tiny_100_5x20_train.pkl'
Subset:
        'Subset_50_10x5_test.pkl'
        'Subset_50_10x5_train.pkl'
'''
ffile = '../embedding/probL3/' + 'Subset_50_10x5_test.pkl' # prob probL3
data_phas, last_tsk = load_feat(ffile)

labs, embeds, outputs = data_phas[last_tsk][last_tsk]
false_id, pred_ = sanity_check(labs, embeds, outputs)

```

```

feature file: ../embedding/probL3/Subset_50_10x5_test.pkl
> loaded tasks: dict_keys([10])
> classes: [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18,
19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38,
39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58,
59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78,
79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98,
99]
> samples: 5000
> embedding: 256
> classification: 400
~ acc (single): 35.04%
~ acc (quadruple): 22.72%

```

```

[17]: ffile = '../embedding/probL3/' + 'Subset_50_10x5_train.pkl' # prob probL3
data_phas, last_tsk = load_feat(ffile)

labst, embedst, outputst = data_phas[last_tsk][last_tsk]
false_id, pred_ = sanity_check(labst, embedst, outputst)

```

```

feature file: ../embedding/probL3/Subset_50_10x5_train.pkl
> loaded tasks: dict_keys([10])
> classes: [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18,
19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38,
39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58,
59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78,
79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98,
99]
> samples: 128832
> embedding: 256
> classification: 400
~ acc (single): 35.23%
~ acc (quadruple): 23.50%

```

```

[18]: embs = id2emb_(labs, embeds, brother=brother)
embst = id2emb_(labst, embedst, brother=brother)

```

```
sam_max, sam_min = num_samp(embst)
print('> loading data done!')
```

```
0 1299,1 1299,2 1267,3 1298,4 1300,5 1299,6 1300,7 1300,8 1281,9 1300,10 1300,11
1213,12 1300,13 1300,14 1300,15 1300,16 1070,17 1238,18 1300,19 1165,20 1300,21
1300,22 1300,23 1299,24 1299,25 1300,26 1300,27 1299,28 1300,29 1300,30 1300,31
1300,32 1299,33 1299,34 1300,35 1300,36 1299,37 1300,38 1300,39 1299,40 1300,41
1300,42 1300,43 1300,44 1300,45 1300,46 1300,47 1300,48 1300,49 1216,50 1300,51
1299,52 1300,53 1300,54 1300,55 1300,56 1300,57 1300,58 1300,59 1300,60 1300,61
1300,62 1300,63 1300,64 1300,65 1297,66 1300,67 1300,68 1299,69 1300,70 1300,71
1300,72 1300,73 1300,74 1300,75 1300,76 1300,77 1300,78 1300,79 1300,80 1034,81
1300,82 1299,83 1300,84 1299,85 1300,86 1300,87 1069,88 1299,89 1300,90 1300,91
1300,92 1300,93 1300,94 1300,95 1300,96 1299,97 1300,98 1300,99 1300,
max samples: 1300
min samples: 1034
> loading data done!
```

```
[19]: for k,v in embst.items():
        if v.shape[0] < sam_max:
            rid = np.random.choice(v.shape[0], sam_max-v.shape[0], replace=False)
            print('filling', sam_max-v.shape[0], 'samples')
            embst[k] = np.vstack((v, v[rid]))
```

```
filling 1 samples
filling 1 samples
filling 33 samples
filling 2 samples
filling 1 samples
filling 19 samples
filling 87 samples
filling 230 samples
filling 62 samples
filling 135 samples
filling 1 samples
filling 1 samples
filling 1 samples
filling 1 samples
filling 1 samples
filling 1 samples
filling 1 samples
filling 84 samples
filling 1 samples
filling 3 samples
filling 1 samples
filling 266 samples
filling 1 samples
filling 1 samples
```

```

filling 231 samples
filling 1 samples
filling 1 samples

```

```

[20]: from voro_helper import get_task_data, feat_trans, NC_o, tsk_cls, fun, \
      ↪acc_brother, forgetting

      i = task_num
      support_data_, support_label_, query_data_, query_label_, n_ways_, n_shot_, _ = \
          get_task_data(embst, embs, i, fg_nc, class_set, task_size, brother=brother)

```

```

##### current_task: 10 #####
current classes [95, 96, 97, 98, 99]
[output] all classes 0 -> 99

```

```

[21]: ### =====
      ↪=====

      be = 1. # 1.
      l2 = False # False True
      protots = np.mean(feat_trans(support_data_, beta=be, l2=l2), axis=1)

```

```

[22]: i = 0
      support_data, support_label, query_data, query_label, n_ways, n_shot, classes = \
          get_task_data(embst, embs, i, fg_nc, class_set, task_size, brother=brother)
      acc, _, nn_pre = NC_o(support_data, support_label,
                           query_data, query_label,
                           n_ways, n_shot,
                           beta = be, l2 = l2,
                           given_cen = protots[classes], given_only = True,
                           brother = brother)

```

```

##### current_task: 0 #####
current classes [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17,
18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37,
38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49]
[output] all classes 0 -> 49
0.4524

```

```

[23]: local = False # True / False
      nn_acc = []
      savefile = path+'NN3' if brother else None # NN / NNp / NN3 / only saved NN
      ↪results!
      savefil2 = path+'NN3'
      forget = True # True False # calculate forgetting
      class_ladder = []
      a = []

```

```

for i in range(task_num + 1):
    support_data, support_label, query_data, query_label, n_ways, n_shot, \
    →classes = \
        get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                        local = local, brother = brother) # False
    if forget:
        class_ladder.append(classes)
    acc, _, nn_pre = NC_o(support_data, support_label,
                          query_data, query_label,
                          n_ways, n_shot,
                          beta = be, l2 = l2,
                          given_cen = protots[classes] if local else protots[:
    →classes[-1]+1],
                          given_only = True,
                          brother = brother,
                          savefile = savefile+'_'+str(i) if brother else None,
                          savefile2 = None, # savefil2+'_'+str(i), # None, #
                          weights = [0.7, 0.3],
                          class_ladder = class_ladder,
                          acc_all = a
                          )

    nn_acc.append(acc)
    # if all classes up2now: local = False, and protots[:classes[-1]+1]
print('local:', local, '| beta:', be, '| l2:', l2)
if brother:
    for accs in nn_acc:
        print('\t'.join([str(i) for i in accs]))
else:
    print('\n'.join([str(i) for i in nn_acc]))
if forget:
    avgf = forgetting(a, task_num)
    print(avgf)

```

```

##### current_task: 0 #####
current classes [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17,
18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37,
38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49]
[output] all classes 0 -> 49
0.4524

```

```

##### current_task: 1 #####
current classes [50, 51, 52, 53, 54]
[output] all classes 0 -> 54
0.4440

```

```

##### current_task: 2 #####

```

```

current classes [55, 56, 57, 58, 59]
[output] all classes 0 -> 59
0.4303

##### current_task: 3 #####
current classes [60, 61, 62, 63, 64]
[output] all classes 0 -> 64
0.4194

##### current_task: 4 #####
current classes [65, 66, 67, 68, 69]
[output] all classes 0 -> 69
0.4063

##### current_task: 5 #####
current classes [70, 71, 72, 73, 74]
[output] all classes 0 -> 74
0.3995

##### current_task: 6 #####
current classes [75, 76, 77, 78, 79]
[output] all classes 0 -> 79
0.3860

##### current_task: 7 #####
current classes [80, 81, 82, 83, 84]
[output] all classes 0 -> 84
0.3748

##### current_task: 8 #####
current classes [85, 86, 87, 88, 89]
[output] all classes 0 -> 89
0.3662

##### current_task: 9 #####
current classes [90, 91, 92, 93, 94]
[output] all classes 0 -> 94
0.3587

##### current_task: 10 #####
current classes [95, 96, 97, 98, 99]
[output] all classes 0 -> 99
0.3504
local: False | beta: 1.0 | l2: False
0.4524
0.444
0.43033333333333335
0.4193846153846154

```

```

0.4062857142857143
0.3994666666666667
0.386
0.3748235294117647
0.3662222222222222
0.35873684210526313
0.3504
[[0.4524 0.      0.      0.      0.      0.      0.      0.      0.
  0.      ]
 [0.4328 0.556  0.      0.      0.      0.      0.      0.      0.
  0.      ]
 [0.4248 0.544  0.372  0.      0.      0.      0.      0.      0.
  0.      ]
 [0.4204 0.54   0.364  0.344  0.      0.      0.      0.      0.
  0.      ]
 [0.404  0.54   0.36   0.344  0.404  0.      0.      0.      0.
  0.      ]
 [0.396  0.536  0.352  0.34   0.4    0.404  0.      0.      0.
  0.      ]
 [0.3756 0.536  0.348  0.316  0.368  0.356  0.496  0.      0.
  0.      ]
 [0.3696 0.536  0.328  0.312  0.368  0.348  0.496  0.288  0.
  0.      ]
 [0.3532 0.512  0.328  0.304  0.364  0.34   0.496  0.288  0.428  0.
  0.      ]
 [0.3432 0.508  0.328  0.296  0.36   0.34   0.492  0.284  0.408  0.368
  0.      ]
 [0.3404 0.508  0.32   0.296  0.352  0.34   0.484  0.276  0.408  0.364
  0.256  ]]
[0, 1.9600000000000006, 1.98000000000000013, 1.8666666666666683,
1.9100000000000006, 2.088, 3.8800000000000002, 3.86857142857143,
4.1400000000000001, 4.2800000000000001, 4.2400000000000001]

```

```

[14]: def predict(model, x, voro=True):
        x = torch.from_numpy(x.astype(np.float32)).cuda()
        with torch.no_grad():
            predi = model.module.classifier(x)
            if voro:
                predi += - torch.sum((model.module.classifier.weight/2.)**2, dim=1)
            return predi

classes_all = []
test_share = []
paccS = []
for i in range(task_num + 1):
    support_data, support_label, query_data, query_label, n_ways, n_shot, \
    classes = \

```

```

        get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                      local = True, brother = brother)
    # load model:
    if brother:
        cls_01 = classes[-1]+1
        assert cls_01 % 4 == 0
        filename = path + '%d_model.pkl' % (int(cls_01/4))
    else:
        filename = path + '%d_model.pkl' % (classes[-1]+1)
    model = torch.load(filename)
    model.eval()
    print('> loaded base phase model from:', filename)
    num_param(model)
    # do prediction:
    min_cls = min(classes)
    if brother:
        pred = predict(model, query_data)
    else:
        pred = predict(model, query_data)[:,:,:4]
    pmax = torch.max(pred, dim=1)[1]
    pacc = np.mean(t2n(pmax) == query_label - min_cls)
    print(pacc)
    if brother:
        accs = acc_brother(t2n(pred), t2n(pmax), query_label - min_cls,
→forLG=True)
        pacc = [pacc] + accs
        paccS.append(pacc)
        classes_all.append(classes)
        test_share.append(len(query_label))
print('all logistic locally:')
if brother:
    for accs in paccS:
        print('\t'.join([str(i) for i in accs]))
else:
    print('\n'.join([str(i) for i in paccS]))

```

```

[15]: for i in range(task_num + 1):
        support_data, support_label, query_data, query_label, n_ways, n_shot,
→classes = \
            get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                          local = True, brother = brother)
        pred_all = []
        for classes in classes_all:
            # load model:
            if brother:
                cls_01 = classes[-1]+1
                assert cls_01 % 4 == 0

```



```

        filename = path + '%d_model.pkl' % (int(cls_01/4))
    else:
        filename = path + '%d_model.pkl' % (classes[-1]+1)
    model = torch.load(filename)
    model.eval()
    print('> loaded base phase model from:', filename)
    num_param(model)
    # do prediction:
    min_cls = min(classes)
    if brother:
        pred = predict(model, query_data)
    else:
        pred = predict(model, query_data)[:,:,:4]
    pmax = torch.max(pred, dim=1)[1]
    # pacc = np.mean(t2n(pmax) == query_label - min_cls)
    # print(pacc)
    if brother:
        labs_01 = query_label[:4]//4
        acc_, sc_pre = merge_sc(t2n(pred), labs_01,
                                mth='softmax', forLG=True, return_pre=True)
        min_cls = int(min_cls / 4)
        pred_all.append( (sc_pre + min_cls).tolist() )
    else:
        pred_all.append( (t2n(pmax) + min_cls).tolist() )
    pred_all = np.array(pred_all)
    print(pred_all.shape)

    if i == 0:
        pred_in_clique = copy.deepcopy(pred_all)
    else:
        pred_in_clique = np.hstack((pred_in_clique, pred_all))

```

```

[42]: print('cliques by test samples:', pred_in_clique.shape)

# compute prototypes
be = 0.6 # 1.
l2 = True # False True
bias = 0 # 0.05
protots = np.mean(feats_trans(support_data_, beta=be, l2=l2, bias=bias), axis=1)
query_pts = feats_trans(query_data_, beta=be, l2=l2, bias=bias)
# acenss = feats_trans(acens, beta=be, l2=l2, bias=bias)
if brother:
    dist = funbtch(query_pts, protots) # protots / acenss
else:
    dist = fun(query_pts, protots) # protots / acenss

test_splt = [sum(test_share[:t+1]) for t in range(len(test_share))]

```

```
[238]: dist_in_clique = np.zeros_like(pred_in_clique, dtype=np.float32)
for c_id, clique in enumerate(pred_in_clique):
    for s_id, samp in enumerate(clique):
        dist_in_clique[c_id][s_id] = dist[s_id][samp]
```

```
[253]: for i in range(task_num + 1):
        clique_dist = dist_in_clique[:i+1,:test_splt[i]]
        clique_pred = np.argmin(clique_dist, axis=0)
        merge_pred = [pred_in_clique[cli,s_id] for s_id, cli in
            →enumerate(clique_pred)]
        merge_acc = np.mean(merge_pred == query_label_[:test_splt[i]])
        print(merge_acc)
    print('DaC:', 'beta:', be, '| 12:', 12)
```

```
[28]: print('==== Experiment Done! ====')

===== Experiment Done! =====
```

## iVoro-AC/AI on ImageNet-Subset Dataset, 3rd Block Features

```
[12]: import matplotlib.pyplot as plt
import os
import pickle
import numpy as np
import pandas as pd
import seaborn as sns
import time
import sys
sys.path.append('../')
sys.path.append('../analysis/')
import copy
import platform
import json
import pickle
import random

import torch
from scipy.stats import mode
```

```
[24]: from ResNet import resnet18_cbam

data_name      = 'Subset' # 'Subset' # 'Tiny' # 'CIFAR100' # 'MNIST'
total_nc       = 100 # 200 # 100 # 10
fg_nc          = 50 # 100 # 40 # 50 # 4
task_num       = 10 # 20 # 5 # 10 # 2

# constant params
class_set      = list(range(total_nc))
ROTATION       = True
EMB2D         = False
DESIGN        = True
virtual_class  = 4*total_nc if ROTATION else total_nc
suffix         = 'voro' # 'prob' 'voro'
assert (total_nc - fg_nc)%task_num == 0
task_size      = int((total_nc - fg_nc)/task_num)
```

```

file_name      =_
    ↳data_name+'_'+str(fg_nc)+'_'+str(task_num)+'x'+str(task_size)+suffix

print(file_name)

brother        = True # True False

```

Subset\_50\_10x5voro

```

[25]: save_path = '../checkpoints/'
      path      = save_path + file_name + '/'
      filename   = path + '%d_model.pkl' % (fg_nc+0) # +5
      model      = torch.load(filename)
      model.eval()
      print('> loaded base phase model from:', filename)

```

> loaded base phase model from: ../checkpoints/Subset\_50\_10x5voro/50\_model.pkl

```

[26]: from voro_helper import num_param, t2n, \
      load_feat, sanity_check, \
      id2emb_, num_samp, merge_sc, funbtch

num_param(model)

# voronoi centers:
vcenter = t2n(model.module.classifier.weight.data / 2.)
print(vcenter.shape)

```

```

module.classifier.weight      torch.Size([200, 512])  102400  True
total: 102400
(200, 512)

```

```

[27]: '''
      CIFAR:
          'CIFAR100_50_5x10_test.pkl'
          'CIFAR100_50_5x10_train.pkl'
          'CIFAR100_40_20x3_test.pkl'
          'CIFAR100_40_20x3_train.pkl'
      more CIFAR:
          'CIFAR100_40_12x5_test.pkl'
          'CIFAR100_40_12x5_train.pkl'
          'CIFAR100_30_14x5_test.pkl'
          'CIFAR100_30_14x5_train.pkl'
          'CIFAR100_20_16x5_test.pkl'
          'CIFAR100_20_16x5_train.pkl'
          'CIFAR100_10_18x5_test.pkl'
          'CIFAR100_10_18x5_train.pkl'
      Tiny:

```

```

        'Tiny_100_20x5_test.pkl'
        'Tiny_100_20x5_train.pkl'
TinyL3:
        'Tiny_100_5x20_test.pkl'
        'Tiny_100_5x20_train.pkl'
Subset:
        'Subset_50_10x5_test.pkl'
        'Subset_50_10x5_train.pkl'
'''
ffile = '../embedding/probL3/' + 'Subset_50_10x5_test.pkl' # prob probL3
dataphas, last_tsk = load_feat(ffile)

labs, embeds, outputs = dataphas[last_tsk][last_tsk]
false_id, pred_ = sanity_check(labs, embeds, outputs)

```

```

feature file: ../embedding/probL3/Subset_50_10x5_test.pkl
> loaded tasks: dict_keys([10])
> classes: [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18,
19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38,
39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58,
59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78,
79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98,
99]
> samples: 5000
> embedding: 256
> classification: 400
~ acc (single): 35.04%
~ acc (quadruple): 22.72%

```

```

[28]: ffile = '../embedding/probL3/' + 'Subset_50_10x5_train.pkl' # prob probL3
dataphas, last_tsk = load_feat(ffile)

labst, embedst, outputst = dataphas[last_tsk][last_tsk]
false_id, pred_ = sanity_check(labst, embedst, outputst)

```

```

feature file: ../embedding/probL3/Subset_50_10x5_train.pkl
> loaded tasks: dict_keys([10])
> classes: [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18,
19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38,
39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58,
59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78,
79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98,
99]
> samples: 128832
> embedding: 256
> classification: 400
~ acc (single): 35.23%
~ acc (quadruple): 23.50%

```

```
[29]: embs = id2emb_(labs, embeds, brother=brother)
      embst = id2emb_(labst, embedst, brother=brother)

      sam_max, sam_min = num_samp(embst)
      print('> loading data done!')
```

```
0 1299,1 1299,2 1299,3 1299,4 1299,5 1299,6 1299,7 1299,8 1267,9 1267,10 1267,11
1267,12 1298,13 1298,14 1298,15 1298,16 1300,17 1300,18 1300,19 1300,20 1299,21
1299,22 1299,23 1299,24 1300,25 1300,26 1300,27 1300,28 1300,29 1300,30 1300,31
1300,32 1281,33 1281,34 1281,35 1281,36 1300,37 1300,38 1300,39 1300,40 1300,41
1300,42 1300,43 1300,44 1213,45 1213,46 1213,47 1213,48 1300,49 1300,50 1300,51
1300,52 1300,53 1300,54 1300,55 1300,56 1300,57 1300,58 1300,59 1300,60 1300,61
1300,62 1300,63 1300,64 1070,65 1070,66 1070,67 1070,68 1238,69 1238,70 1238,71
1238,72 1300,73 1300,74 1300,75 1300,76 1165,77 1165,78 1165,79 1165,80 1300,81
1300,82 1300,83 1300,84 1300,85 1300,86 1300,87 1300,88 1300,89 1300,90 1300,91
1300,92 1299,93 1299,94 1299,95 1299,96 1299,97 1299,98 1299,99 1299,100
1300,101 1300,102 1300,103 1300,104 1300,105 1300,106 1300,107 1300,108 1299,109
1299,110 1299,111 1299,112 1300,113 1300,114 1300,115 1300,116 1300,117 1300,118
1300,119 1300,120 1300,121 1300,122 1300,123 1300,124 1300,125 1300,126 1300,127
1300,128 1299,129 1299,130 1299,131 1299,132 1299,133 1299,134 1299,135 1299,136
1300,137 1300,138 1300,139 1300,140 1300,141 1300,142 1300,143 1300,144 1299,145
1299,146 1299,147 1299,148 1300,149 1300,150 1300,151 1300,152 1300,153 1300,154
1300,155 1300,156 1299,157 1299,158 1299,159 1299,160 1300,161 1300,162 1300,163
1300,164 1300,165 1300,166 1300,167 1300,168 1300,169 1300,170 1300,171 1300,172
1300,173 1300,174 1300,175 1300,176 1300,177 1300,178 1300,179 1300,180 1300,181
1300,182 1300,183 1300,184 1300,185 1300,186 1300,187 1300,188 1300,189 1300,190
1300,191 1300,192 1300,193 1300,194 1300,195 1300,196 1216,197 1216,198 1216,199
1216,200 1300,201 1300,202 1300,203 1300,204 1299,205 1299,206 1299,207 1299,208
1300,209 1300,210 1300,211 1300,212 1300,213 1300,214 1300,215 1300,216 1300,217
1300,218 1300,219 1300,220 1300,221 1300,222 1300,223 1300,224 1300,225 1300,226
1300,227 1300,228 1300,229 1300,230 1300,231 1300,232 1300,233 1300,234 1300,235
1300,236 1300,237 1300,238 1300,239 1300,240 1300,241 1300,242 1300,243 1300,244
1300,245 1300,246 1300,247 1300,248 1300,249 1300,250 1300,251 1300,252 1300,253
1300,254 1300,255 1300,256 1300,257 1300,258 1300,259 1300,260 1297,261 1297,262
1297,263 1297,264 1300,265 1300,266 1300,267 1300,268 1300,269 1300,270 1300,271
1300,272 1299,273 1299,274 1299,275 1299,276 1300,277 1300,278 1300,279 1300,280
1300,281 1300,282 1300,283 1300,284 1300,285 1300,286 1300,287 1300,288 1300,289
1300,290 1300,291 1300,292 1300,293 1300,294 1300,295 1300,296 1300,297 1300,298
1300,299 1300,300 1300,301 1300,302 1300,303 1300,304 1300,305 1300,306 1300,307
1300,308 1300,309 1300,310 1300,311 1300,312 1300,313 1300,314 1300,315 1300,316
1300,317 1300,318 1300,319 1300,320 1034,321 1034,322 1034,323 1034,324 1300,325
1300,326 1300,327 1300,328 1299,329 1299,330 1299,331 1299,332 1300,333 1300,334
1300,335 1300,336 1299,337 1299,338 1299,339 1299,340 1300,341 1300,342 1300,343
1300,344 1300,345 1300,346 1300,347 1300,348 1069,349 1069,350 1069,351 1069,352
1299,353 1299,354 1299,355 1299,356 1300,357 1300,358 1300,359 1300,360 1300,361
1300,362 1300,363 1300,364 1300,365 1300,366 1300,367 1300,368 1300,369 1300,370
1300,371 1300,372 1300,373 1300,374 1300,375 1300,376 1300,377 1300,378 1300,379
1300,380 1300,381 1300,382 1300,383 1300,384 1299,385 1299,386 1299,387 1299,388
```

```
1300,389 1300,390 1300,391 1300,392 1300,393 1300,394 1300,395 1300,396 1300,397
1300,398 1300,399 1300,
max samples: 1300
min samples: 1034
> loading data done!
```

```
[30]: for k,v in embst.items():
        if v.shape[0] < sam_max:
            rid = np.random.choice(v.shape[0], sam_max-v.shape[0], replace=False)
            print('filling', sam_max-v.shape[0], 'samples')
            embst[k] = np.vstack((v, v[rid]))
```

```
filling 1 samples
filling 1 samples
filling 1 samples
filling 1 samples
filling 1 samples
filling 1 samples
filling 1 samples
filling 1 samples
filling 33 samples
filling 33 samples
filling 33 samples
filling 33 samples
filling 2 samples
filling 2 samples
filling 2 samples
filling 2 samples
filling 1 samples
filling 1 samples
filling 1 samples
filling 19 samples
filling 19 samples
filling 19 samples
filling 19 samples
filling 87 samples
filling 87 samples
filling 87 samples
filling 87 samples
filling 230 samples
filling 230 samples
filling 230 samples
filling 230 samples
filling 62 samples
filling 62 samples
filling 62 samples
filling 62 samples
```

filling	135 samples
filling	135 samples
filling	135 samples
filling	135 samples
filling	1 samples
filling	1 samples
filling	1 samples
filling	1 samples
filling	1 samples
filling	1 samples
filling	1 samples
filling	1 samples
filling	1 samples
filling	1 samples
filling	1 samples
filling	1 samples
filling	1 samples
filling	1 samples
filling	1 samples
filling	1 samples
filling	1 samples
filling	1 samples
filling	1 samples
filling	1 samples
filling	1 samples
filling	1 samples
filling	1 samples
filling	84 samples
filling	84 samples
filling	84 samples
filling	84 samples
filling	1 samples
filling	1 samples
filling	1 samples
filling	1 samples
filling	3 samples
filling	3 samples
filling	3 samples
filling	3 samples
filling	1 samples
filling	1 samples
filling	1 samples
filling	1 samples



[illegible]

```
[31]: from voro_helper import get_task_data, feat_trans, NC_o, tsk_cls, fun, \
      ↪ acc_brother, forgetting

      i = task_num
      support_data_, support_label_, query_data_, query_label_, n_ways_, n_shot_, _ = \
          get_task_data(embst, embs, i, fg_nc, class_set, task_size, brother=brother)
```

```
##### current_task: 10 #####
current classes [380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395
396 397
    398 399]
[output] all classes 0 -> 399
```

```
[32]: #####
      ↪ #####
be      = 1. # 1.
l2      = False # False True
protots = np.mean(feats_trans(support_data_, beta=be, l2=l2), axis=1)
```

```
[22]: i = 0
      support_data, support_label, query_data, query_label, n_ways, n_shot, classes = \
          get_task_data(embst, embs, i, fg_nc, class_set, task_size, brother=brother)
```

```

acc, _, nn_pre = NC_o(support_data, support_label,
                      query_data, query_label,
                      n_ways, n_shot,
                      beta = be, l2 = l2,
                      given_cen = protots[classes], given_only = True,
                      brother = brother)

```

```

##### current_task: 0 #####
current classes [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17,
18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37,
38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49]
[output] all classes 0 -> 49
0.4524

```

```

[33]: local      = False # True / False
nn_acc    = []
savefile  = path+'NN3' if brother else None # NN / NNp / NN3 / only saved NN
→results!
savefil2  = path+'NN3'
forget    = True # True False # calculate forgetting
class_ladder = []
a         = []
for i in range(task_num + 1):
    support_data, support_label, query_data, query_label, n_ways, n_shot,
→classes = \
        get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                      local = local, brother = brother) # False
    if forget:
        class_ladder.append(classes)
    acc, _, nn_pre = NC_o(support_data, support_label,
                          query_data, query_label,
                          n_ways, n_shot,
                          beta = be, l2 = l2,
                          given_cen = protots[classes] if local else protots[:
→classes[-1]+1],
                          given_only = True,
                          brother = brother,
                          savefile = savefile+'_'+str(i) if brother else None,
                          savefile2 = None, # savefil2+'_'+str(i), # None, #
                          weights = [0.7, 0.3],
                          class_ladder = class_ladder,
                          acc_all = a
                          )
    nn_acc.append(acc)
    # if all classes up2now: local = False, and protots[:classes[-1]+1]
print('local:', local, '| beta:', be, '| l2:', l2)

```

```

if brother:
    for accs in nn_acc:
        print('\t'.join([str(i) for i in accs]))
else:
    print('\n'.join([str(i) for i in nn_acc]))
if forget:
    avgf = forgetting(a, task_num)
    print(avgf)

```

```

##### current_task: 0 #####
current classes [ 0  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15
16 17
    18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35
    36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53
    54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71
    72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89
    90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107
    108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125
    126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143
    144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161
    162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179
    180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197
    198 199]

```

[output] all classes 0 -> 199

```

<<< loaded from: ../checkpoints/Subset_50_10x5voro/NN3_0.npy
0.3006

```

```

##### current_task: 1 #####
current classes [200 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215
216 217
    218 219]

```

[output] all classes 0 -> 219

```

<<< loaded from: ../checkpoints/Subset_50_10x5voro/NN3_1.npy
0.2995

```

```

##### current_task: 2 #####
current classes [220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235
236 237
    238 239]

```

[output] all classes 0 -> 239

```

<<< loaded from: ../checkpoints/Subset_50_10x5voro/NN3_2.npy
0.2859

```

```

##### current_task: 3 #####
current classes [240 241 242 243 244 245 246 247 248 249 250 251 252 253 254 255
256 257
    258 259]

```

```

[output] all classes 0 -> 259
<<< loaded from: ../checkpoints/Subset_50_10x5voro/NN3_3.npy
0.2763

##### current_task: 4 #####
current classes [260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275
276 277
278 279]
[output] all classes 0 -> 279
<<< loaded from: ../checkpoints/Subset_50_10x5voro/NN3_4.npy
0.2677

##### current_task: 5 #####
current classes [280 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295
296 297
298 299]
[output] all classes 0 -> 299
<<< loaded from: ../checkpoints/Subset_50_10x5voro/NN3_5.npy
0.2608

##### current_task: 6 #####
current classes [300 301 302 303 304 305 306 307 308 309 310 311 312 313 314 315
316 317
318 319]
[output] all classes 0 -> 319
<<< loaded from: ../checkpoints/Subset_50_10x5voro/NN3_6.npy
0.2560

##### current_task: 7 #####
current classes [320 321 322 323 324 325 326 327 328 329 330 331 332 333 334 335
336 337
338 339]
[output] all classes 0 -> 339
<<< loaded from: ../checkpoints/Subset_50_10x5voro/NN3_7.npy
0.2496

##### current_task: 8 #####
current classes [340 341 342 343 344 345 346 347 348 349 350 351 352 353 354 355
356 357
358 359]
[output] all classes 0 -> 359
<<< loaded from: ../checkpoints/Subset_50_10x5voro/NN3_8.npy
0.2444

##### current_task: 9 #####
current classes [360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375
376 377
378 379]

```

```

[output] all classes 0 -> 379
<<< loaded from: ../checkpoints/Subset_50_10x5voro/NN3_9.npy
0.2416

##### current_task: 10 #####
current classes [380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395
396 397
398 399]
[output] all classes 0 -> 399
<<< loaded from: ../checkpoints/Subset_50_10x5voro/NN3_10.npy
0.2361
local: False | beta: 1.0 | l2: False
0.3006 0.596 0.7276 0.7224 0.7232
0.29954545454545456 0.5847272727272728 0.7294545454545455
0.7243636363636363 0.7247272727272728
0.28591666666666665 0.567 0.7173333333333334 0.7123333333333334
0.7123333333333334
0.2763076923076923 0.5464615384615384 0.7052307692307692
0.7024615384615385 0.7009230769230769
0.26771428571428574 0.5277142857142857 0.6971428571428572
0.6942857142857143 0.694
0.2608 0.5144 0.6856 0.6832 0.6832
0.256 0.507 0.68225 0.67925 0.681
0.24958823529411764 0.49270588235294116 0.6670588235294118
0.6644705882352941 0.6668235294117647
0.24444444444444444 0.4908888888888889 0.6528888888888889 0.65
0.654
0.24157894736842106 0.4791578947368421 0.6448421052631579
0.6427368421052632 0.6450526315789473
0.23605 0.4682 0.6432 0.6394 0.6432
[[0.3006 0. 0. 0. 0. 0. 0. 0. 0. 0.
0. ]
[0.2837 0.458 0. 0. 0. 0. 0. 0. 0. 0.
0. ]
[0.2793 0.451 0.187 0. 0. 0. 0. 0. 0. 0.
0. ]
[0.2745 0.451 0.18 0.216 0. 0. 0. 0. 0. 0.
0. ]
[0.2644 0.451 0.178 0.212 0.263 0. 0. 0. 0. 0.
0. ]
[0.2574 0.448 0.174 0.208 0.255 0.253 0. 0. 0. 0.
0. ]
[0.2474 0.446 0.172 0.197 0.243 0.242 0.322 0. 0. 0.
0. ]
[0.2443 0.446 0.157 0.196 0.242 0.241 0.32 0.198 0. 0.
0. ]
[0.2329 0.426 0.156 0.19 0.239 0.24 0.32 0.198 0.302 0.
0. ]

```

```

[0.2261 0.416 0.156 0.186 0.236 0.238 0.314 0.194 0.29 0.299
0. ]
[0.2242 0.414 0.154 0.176 0.234 0.237 0.31 0.194 0.29 0.298
0.172 ]]
[0, 1.689999999999997, 1.414999999999996, 1.3366666666666658,
1.4049999999999994, 1.644, 2.17, 2.1900000000000004, 2.4462500000000005,
2.705555555555556, 2.6740000000000001]

```

```

[14]: def predict(model, x, voro=True):
    x = torch.from_numpy(x.astype(np.float32)).cuda()
    with torch.no_grad():
        predi = model.module.classifier(x)
    if voro:
        predi += - torch.sum((model.module.classifier.weight/2.）**2, dim=1)
    return predi

classes_all = []
test_share = []
paccS = []
for i in range(task_num + 1):
    support_data, support_label, query_data, query_label, n_ways, n_shot, \
    →classes = \
        get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                        local = True, brother = brother)

    # load model:
    if brother:
        cls_01 = classes[-1]+1
        assert cls_01 % 4 == 0
        filename = path + '%d_model.pkl' % (int(cls_01/4))
    else:
        filename = path + '%d_model.pkl' % (classes[-1]+1)
    model = torch.load(filename)
    model.eval()
    print('> loaded base phase model from:', filename)
    num_param(model)
    # do prediction:
    min_cls = min(classes)
    if brother:
        pred = predict(model, query_data)
    else:
        pred = predict(model, query_data)[:,:,:4]
    pmax = torch.max(pred, dim=1)[1]
    pacc = np.mean(t2n(pmax) == query_label - min_cls)
    print(pacc)
    if brother:
        accs = acc_brother(t2n(pred), t2n(pmax), query_label - min_cls, \
    →forLG=True)

```

```

        pacc = [pacc] + accs
    paccS.append(pacc)
    classes_all.append(classes)
    test_share.append(len(query_label))
print('all logistic locally:')
if brother:
    for accs in paccS:
        print('\t'.join([str(i) for i in accs]))
else:
    print('\n'.join([str(i) for i in paccS]))

```

```

[15]: for i in range(task_num + 1):
    support_data, support_label, query_data, query_label, n_ways, n_shot, \
    classes = \
        get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                        local = True, brother = brother)
    pred_all = []
    for classes in classes_all:
        # load model:
        if brother:
            cls_01 = classes[-1]+1
            assert cls_01 % 4 == 0
            filename = path + '%d_model.pkl' % (int(cls_01/4))
        else:
            filename = path + '%d_model.pkl' % (classes[-1]+1)
        model = torch.load(filename)
        model.eval()
        print('> loaded base phase model from:', filename)
        num_param(model)
        # do prediction:
        min_cls = min(classes)
        if brother:
            pred = predict(model, query_data)
        else:
            pred = predict(model, query_data)[:,:4]
        pmax = torch.max(pred, dim=1)[1]
        # pacc = np.mean(t2n(pmax) == query_label - min_cls)
        # print(pacc)
        if brother:
            labs_01 = query_label[:4]//4
            acc_, sc_pre = merge_sc(t2n(pred), labs_01,
                                    mth='softmax', forLG=True, return_pre=True)
            min_cls = int(min_cls / 4)
            pred_all.append( (sc_pre + min_cls).tolist() )
        else:
            pred_all.append( (t2n(pmax) + min_cls).tolist() )
    pred_all = np.array(pred_all)

```

```

print(pred_all.shape)

if i == 0:
    pred_in_clique = copy.deepcopy(pred_all)
else:
    pred_in_clique = np.hstack((pred_in_clique, pred_all))

```

```

[42]: print('cliques by test samples:', pred_in_clique.shape)

# compute prototypes
be      = 0.6 # 1.
l2      = True # False True
bias    = 0 # 0.05
protots = np.mean(feats_trans(support_data_, beta=be, l2=l2, bias=bias), axis=1)
query_pts = feats_trans(query_data_, beta=be, l2=l2, bias=bias)
# acenss = feats_trans(acens, beta=be, l2=l2, bias=bias)
if brother:
    dist = funbtch(query_pts, protots) # protots / acenss
else:
    dist = fun(query_pts, protots) # protots / acenss

test_splt = [sum(test_share[:t+1]) for t in range(len(test_share))]

```

```

[238]: dist_in_clique = np.zeros_like(pred_in_clique, dtype=np.float32)
for c_id, clique in enumerate(pred_in_clique):
    for s_id, samp in enumerate(clique):
        dist_in_clique[c_id][s_id] = dist[s_id][samp]

```

```

[253]: for i in range(task_num + 1):
        clique_dist = dist_in_clique[:i+1,:test_splt[i]]
        clique_pred = np.argmax(clique_dist, axis=0)
        merge_pred = [pred_in_clique[cli,s_id] for s_id, cli in
→enumerate(clique_pred)]
        merge_acc = np.mean(merge_pred == query_label_[:test_splt[i]])
        print(merge_acc)
print('DaC:', 'beta:', be, '| l2:', l2)

```

```

[28]: print('===== Experiment Done! =====')

```

```

===== Experiment Done! =====

```



## iVoro on CIFAR-100 Dataset (12 Phases)

```
[99]: import matplotlib.pyplot as plt
import os
import pickle
import numpy as np
import pandas as pd
import seaborn as sns
import time
import sys
sys.path.append('../')
sys.path.append('../analysis/')
import copy
import platform
import json
import pickle
import random

import torch
from scipy.stats import mode
```

```
[100]: from ResNet import resnet18_cbam

data_name      = 'CIFAR100' # 'Subset' # 'Tiny' # 'CIFAR100' # 'MNIST'
total_nc       = 100 # 200 # 100 # 10
fg_nc          = 40 # 100 # 40 # 50 # 4
task_num       = 12 # 20 # 5 # 10 # 2

# constant params
class_set      = list(range(total_nc))
ROTATION       = True
EMB2D          = False
DESIGN         = True
virtual_class  = 4*total_nc if ROTATION else total_nc
suffix         = 'voro' # 'prob' 'voro'
assert (total_nc - fg_nc)%task_num == 0
task_size      = int((total_nc - fg_nc)/task_num)
file_name      =
    ↳data_name+'_'+str(fg_nc)+'_'+str(task_num)+'x'+str(task_size)+suffix
```

```
print(file_name)

brother      = False # True False
```

CIFAR100\_40\_12x5voro

```
[101]: save_path = '../checkpoints/'
path    = save_path + file_name + '/'
filename = path + '%d_model.pkl' % (fg_nc+0) # +5
model    = torch.load(filename)
model.eval()
print('> loaded base phase model from:', filename)
```

> loaded base phase model from: ../checkpoints/CIFAR100\_40\_12x5voro/40\_model.pkl

```
[102]: from voro_helper import num_param, t2n, \
        load_feat, sanity_check, \
        id2emb_, num_samp, merge_sc, funbtch

num_param(model)

# voronoi centers:
vcenter = t2n(model.module.classifier.weight.data / 2.)
print(vcenter.shape)
```

```
module.classifier.weight      torch.Size([160, 512])  81920   True
total: 81920
(160, 512)
```

```
[103]: '''
CIFAR:
    'CIFAR100_50_5x10_test.pkl'
    'CIFAR100_50_5x10_train.pkl'
    'CIFAR100_40_20x3_test.pkl'
    'CIFAR100_40_20x3_train.pkl'
more CIFAR:
    'CIFAR100_40_12x5_test.pkl'
    'CIFAR100_40_12x5_train.pkl'
    'CIFAR100_30_14x5_test.pkl'
    'CIFAR100_30_14x5_train.pkl'
    'CIFAR100_20_16x5_test.pkl'
    'CIFAR100_20_16x5_train.pkl'
    'CIFAR100_10_18x5_test.pkl'
    'CIFAR100_10_18x5_train.pkl'
Tiny:
    'Tiny_100_20x5_test.pkl'
    'Tiny_100_20x5_train.pkl'
TinyL3:
    'Tiny_100_5x20_test.pkl'
```

```

        'Tiny_100_5x20_train.pkl'
Subset:
        'Subset_50_10x5_test.pkl'
        'Subset_50_10x5_train.pkl'
'''
ffile = '../embedding/prob/' + 'CIFAR100_40_12x5_test.pkl' # prob probL3
data_phas, last_tsk = load_feat(ffile)

labs, embeds, outputs = data_phas[last_tsk][last_tsk]
false_id, pred_ = sanity_check(labs, embeds, outputs)

```

```

feature file: ../embedding/prob/CIFAR100_40_12x5_test.pkl
> loaded tasks: dict_keys([12])
> classes: [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18,
19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38,
39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58,
59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78,
79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98,
99]
> samples: 10000
> embedding: 512
> classification: 400
~ acc (single): 59.41%
~ acc (quadruple): 50.43%

```

```

[104]: ffile = '../embedding/prob/' + 'CIFAR100_40_12x5_train.pkl' # prob probL3
data_phas, last_tsk = load_feat(ffile)

labst, embedst, outputst = data_phas[last_tsk][last_tsk]
false_id, pred_ = sanity_check(labst, embedst, outputst)

```

```

feature file: ../embedding/prob/CIFAR100_40_12x5_train.pkl
> loaded tasks: dict_keys([12])
> classes: [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18,
19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38,
39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58,
59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78,
79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98,
99]
> samples: 50000
> embedding: 512
> classification: 400
~ acc (single): 73.08%
~ acc (quadruple): 65.20%

```

```

[105]: embs = id2emb_(labs, embeds, brother=brother)
embst = id2emb_(labst, embedst, brother=brother)

```

```
sam_max, sam_min = num_samp(embst)
print('> loading data done!')
```

```
0 500,1 500,2 500,3 500,4 500,5 500,6 500,7 500,8 500,9 500,10 500,11 500,12
500,13 500,14 500,15 500,16 500,17 500,18 500,19 500,20 500,21 500,22 500,23
500,24 500,25 500,26 500,27 500,28 500,29 500,30 500,31 500,32 500,33 500,34
500,35 500,36 500,37 500,38 500,39 500,40 500,41 500,42 500,43 500,44 500,45
500,46 500,47 500,48 500,49 500,50 500,51 500,52 500,53 500,54 500,55 500,56
500,57 500,58 500,59 500,60 500,61 500,62 500,63 500,64 500,65 500,66 500,67
500,68 500,69 500,70 500,71 500,72 500,73 500,74 500,75 500,76 500,77 500,78
500,79 500,80 500,81 500,82 500,83 500,84 500,85 500,86 500,87 500,88 500,89
500,90 500,91 500,92 500,93 500,94 500,95 500,96 500,97 500,98 500,99 500,
max samples: 500
min samples: 500
> loading data done!
```

```
[106]: for k,v in embst.items():
        if v.shape[0] < sam_max:
            rid = np.random.choice(v.shape[0], sam_max-v.shape[0], replace=False)
            print('filling', sam_max-v.shape[0], 'samples')
            embst[k] = np.vstack((v, v[rid]))
```

```
[107]: from voro_helper import get_task_data, feat_trans, NC_o, tsk_cls, fun, \
        ↪acc_brother, forgetting

i = task_num
support_data_, support_label_, query_data_, query_label_, n_ways_, n_shot_, _ = \
    get_task_data(embst, embs, i, fg_nc, class_set, task_size, brother=brother)
```

```
##### current_task: 12 #####
current classes [95, 96, 97, 98, 99]
[output] all classes 0 -> 99
```

```
[108]: #%% =====
        ↪=====
be      = 1. # 1.
l2      = False # False True
protots = np.mean(feat_trans(support_data_, beta=be, l2=l2), axis=1)
```

```
[109]: i = 0
support_data, support_label, query_data, query_label, n_ways, n_shot, classes = \
    get_task_data(embst, embs, i, fg_nc, class_set, task_size, brother=brother)
acc, _, nn_pre = NC_o(support_data, support_label,
                      query_data, query_label,
                      n_ways, n_shot,
                      beta = be, l2 = l2,
                      given_cen = protots[classes], given_only = True,
```

```
brother = brother)
```

```
##### current_task: 0 #####
current classes [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17,
18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37,
38, 39]
[output] all classes 0 -> 39
0.8203
```

```
[110]: local      = False # True / False
nn_acc   = []
savefile = path+'NN3' if brother else None # NN / NNp / NN3 / only saved NN
→results!
savefil2 = path+'NN3'
forget    = True # True False # calculate forgetting
class_ladder = []
a         = []
for i in range(task_num + 1):
    support_data, support_label, query_data, query_label, n_ways, n_shot,
→classes = \
        get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                        local = local, brother = brother) # False
    if forget:
        class_ladder.append(classes)
    acc, _, nn_pre = NC_o(support_data, support_label,
                           query_data, query_label,
                           n_ways, n_shot,
                           beta = be, l2 = l2,
                           given_cen = protots[classes] if local else protots[:
→classes[-1]+1],
                           given_only = True,
                           brother = brother,
                           savefile = savefile+'_'+str(i) if brother else None,
                           savefile2 = None, # savefil2+'_'+str(i), # None, #
                           weights = [0.7, 0.3],
                           class_ladder = class_ladder,
                           acc_all = a
                           )
    nn_acc.append(acc)
    # if all classes up2now: local = False, and protots[:classes[-1]+1]
print('local:', local, '| beta:', be, '| l2:', l2)
if brother:
    for accs in nn_acc:
        print('\t'.join([str(i) for i in accs]))
else:
    print('\n'.join([str(i) for i in nn_acc]))
```

```
if forget:
    avgf = forgetting(a, task_num)
    print(avgf)
```

```
##### current_task: 0 #####
current classes [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17,
18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37,
38, 39]
[output] all classes 0 -> 39
0.8203
```

```
##### current_task: 1 #####
current classes [40, 41, 42, 43, 44]
[output] all classes 0 -> 44
0.7522
```

```
##### current_task: 2 #####
current classes [45, 46, 47, 48, 49]
[output] all classes 0 -> 49
0.7160
```

```
##### current_task: 3 #####
current classes [50, 51, 52, 53, 54]
[output] all classes 0 -> 54
0.6893
```

```
##### current_task: 4 #####
current classes [55, 56, 57, 58, 59]
[output] all classes 0 -> 59
0.6557
```

```
##### current_task: 5 #####
current classes [60, 61, 62, 63, 64]
[output] all classes 0 -> 64
0.6323
```

```
##### current_task: 6 #####
current classes [65, 66, 67, 68, 69]
[output] all classes 0 -> 69
0.6110
```

```
##### current_task: 7 #####
current classes [70, 71, 72, 73, 74]
[output] all classes 0 -> 74
0.5815
```

```
##### current_task: 8 #####
```

```
current classes [75, 76, 77, 78, 79]
[output] all classes 0 -> 79
0.5644
```

```
##### current_task: 9 #####
current classes [80, 81, 82, 83, 84]
[output] all classes 0 -> 84
0.5464
```

```
##### current_task: 10 #####
current classes [85, 86, 87, 88, 89]
[output] all classes 0 -> 89
0.5356
```

```
##### current_task: 11 #####
current classes [90, 91, 92, 93, 94]
[output] all classes 0 -> 94
0.5232
```

```
##### current_task: 12 #####
current classes [95, 96, 97, 98, 99]
[output] all classes 0 -> 99
0.5061
local: False | beta: 1.0 | 12: False
0.82025
0.7522222222222222
0.716
0.6892727272727273
0.6556666666666666
0.6323076923076923
0.611
0.5814666666666667
0.564375
0.5463529411764706
0.5355555555555556
0.5231578947368422
0.5061
```

```
[0.82025 0.      0.      0.      0.      0.      0.      0.      0.
 0.      0.      0.      0.      ]
[0.76525 0.648  0.      0.      0.      0.      0.      0.      0.
 0.      0.      0.      0.      ]
[0.74625 0.614  0.576  0.      0.      0.      0.      0.      0.
 0.      0.      0.      0.      ]
[0.73175 0.578  0.512  0.638  0.      0.      0.      0.      0.
 0.      0.      0.      0.      ]
[0.72225 0.562  0.49   0.614  0.424  0.      0.      0.      0.
 0.      0.      0.      0.      ]
[0.7135  0.538  0.472  0.572  0.418  0.512  0.      0.      0.]
```

```

0.      0.      0.      0.      ]
[0.706  0.518  0.458  0.566  0.404  0.496  0.464  0.      0.
0.      0.      0.      0.      ]
[0.70125 0.516  0.446  0.55   0.38   0.45   0.418  0.352  0.
0.      0.      0.      0.      ]
[0.69725 0.502  0.43   0.534  0.37   0.442  0.39   0.344  0.44
0.      0.      0.      0.      ]
[0.688   0.492  0.43   0.516  0.354  0.434  0.372  0.34   0.432
0.414   0.      0.      0.      ]
[0.68275 0.466  0.424  0.516  0.344  0.43   0.368  0.338  0.414
0.388   0.49   0.      0.      ]
[0.68025 0.458  0.418  0.504  0.342  0.418  0.36   0.324  0.406
0.378   0.472  0.418  0.      ]
[0.674   0.446  0.402  0.5    0.334  0.414  0.344  0.318  0.386
0.378   0.468  0.418  0.322  ]]
[0, 5.5000000000000005, 5.4000000000000005, 7.416666666666667, 7.350000000000001,
7.855, 7.837500000000001, 8.871428571428572, 9.062500000000002,
9.069444444444448, 9.175000000000002, 9.254545454545458, 9.285416666666668]

```

```

[111]: def predict(model, x, voro=True):
        x = torch.from_numpy(x.astype(np.float32)).cuda()
        with torch.no_grad():
            predi = model.module.classifier(x)
            if voro:
                predi += - torch.sum((model.module.classifier.weight/2.)**2, dim=1)
            return predi

classes_all = []
test_share = []
paccS = []
for i in range(task_num + 1):
    support_data, support_label, query_data, query_label, n_ways, n_shot, \
    classes = \
        get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                        local = True, brother = brother)

    # load model:
    if brother:
        cls_01 = classes[-1]+1
        assert cls_01 % 4 == 0
        filename = path + '%d_model.pkl' % (int(cls_01/4))
    else:
        filename = path + '%d_model.pkl' % (classes[-1]+1)
    model = torch.load(filename)
    model.eval()
    print('> loaded base phase model from:', filename)
    num_param(model)
    # do prediction:

```



```

min_cls = min(classes)
if brother:
    pred = predict(model, query_data)
else:
    pred = predict(model, query_data)[:,:,:4]
pmax = torch.max(pred, dim=1)[1]
pacc = np.mean(t2n(pmax) == query_label - min_cls)
print(pacc)
if brother:
    accs = acc_brother(t2n(pred), t2n(pmax), query_label - min_cls,
→forLG=True)
    pacc = [pacc] + accs
    paccS.append(pacc)
    classes_all.append(classes)
    test_share.append(len(query_label))
print('all logistic locally:')
if brother:
    for accs in paccS:
        print('\t'.join([str(i) for i in accs]))
else:
    print('\n'.join([str(i) for i in paccS]))

```

```

##### current_task: 0 #####
[output] current classes [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15,
16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35,
36, 37, 38, 39]
all classes 0 -> 39
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/40_model.pkl
module.classifier.weight      torch.Size([160, 512])  81920   True
total: 81920
0.8185

```

```

##### current_task: 1 #####
[output] current classes [40, 41, 42, 43, 44]
all classes 0 -> 44
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
0.862

```

```

##### current_task: 2 #####
[output] current classes [45, 46, 47, 48, 49]
all classes 0 -> 49
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
0.95

```

```
##### current_task: 3 #####
[output] current classes [50, 51, 52, 53, 54]
all classes 0 -> 54
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.914
```

```
##### current_task: 4 #####
[output] current classes [55, 56, 57, 58, 59]
all classes 0 -> 59
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.906
```

```
##### current_task: 5 #####
[output] current classes [60, 61, 62, 63, 64]
all classes 0 -> 64
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.904
```

```
##### current_task: 6 #####
[output] current classes [65, 66, 67, 68, 69]
all classes 0 -> 69
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.88
```

```
##### current_task: 7 #####
[output] current classes [70, 71, 72, 73, 74]
all classes 0 -> 74
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.904
```

```
##### current_task: 8 #####
[output] current classes [75, 76, 77, 78, 79]
all classes 0 -> 79
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.874
```

```

##### current_task: 9 #####
[output] current classes [80, 81, 82, 83, 84]
all classes 0 -> 84
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.944

##### current_task: 10 #####
[output] current classes [85, 86, 87, 88, 89]
all classes 0 -> 89
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.902

##### current_task: 11 #####
[output] current classes [90, 91, 92, 93, 94]
all classes 0 -> 94
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.926

##### current_task: 12 #####
[output] current classes [95, 96, 97, 98, 99]
all classes 0 -> 99
> loaded base phase model from:
../checkpoints/CIFAR100_40_12x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.952
all logistic locally:
0.8185
0.862
0.95
0.914
0.906
0.904
0.88
0.904
0.874
0.944
0.902
0.926
0.952

```

```

[112]: for i in range(task_num + 1):
        support_data, support_label, query_data, query_label, n_ways, n_shot, \
        classes = \
            get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                          local = True, brother = brother)

        pred_all = []
        for classes in classes_all:
            # load model:
            if brother:
                cls_01 = classes[-1]+1
                assert cls_01 % 4 == 0
                filename = path + '%d_model.pkl' % (int(cls_01/4))
            else:
                filename = path + '%d_model.pkl' % (classes[-1]+1)
            model = torch.load(filename)
            model.eval()
            print('> loaded base phase model from:', filename)
            num_param(model)
            # do prediction:
            min_cls = min(classes)
            if brother:
                pred = predict(model, query_data)
            else:
                pred = predict(model, query_data)[:,:4]
            pmax = torch.max(pred, dim=1)[1]
            # pacc = np.mean(t2n(pmax) == query_label - min_cls)
            # print(pacc)
            if brother:
                labs_01 = query_label[:4]//4
                acc_, sc_pre = merge_sc(t2n(pred), labs_01,
                                         mth='softmax', forLG=True, return_pre=True)
                min_cls = int(min_cls / 4)
                pred_all.append( (sc_pre + min_cls).tolist() )
            else:
                pred_all.append( (t2n(pmax) + min_cls).tolist() )
        pred_all = np.array(pred_all)
        print(pred_all.shape)

        if i == 0:
            pred_in_clique = copy.deepcopy(pred_all)
        else:
            pred_in_clique = np.hstack((pred_in_clique, pred_all))

```

##### current\_task: 0 #####

[output] current classes [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39]

```

all classes 0 -> 39
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/40_model.pkl
module.classifier.weight      torch.Size([160, 512])  81920   True
total: 81920
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_40_12x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
(13, 4000)

##### current_task: 1 #####
[output] current classes [40, 41, 42, 43, 44]
all classes 0 -> 44
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/40_model.pkl
module.classifier.weight      torch.Size([160, 512])  81920   True

```

```

total: 81920
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_40_12x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(13, 500)

```

```
##### current_task: 2 #####
```

```
[output] current classes [45, 46, 47, 48, 49]
```

```
all classes 0 -> 49
```

```

> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/40_model.pkl
module.classifier.weight      torch.Size([160, 512])   81920    True
total: 81920
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True

```

```

total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_40_12x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(13, 500)

##### current_task: 3 #####
[output] current classes [50, 51, 52, 53, 54]
all classes 0 -> 54
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/40_model.pkl
module.classifier.weight      torch.Size([160, 512])   81920    True
total: 81920
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True

```

```

total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_40_12x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(13, 500)

```

```
##### current_task: 4 #####
```

```
[output] current classes [55, 56, 57, 58, 59]
```

```
all classes 0 -> 59
```

```

> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/40_model.pkl
module.classifier.weight      torch.Size([160, 512])   81920    True
total: 81920
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True

```



```

total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_40_12x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(13, 500)

```

```
##### current_task: 5 #####
```

```
[output] current classes [60, 61, 62, 63, 64]
```

```
all classes 0 -> 64
```

```

> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/40_model.pkl
module.classifier.weight      torch.Size([160, 512])   81920    True
total: 81920
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True

```

```

total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_40_12x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(13, 500)

##### current_task: 6 #####
[output] current classes [65, 66, 67, 68, 69]
all classes 0 -> 69
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/40_model.pkl
module.classifier.weight      torch.Size([160, 512])   81920    True
total: 81920
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True

```

```

total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_40_12x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(13, 500)

```

```
##### current_task: 7 #####
```

```
[output] current classes [70, 71, 72, 73, 74]
```

```
all classes 0 -> 74
```

```

> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/40_model.pkl
module.classifier.weight      torch.Size([160, 512])    81920    True
total: 81920
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True

```

```

total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_40_12x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(13, 500)

```

```
##### current_task: 8 #####
```

```
[output] current classes [75, 76, 77, 78, 79]
```

```
all classes 0 -> 79
```

```

> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/40_model.pkl
module.classifier.weight      torch.Size([160, 512])   81920    True
total: 81920
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True

```

```

total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_40_12x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(13, 500)

##### current_task: 9 #####
[output] current classes [80, 81, 82, 83, 84]
all classes 0 -> 84
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/40_model.pkl
module.classifier.weight      torch.Size([160, 512])   81920    True
total: 81920
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True

```

```

total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_40_12x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(13, 500)

```

```
##### current_task: 10 #####
```

```
[output] current classes [85, 86, 87, 88, 89]
```

```
all classes 0 -> 89
```

```

> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/40_model.pkl
module.classifier.weight      torch.Size([160, 512])   81920    True
total: 81920
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True

```

```

total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_40_12x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(13, 500)

```

```
##### current_task: 11 #####
```

```
[output] current classes [90, 91, 92, 93, 94]
```

```
all classes 0 -> 94
```

```

> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/40_model.pkl
module.classifier.weight      torch.Size([160, 512])   81920    True
total: 81920
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True

```

```

total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_40_12x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(13, 500)

##### current_task: 12 #####
[output] current classes [95, 96, 97, 98, 99]
all classes 0 -> 99
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/40_model.pkl
module.classifier.weight      torch.Size([160, 512])   81920    True
total: 81920
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True

```



```

total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_40_12x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(13, 500)

```

```

[113]: print('cliques by test samples:', pred_in_clique.shape)

# compute prototypes
be      = 0.6 # 1.
l2      = True # False True
bias    = 0 # 0.05
protots  = np.mean(feet_trans(support_data_, beta=be, l2=l2, bias=bias), axis=1)
query_pts = feet_trans(query_data_, beta=be, l2=l2, bias=bias)
# acenss  = feet_trans(acens, beta=be, l2=l2, bias=bias)
if brother:
    dist    = funbtch(query_pts, protots) # protots / acenss
else:
    dist    = fun(query_pts, protots) # protots / acenss

test_splt = [sum(test_share[:t+1]) for t in range(len(test_share))]

```

cliques by test samples: (13, 10000)

```

[114]: dist_in_clique = np.zeros_like(pred_in_clique, dtype=np.float32)
for c_id, clique in enumerate(pred_in_clique):
    for s_id, samp in enumerate(clique):
        dist_in_clique[c_id][s_id] = dist[s_id][samp]

```

```

[115]: for i in range(task_num + 1):
        clique_dist = dist_in_clique[:i+1,:test_splt[i]]
        clique_pred = np.argmax(clique_dist, axis=0)
        merge_pred = [pred_in_clique[cli,s_id] for s_id, cli in
            ↪ enumerate(clique_pred)]
        merge_acc = np.mean(merge_pred == query_label_[:test_splt[i]])
        print(merge_acc)
print('DaC:', 'beta:', be, '| l2:', l2)

```

```

0.8185
0.7577777777777778
0.7236
0.6987272727272728
0.6676666666666666
0.6450769230769231
0.623
0.5922666666666667
0.577625
0.5583529411764706

```

```
0.5501111111111111
0.5365263157894736
0.5198
DaC: beta: 0.6 | 12: True
```

```
[28]: print('===== Experiment Done! =====')
```

```
===== Experiment Done! =====
```

## iVoro-AC/AI on CIFAR-100 Dataset (12 Phases)

```
[99]: import matplotlib.pyplot as plt
import os
import pickle
import numpy as np
import pandas as pd
import seaborn as sns
import time
import sys
sys.path.append('../')
sys.path.append('../analysis/')
import copy
import platform
import json
import pickle
import random

import torch
from scipy.stats import mode
```

```
[116]: from ResNet import resnet18_cbam

data_name      = 'CIFAR100' # 'Subset' # 'Tiny' # 'CIFAR100' # 'MNIST'
total_nc       = 100 # 200 # 100 # 10
fg_nc          = 40 # 100 # 40 # 50 # 4
task_num       = 12 # 20 # 5 # 10 # 2

# constant params
class_set      = list(range(total_nc))
ROTATION       = True
EMB2D          = False
DESIGN         = True
virtual_class  = 4*total_nc if ROTATION else total_nc
suffix         = 'voro' # 'prob' 'voro'
assert (total_nc - fg_nc)%task_num == 0
task_size      = int((total_nc - fg_nc)/task_num)
file_name      =
    ↳data_name+'_'+str(fg_nc)+'_'+str(task_num)+'x'+str(task_size)+suffix
```

```
print(file_name)

brother      = True # True False
```

CIFAR100\_40\_12x5voro

```
[117]: save_path = '../checkpoints/'
path    = save_path + file_name + '/'
filename = path + '%d_model.pkl' % (fg_nc+0) # +5
model    = torch.load(filename)
model.eval()
print('> loaded base phase model from:', filename)
```

> loaded base phase model from: ../checkpoints/CIFAR100\_40\_12x5voro/40\_model.pkl

```
[118]: from voro_helper import num_param, t2n, \
        load_feat, sanity_check, \
        id2emb_, num_samp, merge_sc, funbtch

num_param(model)

# voronoi centers:
vcenter = t2n(model.module.classifier.weight.data / 2.)
print(vcenter.shape)
```

```
module.classifier.weight      torch.Size([160, 512])  81920    True
total: 81920
(160, 512)
```

```
[119]: '''
CIFAR:
    'CIFAR100_50_5x10_test.pkl'
    'CIFAR100_50_5x10_train.pkl'
    'CIFAR100_40_20x3_test.pkl'
    'CIFAR100_40_20x3_train.pkl'
more CIFAR:
    'CIFAR100_40_12x5_test.pkl'
    'CIFAR100_40_12x5_train.pkl'
    'CIFAR100_30_14x5_test.pkl'
    'CIFAR100_30_14x5_train.pkl'
    'CIFAR100_20_16x5_test.pkl'
    'CIFAR100_20_16x5_train.pkl'
    'CIFAR100_10_18x5_test.pkl'
    'CIFAR100_10_18x5_train.pkl'
Tiny:
    'Tiny_100_20x5_test.pkl'
    'Tiny_100_20x5_train.pkl'
TinyL3:
    'Tiny_100_5x20_test.pkl'
```

```

    'Tiny_100_5x20_train.pkl'
Subset:
    'Subset_50_10x5_test.pkl'
    'Subset_50_10x5_train.pkl'
'''
ffile = '../embedding/prob/' + 'CIFAR100_40_12x5_test.pkl' # prob probL3
dataphas, last_tsk = load_feat(ffile)

labs, embeds, outputs = dataphas[last_tsk][last_tsk]
false_id, pred_ = sanity_check(labs, embeds, outputs)

```

```

feature file: ../embedding/prob/CIFAR100_40_12x5_test.pkl
> loaded tasks: dict_keys([12])
> classes: [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18,
19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38,
39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58,
59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78,
79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98,
99]
> samples: 10000
> embedding: 512
> classification: 400
~ acc (single): 59.41%
~ acc (quadruple): 50.43%

```

```

[120]: ffile = '../embedding/prob/' + 'CIFAR100_40_12x5_train.pkl' # prob probL3
dataphas, last_tsk = load_feat(ffile)

labst, embedst, outputst = dataphas[last_tsk][last_tsk]
false_id, pred_ = sanity_check(labst, embedst, outputst)

```

```

feature file: ../embedding/prob/CIFAR100_40_12x5_train.pkl
> loaded tasks: dict_keys([12])
> classes: [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18,
19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38,
39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58,
59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78,
79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98,
99]
> samples: 50000
> embedding: 512
> classification: 400
~ acc (single): 73.08%
~ acc (quadruple): 65.20%

```

```

[121]: embs = id2emb_(labs, embeds, brother=brother)
embst = id2emb_(labst, embedst, brother=brother)

```

```
sam_max, sam_min = num_samp(embst)
print('> loading data done!')
```

```
0 500,1 500,2 500,3 500,4 500,5 500,6 500,7 500,8 500,9 500,10 500,11 500,12
500,13 500,14 500,15 500,16 500,17 500,18 500,19 500,20 500,21 500,22 500,23
500,24 500,25 500,26 500,27 500,28 500,29 500,30 500,31 500,32 500,33 500,34
500,35 500,36 500,37 500,38 500,39 500,40 500,41 500,42 500,43 500,44 500,45
500,46 500,47 500,48 500,49 500,50 500,51 500,52 500,53 500,54 500,55 500,56
500,57 500,58 500,59 500,60 500,61 500,62 500,63 500,64 500,65 500,66 500,67
500,68 500,69 500,70 500,71 500,72 500,73 500,74 500,75 500,76 500,77 500,78
500,79 500,80 500,81 500,82 500,83 500,84 500,85 500,86 500,87 500,88 500,89
500,90 500,91 500,92 500,93 500,94 500,95 500,96 500,97 500,98 500,99 500,100
500,101 500,102 500,103 500,104 500,105 500,106 500,107 500,108 500,109 500,110
500,111 500,112 500,113 500,114 500,115 500,116 500,117 500,118 500,119 500,120
500,121 500,122 500,123 500,124 500,125 500,126 500,127 500,128 500,129 500,130
500,131 500,132 500,133 500,134 500,135 500,136 500,137 500,138 500,139 500,140
500,141 500,142 500,143 500,144 500,145 500,146 500,147 500,148 500,149 500,150
500,151 500,152 500,153 500,154 500,155 500,156 500,157 500,158 500,159 500,160
500,161 500,162 500,163 500,164 500,165 500,166 500,167 500,168 500,169 500,170
500,171 500,172 500,173 500,174 500,175 500,176 500,177 500,178 500,179 500,180
500,181 500,182 500,183 500,184 500,185 500,186 500,187 500,188 500,189 500,190
500,191 500,192 500,193 500,194 500,195 500,196 500,197 500,198 500,199 500,200
500,201 500,202 500,203 500,204 500,205 500,206 500,207 500,208 500,209 500,210
500,211 500,212 500,213 500,214 500,215 500,216 500,217 500,218 500,219 500,220
500,221 500,222 500,223 500,224 500,225 500,226 500,227 500,228 500,229 500,230
500,231 500,232 500,233 500,234 500,235 500,236 500,237 500,238 500,239 500,240
500,241 500,242 500,243 500,244 500,245 500,246 500,247 500,248 500,249 500,250
500,251 500,252 500,253 500,254 500,255 500,256 500,257 500,258 500,259 500,260
500,261 500,262 500,263 500,264 500,265 500,266 500,267 500,268 500,269 500,270
500,271 500,272 500,273 500,274 500,275 500,276 500,277 500,278 500,279 500,280
500,281 500,282 500,283 500,284 500,285 500,286 500,287 500,288 500,289 500,290
500,291 500,292 500,293 500,294 500,295 500,296 500,297 500,298 500,299 500,300
500,301 500,302 500,303 500,304 500,305 500,306 500,307 500,308 500,309 500,310
500,311 500,312 500,313 500,314 500,315 500,316 500,317 500,318 500,319 500,320
500,321 500,322 500,323 500,324 500,325 500,326 500,327 500,328 500,329 500,330
500,331 500,332 500,333 500,334 500,335 500,336 500,337 500,338 500,339 500,340
500,341 500,342 500,343 500,344 500,345 500,346 500,347 500,348 500,349 500,350
500,351 500,352 500,353 500,354 500,355 500,356 500,357 500,358 500,359 500,360
500,361 500,362 500,363 500,364 500,365 500,366 500,367 500,368 500,369 500,370
500,371 500,372 500,373 500,374 500,375 500,376 500,377 500,378 500,379 500,380
500,381 500,382 500,383 500,384 500,385 500,386 500,387 500,388 500,389 500,390
500,391 500,392 500,393 500,394 500,395 500,396 500,397 500,398 500,399 500,
max samples: 500
min samples: 500
> loading data done!
```

```
[122]: for k,v in embst.items():
        if v.shape[0] < sam_max:
            rid = np.random.choice(v.shape[0], sam_max-v.shape[0], replace=False)
            print('filling', sam_max-v.shape[0], 'samples')
            embst[k] = np.vstack((v, v[rid]))
```

```
[123]: from voro_helper import get_task_data, feat_trans, NC_o, tsk_cls, fun,
        ↪acc_brother, forgetting

i = task_num
support_data_, support_label_, query_data_, query_label_, n_ways_, n_shot_, _ = \
    get_task_data(embst, embs, i, fg_nc, class_set, task_size, brother=brother)
```

```
##### current_task: 12 #####
current classes [380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395
396 397
398 399]
[output] all classes 0 -> 399
```

```
[124]: #%% =====
        ↪=====
be      = 1. # 1.
l2      = False # False True
protots = np.mean(feat_trans(support_data_, beta=be, l2=l2), axis=1)
```

```
[109]: i = 0
support_data, support_label, query_data, query_label, n_ways, n_shot, classes = \
    get_task_data(embst, embs, i, fg_nc, class_set, task_size, brother=brother)
acc, _, nn_pre = NC_o(support_data, support_label,
                      query_data, query_label,
                      n_ways, n_shot,
                      beta = be, l2 = l2,
                      given_cen = protots[classes], given_only = True,
                      brother = brother)
```

```
##### current_task: 0 #####
current classes [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17,
18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37,
38, 39]
[output] all classes 0 -> 39
0.8203
```

```
[125]: local      = False # True / False
nn_acc      = []
savefile = path+'NN' if brother else None # NN / NNp / NN3 / only saved NN
        ↪results!
```

```

savefil2 = path+'NN3'
forget    = True # True False # calculate forgetting
class_ladder = []
a         = []
for i in range(task_num + 1):
    support_data, support_label, query_data, query_label, n_ways, n_shot, \
    →classes = \
        get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                        local = local, brother = brother) # False
    if forget:
        class_ladder.append(classes)
    acc, _, nn_pre = NC_o(support_data, support_label,
                          query_data, query_label,
                          n_ways, n_shot,
                          beta = be, l2 = l2,
                          given_cen = protots[classes] if local else protots[:
    →classes[-1]+1],

                          given_only = True,
                          brother = brother,
                          savefile = savefile+'_'+str(i) if brother else None,
                          savefile2 = None, # savefil2+'_'+str(i), # None, #
                          weights = [0.7, 0.3],
                          class_ladder = class_ladder,
                          acc_all = a
                          )

    nn_acc.append(acc)
    # if all classes up2now: local = False, and protots[:classes[-1]+1]
print('local:', local, '| beta:', be, '| l2:', l2)
if brother:
    for accs in nn_acc:
        print('\t'.join([str(i) for i in accs]))
else:
    print('\n'.join([str(i) for i in nn_acc]))
if forget:
    avgf = forgetting(a, task_num)
    print(avgf)

```

##### current\_task: 0 #####

```

current classes [ 0  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15
16 17
18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35
36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53
54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71
72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89
90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107
108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125

```



```

126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143
144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159]
[output] all classes 0 -> 159
<<< loaded from: ../checkpoints/CIFAR100_40_12x5voro/NN_0.npy
0.7223

##### current_task: 1 #####
current classes [160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175
176 177
178 179]
[output] all classes 0 -> 179
<<< loaded from: ../checkpoints/CIFAR100_40_12x5voro/NN_1.npy
0.6663

##### current_task: 2 #####
current classes [180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195
196 197
198 199]
[output] all classes 0 -> 199
<<< loaded from: ../checkpoints/CIFAR100_40_12x5voro/NN_2.npy
0.6355

##### current_task: 3 #####
current classes [200 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215
216 217
218 219]
[output] all classes 0 -> 219
<<< loaded from: ../checkpoints/CIFAR100_40_12x5voro/NN_3.npy
0.6053

##### current_task: 4 #####
current classes [220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235
236 237
238 239]
[output] all classes 0 -> 239
<<< loaded from: ../checkpoints/CIFAR100_40_12x5voro/NN_4.npy
0.5767

##### current_task: 5 #####
current classes [240 241 242 243 244 245 246 247 248 249 250 251 252 253 254 255
256 257
258 259]
[output] all classes 0 -> 259
<<< loaded from: ../checkpoints/CIFAR100_40_12x5voro/NN_5.npy
0.5536

##### current_task: 6 #####
current classes [260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275

```

```

276 277
  278 279]
[output] all classes 0 -> 279
<<< loaded from: ../checkpoints/CIFAR100_40_12x5voro/NN_6.npy
0.5327

##### current_task: 7 #####
current classes [280 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295
296 297
  298 299]
[output] all classes 0 -> 299
<<< loaded from: ../checkpoints/CIFAR100_40_12x5voro/NN_7.npy
0.5082

##### current_task: 8 #####
current classes [300 301 302 303 304 305 306 307 308 309 310 311 312 313 314 315
316 317
  318 319]
[output] all classes 0 -> 319
<<< loaded from: ../checkpoints/CIFAR100_40_12x5voro/NN_8.npy
0.4888

##### current_task: 9 #####
current classes [320 321 322 323 324 325 326 327 328 329 330 331 332 333 334 335
336 337
  338 339]
[output] all classes 0 -> 339
<<< loaded from: ../checkpoints/CIFAR100_40_12x5voro/NN_9.npy
0.4706

##### current_task: 10 #####
current classes [340 341 342 343 344 345 346 347 348 349 350 351 352 353 354 355
356 357
  358 359]
[output] all classes 0 -> 359
<<< loaded from: ../checkpoints/CIFAR100_40_12x5voro/NN_10.npy
0.4592

##### current_task: 11 #####
current classes [360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375
376 377
  378 379]
[output] all classes 0 -> 379
<<< loaded from: ../checkpoints/CIFAR100_40_12x5voro/NN_11.npy
0.4463

##### current_task: 12 #####
current classes [380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395

```

```

396 397
398 399]
[output] all classes 0 -> 399
<<< loaded from: ../checkpoints/CIFAR100_40_12x5voro/NN_12.npy
0.4304
local: False | beta: 1.0 | l2: False
0.7223125      0.95825 0.95125 0.94875 0.91675
0.6663333333333333      0.9302222222222222      0.5448888888888889
0.5391111111111111      0.4657777777777778
0.63555 0.897 0.525 0.5176 0.446
0.6053181818181818      0.8712727272727273      0.4916363636363636
0.4845454545454545      0.418
0.5767083333333334      0.83 0.487 0.4811666666666667      0.4195
0.5536153846153846      0.8033846153846154      0.4776923076923077
0.47107692307692306      0.41323076923076923
0.5326785714285714      0.7784285714285715      0.4684285714285714
0.4612857142857143      0.407
0.5082 0.7450666666666667      0.4592 0.4522666666666665      0.3944
0.4888125      0.724 0.465 0.458375      0.405875
0.47061764705882353      0.7048235294117647      0.4692941176470588
0.46258823529411763      0.41552941176470587
0.4592222222222222      0.6946666666666667      0.4688888888888889      0.463
0.4136666666666667
0.4463157894736842      0.6786315789473685      0.4709473684210526
0.46557894736842104      0.414
0.430375      0.6566 0.4679 0.4632 0.4115
[[0.7223125 0.      0.      0.      0.      0.      0.
  0.      0.      0.      0.      0.      0.      ]
[0.6970625 0.4205 0.      0.      0.      0.      0.
  0.      0.      0.      0.      0.      0.      ]
[0.6795 0.3935 0.526 0.      0.      0.      0.
  0.      0.      0.      0.      0.      0.      ]
[0.6725625 0.382 0.4705 0.4255 0.      0.      0.
  0.      0.      0.      0.      0.      0.      ]
[0.6641875 0.3715 0.4535 0.4035 0.3785 0.      0.
  0.      0.      0.      0.      0.      0.      ]
[0.6588125 0.36 0.438 0.382 0.3765 0.37 0.
  0.      0.      0.      0.      0.      0.      ]
[0.65375 0.345 0.429 0.377 0.3655 0.356 0.355
  0.      0.      0.      0.      0.      0.      ]
[0.648875 0.344 0.4265 0.367 0.3475 0.3265 0.333
  0.2875 0.      0.      0.      0.      0.      ]
[0.6455625 0.3345 0.4185 0.362 0.338 0.3215 0.3195
  0.284 0.2785 0.      0.      0.      0.      ]
[0.6374375 0.323 0.4155 0.3495 0.3215 0.3165 0.314
  0.2775 0.2755 0.308 0.      0.      0.      ]
[0.633375 0.307 0.4105 0.348 0.311 0.3155 0.3095
  0.2755 0.272 0.2925 0.3575 0.      0.      ]

```

```

[0.6295625 0.3      0.404    0.34     0.307    0.307    0.304
 0.2645    0.266    0.28     0.345    0.326    0.      ]
[0.6235    0.294    0.3835    0.331    0.304    0.3035    0.2915
 0.2595    0.257    0.279    0.3435    0.325    0.248    ]]
[0, 2.5249999999999995, 3.490625, 4.791666666666667, 5.040624999999999, 5.15,
5.276041666666667, 5.777678571428573, 5.771875, 5.926388888888889,
5.969374999999999, 6.202272727272725, 6.335937499999998]

```

```

[126]: def predict(model, x, voro=True):
        x = torch.from_numpy(x.astype(np.float32)).cuda()
        with torch.no_grad():
            predi = model.module.classifier(x)
        if voro:
            predi += - torch.sum((model.module.classifier.weight/2.）**2, dim=1)
        return predi

classes_all = []
test_share = []
paccS = []
for i in range(task_num + 1):
    support_data, support_label, query_data, query_label, n_ways, n_shot, \
    →classes = \
        get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                      local = True, brother = brother)

    # load model:
    if brother:
        cls_01 = classes[-1]+1
        assert cls_01 % 4 == 0
        filename = path + '%d_model.pkl' % (int(cls_01/4))
    else:
        filename = path + '%d_model.pkl' % (classes[-1]+1)
    model = torch.load(filename)
    model.eval()
    print('> loaded base phase model from:', filename)
    num_param(model)
    # do prediction:
    min_cls = min(classes)
    if brother:
        pred = predict(model, query_data)
    else:
        pred = predict(model, query_data)[:,:,:4]
    pmax = torch.max(pred, dim=1)[1]
    pacc = np.mean(t2n(pmax) == query_label - min_cls)
    print(pacc)
    if brother:
        accs = acc_brother(t2n(pred), t2n(pmax), query_label - min_cls, \
    →forLG=True)

```

```

        pacc = [pacc] + accs
    paccS.append(pacc)
    classes_all.append(classes)
    test_share.append(len(query_label))
print('all logistic locally:')
if brother:
    for accs in paccS:
        print('\t'.join([str(i) for i in accs]))
else:
    print('\n'.join([str(i) for i in paccS]))

```

```

##### current_task: 0 #####
[output] current classes [ 0  1  2  3  4  5  6  7  8  9 10 11 12
13 14 15 16 17
 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35
 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53
 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71
 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89
 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107
108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125
126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143
144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159]
all classes 0 -> 159
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/40_model.pkl
module.classifier.weight      torch.Size([160, 512])  81920    True
total: 81920
0.71975

##### current_task: 1 #####
[output] current classes [160 161 162 163 164 165 166 167 168 169 170 171 172
173 174 175 176 177
178 179]
all classes 0 -> 179
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240    True
total: 10240
0.6615

##### current_task: 2 #####
[output] current classes [180 181 182 183 184 185 186 187 188 189 190 191 192
193 194 195 196 197
198 199]
all classes 0 -> 199
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240    True
total: 10240
0.844

```

```

##### current_task: 3 #####
[output] current classes [200 201 202 203 204 205 206 207 208 209 210 211 212
213 214 215 216 217
218 219]
all classes 0 -> 219
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.672

##### current_task: 4 #####
[output] current classes [220 221 222 223 224 225 226 227 228 229 230 231 232
233 234 235 236 237
238 239]
all classes 0 -> 239
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.8095

##### current_task: 5 #####
[output] current classes [240 241 242 243 244 245 246 247 248 249 250 251 252
253 254 255 256 257
258 259]
all classes 0 -> 259
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.6625

##### current_task: 6 #####
[output] current classes [260 261 262 263 264 265 266 267 268 269 270 271 272
273 274 275 276 277
278 279]
all classes 0 -> 279
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.705

##### current_task: 7 #####
[output] current classes [280 281 282 283 284 285 286 287 288 289 290 291 292
293 294 295 296 297
298 299]
all classes 0 -> 299
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True

```

```

total: 10240
0.678

##### current_task: 8 #####
[output] current classes [300 301 302 303 304 305 306 307 308 309 310 311 312
313 314 315 316 317
318 319]
all classes 0 -> 319
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.6065

##### current_task: 9 #####
[output] current classes [320 321 322 323 324 325 326 327 328 329 330 331 332
333 334 335 336 337
338 339]
all classes 0 -> 339
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.733

##### current_task: 10 #####
[output] current classes [340 341 342 343 344 345 346 347 348 349 350 351 352
353 354 355 356 357
358 359]
all classes 0 -> 359
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.689

##### current_task: 11 #####
[output] current classes [360 361 362 363 364 365 366 367 368 369 370 371 372
373 374 375 376 377
378 379]
all classes 0 -> 379
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.726

##### current_task: 12 #####
[output] current classes [380 381 382 383 384 385 386 387 388 389 390 391 392
393 394 395 396 397
398 399]
all classes 0 -> 399

```

```

> loaded base phase model from:
../checkpoints/CIFAR100_40_12x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.733
all logistic locally:
0.71975 0.959   0.97975 0.0    0.98075
0.6615  0.98    0.998   0.0    0.998
0.844   0.988   0.98    0.0    0.998
0.672   0.968   0.942   0.0    0.996
0.8095  0.99    0.996   0.0    0.996
0.6625  0.968   0.986   0.0    0.986
0.705   0.938   0.978   0.0    0.984
0.678   0.976   0.984   0.0    0.996
0.6065  0.97    0.986   0.0    0.99
0.733   0.996   0.998   0.0    1.0
0.689   0.964   0.968   0.0    0.984
0.726   0.988   0.962   0.0    1.0
0.733   0.996   0.992   0.0    1.0

```

```

[127]: for i in range(task_num + 1):
        support_data, support_label, query_data, query_label, n_ways, n_shot, \
        classes = \
            get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                          local = True, brother = brother)

        pred_all = []
        for classes in classes_all:
            # load model:
            if brother:
                cls_01 = classes[-1]+1
                assert cls_01 % 4 == 0
                filename = path + '%d_model.pkl' % (int(cls_01/4))
            else:
                filename = path + '%d_model.pkl' % (classes[-1]+1)
            model = torch.load(filename)
            model.eval()
            print('> loaded base phase model from:', filename)
            num_param(model)
            # do prediction:
            min_cls = min(classes)
            if brother:
                pred = predict(model, query_data)
            else:
                pred = predict(model, query_data)[:,:,:4]
            pmax = torch.max(pred, dim=1)[1]
            # pacc = np.mean(t2n(pmax) == query_label - min_cls)
            # print(pacc)

```



```

    if brother:
        labs_01 = query_label[:,4]//4
        acc_, sc_pre = merge_sc(t2n(pred), labs_01,
                                mth='softmax', forLG=True, return_pre=True)
        min_cls = int(min_cls / 4)
        pred_all.append( (sc_pre + min_cls).tolist() )
    else:
        pred_all.append( (t2n(pmax) + min_cls).tolist() )
pred_all = np.array(pred_all)
print(pred_all.shape)

if i == 0:
    pred_in_clique = copy.deepcopy(pred_all)
else:
    pred_in_clique = np.hstack((pred_in_clique, pred_all))

```

##### current\_task: 0 #####

[output] current classes [ 0 1 2 3 4 5 6 7 8 9 10 11 12

13 14 15 16 17

18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35  
36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53  
54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71  
72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89  
90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107  
108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125  
126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143  
144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159]

all classes 0 -> 159

> loaded base phase model from: ../checkpoints/CIFAR100\_40\_12x5voro/40\_model.pkl  
module.classifier.weight torch.Size([160, 512]) 81920 True  
total: 81920

> loaded base phase model from: ../checkpoints/CIFAR100\_40\_12x5voro/45\_model.pkl  
module.classifier.weight torch.Size([20, 512]) 10240 True  
total: 10240

> loaded base phase model from: ../checkpoints/CIFAR100\_40\_12x5voro/50\_model.pkl  
module.classifier.weight torch.Size([20, 512]) 10240 True  
total: 10240

> loaded base phase model from: ../checkpoints/CIFAR100\_40\_12x5voro/55\_model.pkl  
module.classifier.weight torch.Size([20, 512]) 10240 True  
total: 10240

> loaded base phase model from: ../checkpoints/CIFAR100\_40\_12x5voro/60\_model.pkl  
module.classifier.weight torch.Size([20, 512]) 10240 True  
total: 10240

> loaded base phase model from: ../checkpoints/CIFAR100\_40\_12x5voro/65\_model.pkl  
module.classifier.weight torch.Size([20, 512]) 10240 True  
total: 10240

> loaded base phase model from: ../checkpoints/CIFAR100\_40\_12x5voro/70\_model.pkl

```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_40_12x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(13, 4000)

```

##### current\_task: 1 #####

```

[output] current classes [160 161 162 163 164 165 166 167 168 169 170 171 172
173 174 175 176 177
178 179]
all classes 0 -> 179
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/40_model.pkl
module.classifier.weight      torch.Size([160, 512])   81920    True
total: 81920
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True

```

```

total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_40_12x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(13, 500)

```

```
##### current_task: 2 #####
```

```

[output] current classes [180 181 182 183 184 185 186 187 188 189 190 191 192
193 194 195 196 197
198 199]
all classes 0 -> 199
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/40_model.pkl
module.classifier.weight      torch.Size([160, 512])   81920    True
total: 81920
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240

```

```

> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_40_12x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(13, 500)

```

```
##### current_task: 3 #####
```

```

[output] current classes [200 201 202 203 204 205 206 207 208 209 210 211 212
213 214 215 216 217
218 219]

```

```
all classes 0 -> 219
```

```

> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/40_model.pkl
module.classifier.weight      torch.Size([160, 512])   81920    True
total: 81920
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/75_model.pkl

```

```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_40_12x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(13, 500)

##### current_task: 4 #####
[output] current classes [220 221 222 223 224 225 226 227 228 229 230 231 232
233 234 235 236 237
238 239]
all classes 0 -> 239
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/40_model.pkl
module.classifier.weight      torch.Size([160, 512])   81920    True
total: 81920
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True

```

```

total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_40_12x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(13, 500)

```

```
##### current_task: 5 #####
```

```

[output] current classes [240 241 242 243 244 245 246 247 248 249 250 251 252
253 254 255 256 257
258 259]
all classes 0 -> 259
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/40_model.pkl
module.classifier.weight      torch.Size([160, 512])   81920    True
total: 81920
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240

```

```

> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_40_12x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(13, 500)

```

```
##### current_task: 6 #####
```

```

[output] current classes [260 261 262 263 264 265 266 267 268 269 270 271 272
273 274 275 276 277
278 279]

```

```
all classes 0 -> 279
```

```

> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/40_model.pkl
module.classifier.weight      torch.Size([160, 512])   81920    True
total: 81920
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/80_model.pkl

```

```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_40_12x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(13, 500)

```

##### current\_task: 7 #####

```

[output] current classes [280 281 282 283 284 285 286 287 288 289 290 291 292
293 294 295 296 297
298 299]
all classes 0 -> 299
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/40_model.pkl
module.classifier.weight      torch.Size([160, 512])   81920    True
total: 81920
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True

```



```

total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_40_12x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(13, 500)

```

```
##### current_task: 8 #####
```

```

[output] current classes [300 301 302 303 304 305 306 307 308 309 310 311 312
313 314 315 316 317
318 319]

```

```
all classes 0 -> 319
```

```

> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/40_model.pkl
module.classifier.weight      torch.Size([160, 512])   81920    True
total: 81920
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240

```

```

> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_40_12x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(13, 500)

##### current_task: 9 #####
[output] current classes [320 321 322 323 324 325 326 327 328 329 330 331 332
333 334 335 336 337
338 339]
all classes 0 -> 339
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/40_model.pkl
module.classifier.weight      torch.Size([160, 512])   81920    True
total: 81920
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/85_model.pkl

```

```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_40_12x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(13, 500)

##### current_task: 10 #####
[output] current classes [340 341 342 343 344 345 346 347 348 349 350 351 352
353 354 355 356 357
358 359]
all classes 0 -> 359
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/40_model.pkl
module.classifier.weight      torch.Size([160, 512])   81920    True
total: 81920
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True

```

```

total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_40_12x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(13, 500)

```

```
##### current_task: 11 #####
```

```

[output] current classes [360 361 362 363 364 365 366 367 368 369 370 371 372
373 374 375 376 377
378 379]

```

```
all classes 0 -> 379
```

```

> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/40_model.pkl
module.classifier.weight      torch.Size([160, 512])   81920    True
total: 81920
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240

```

```

> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_40_12x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(13, 500)

```

```
##### current_task: 12 #####
```

```

[output] current classes [380 381 382 383 384 385 386 387 388 389 390 391 392
393 394 395 396 397
398 399]

```

```
all classes 0 -> 399
```

```

> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/40_model.pkl
module.classifier.weight      torch.Size([160, 512])   81920    True
total: 81920
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/90_model.pkl

```

```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_40_12x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_40_12x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(13, 500)

```

```

[113]: print('cliques by test samples:', pred_in_clique.shape)

# compute prototypes
be      = 0.6 # 1.
l2      = True # False True
bias    = 0 # 0.05
protots  = np.mean(feats_trans(support_data_, beta=be, l2=l2, bias=bias), axis=1)
query_pts = feats_trans(query_data_, beta=be, l2=l2, bias=bias)
# acenss  = feats_trans(acens, beta=be, l2=l2, bias=bias)
if brother:
    dist    = funbtch(query_pts, protots) # protots / acenss
else:
    dist    = fun(query_pts, protots) # protots / acenss

test_splt = [sum(test_share[:t+1]) for t in range(len(test_share))]

```

cliques by test samples: (13, 10000)

```

[114]: dist_in_clique = np.zeros_like(pred_in_clique, dtype=np.float32)
for c_id, clique in enumerate(pred_in_clique):
    for s_id, samp in enumerate(clique):
        dist_in_clique[c_id][s_id] = dist[s_id][samp]

```

```

[128]: for i in range(task_num + 1):
        clique_dist = dist_in_clique[:i+1,:test_splt[i]]
        clique_pred = np.argmax(clique_dist, axis=0)
        merge_pred = [pred_in_clique[cli,s_id] for s_id, cli in
            ↪enumerate(clique_pred)]
        merge_acc = np.mean(merge_pred == query_label_[:test_splt[i]])
        print(merge_acc)
print('DaC:', 'beta:', be, '| l2:', l2)

```

```

[28]: print('===== Experiment Done! =====')

```

===== Experiment Done! =====

## iVoro on CIFAR-100 Dataset (14 Phases)

```
[99]: import matplotlib.pyplot as plt
import os
import pickle
import numpy as np
import pandas as pd
import seaborn as sns
import time
import sys
sys.path.append('../')
sys.path.append('../analysis/')
import copy
import platform
import json
import pickle
import random

import torch
from scipy.stats import mode
```

```
[141]: from ResNet import resnet18_cbam

data_name      = 'CIFAR100' # 'Subset' # 'Tiny' # 'CIFAR100' # 'MNIST'
total_nc       = 100 # 200 # 100 # 10
fg_nc          = 30 # 100 # 40 # 50 # 4
task_num       = 14 # 20 # 5 # 10 # 2

# constant params
class_set      = list(range(total_nc))
ROTATION       = True
EMB2D          = False
DESIGN         = True
virtual_class  = 4*total_nc if ROTATION else total_nc
suffix         = 'voro' # 'prob' 'voro'
assert (total_nc - fg_nc)%task_num == 0
task_size      = int((total_nc - fg_nc)/task_num)
file_name      =
    ↳data_name+'_'+str(fg_nc)+'_'+str(task_num)+'x'+str(task_size)+suffix
```

```
print(file_name)

brother      = False # True False
```

CIFAR100\_30\_14x5voro

```
[142]: save_path = '../checkpoints/'
path    = save_path + file_name + '/'
filename = path + '%d_model.pkl' % (fg_nc+0) # +5
model    = torch.load(filename)
model.eval()
print('> loaded base phase model from:', filename)
```

> loaded base phase model from: ../checkpoints/CIFAR100\_30\_14x5voro/30\_model.pkl

```
[143]: from voro_helper import num_param, t2n, \
        load_feat, sanity_check, \
        id2emb_, num_samp, merge_sc, funbtch

num_param(model)

# voronoi centers:
vcenter = t2n(model.module.classifier.weight.data / 2.)
print(vcenter.shape)
```

```
module.classifier.weight      torch.Size([120, 512])  61440   True
total: 61440
(120, 512)
```

```
[144]: '''
CIFAR:
    'CIFAR100_50_5x10_test.pkl'
    'CIFAR100_50_5x10_train.pkl'
    'CIFAR100_40_20x3_test.pkl'
    'CIFAR100_40_20x3_train.pkl'
more CIFAR:
    'CIFAR100_40_12x5_test.pkl'
    'CIFAR100_40_12x5_train.pkl'
    'CIFAR100_30_14x5_test.pkl'
    'CIFAR100_30_14x5_train.pkl'
    'CIFAR100_20_16x5_test.pkl'
    'CIFAR100_20_16x5_train.pkl'
    'CIFAR100_10_18x5_test.pkl'
    'CIFAR100_10_18x5_train.pkl'
Tiny:
    'Tiny_100_20x5_test.pkl'
    'Tiny_100_20x5_train.pkl'
TinyL3:
    'Tiny_100_5x20_test.pkl'
```



```

    'Tiny_100_5x20_train.pkl'
Subset:
    'Subset_50_10x5_test.pkl'
    'Subset_50_10x5_train.pkl'
'''
ffile = '../embedding/prob/' + 'CIFAR100_30_14x5_test.pkl' # prob probL3
data_phas, last_tsk = load_feat(ffile)

labs, embeds, outputs = data_phas[last_tsk][last_tsk]
false_id, pred_ = sanity_check(labs, embeds, outputs)

```

```

feature file: ../embedding/prob/CIFAR100_30_14x5_test.pkl
> loaded tasks: dict_keys([14])
> classes: [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18,
19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38,
39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58,
59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78,
79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98,
99]
> samples: 10000
> embedding: 512
> classification: 400
~ acc (single): 56.53%
~ acc (quadruple): 46.73%

```

```

[145]: ffile = '../embedding/prob/' + 'CIFAR100_30_14x5_train.pkl' # prob probL3
data_phas, last_tsk = load_feat(ffile)

labst, embedst, outputst = data_phas[last_tsk][last_tsk]
false_id, pred_ = sanity_check(labst, embedst, outputst)

```

```

feature file: ../embedding/prob/CIFAR100_30_14x5_train.pkl
> loaded tasks: dict_keys([14])
> classes: [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18,
19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38,
39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58,
59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78,
79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98,
99]
> samples: 50000
> embedding: 512
> classification: 400
~ acc (single): 65.09%
~ acc (quadruple): 55.79%

```

```

[146]: embs = id2emb_(labs, embeds, brother=brother)
embst = id2emb_(labst, embedst, brother=brother)

```

```
sam_max, sam_min = num_samp(embst)
print('> loading data done!')
```

```
0 500,1 500,2 500,3 500,4 500,5 500,6 500,7 500,8 500,9 500,10 500,11 500,12
500,13 500,14 500,15 500,16 500,17 500,18 500,19 500,20 500,21 500,22 500,23
500,24 500,25 500,26 500,27 500,28 500,29 500,30 500,31 500,32 500,33 500,34
500,35 500,36 500,37 500,38 500,39 500,40 500,41 500,42 500,43 500,44 500,45
500,46 500,47 500,48 500,49 500,50 500,51 500,52 500,53 500,54 500,55 500,56
500,57 500,58 500,59 500,60 500,61 500,62 500,63 500,64 500,65 500,66 500,67
500,68 500,69 500,70 500,71 500,72 500,73 500,74 500,75 500,76 500,77 500,78
500,79 500,80 500,81 500,82 500,83 500,84 500,85 500,86 500,87 500,88 500,89
500,90 500,91 500,92 500,93 500,94 500,95 500,96 500,97 500,98 500,99 500,
max samples: 500
min samples: 500
> loading data done!
```

```
[147]: for k,v in embst.items():
        if v.shape[0] < sam_max:
            rid = np.random.choice(v.shape[0], sam_max-v.shape[0], replace=False)
            print('filling', sam_max-v.shape[0], 'samples')
            embst[k] = np.vstack((v, v[rid]))
```

```
[148]: from voro_helper import get_task_data, feat_trans, NC_o, tsk_cls, fun, \
        ↪acc_brother, forgetting

i = task_num
support_data_, support_label_, query_data_, query_label_, n_ways_, n_shot_, _ = \
    get_task_data(embst, embs, i, fg_nc, class_set, task_size, brother=brother)
```

```
##### current_task: 14 #####
current classes [95, 96, 97, 98, 99]
[output] all classes 0 -> 99
```

```
[149]: #%% =====
        ↪=====
be      = 1. # 1.
l2      = False # False True
protots = np.mean(feat_trans(support_data_, beta=be, l2=l2), axis=1)
```

```
[150]: i = 0
support_data, support_label, query_data, query_label, n_ways, n_shot, classes = \
    get_task_data(embst, embs, i, fg_nc, class_set, task_size, brother=brother)
acc, _, nn_pre = NC_o(support_data, support_label,
                      query_data, query_label,
                      n_ways, n_shot,
                      beta = be, l2 = l2,
                      given_cen = protots[classes], given_only = True,
```

```
brother = brother)
```

```
##### current_task: 0 #####
current classes [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17,
18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29]
[output] all classes 0 -> 29
0.8417
```

```
[151]: local      = False # True / False
nn_acc   = []
savefile = path+'NN' if brother else None # NN / NNp / NN3 / only saved NN
→results!
savefil2 = path+'NN3'
forget    = True # True False # calculate forgetting
class_ladder = []
a         = []
for i in range(task_num + 1):
    support_data, support_label, query_data, query_label, n_ways, n_shot,
→classes = \
        get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                        local = local, brother = brother) # False
    if forget:
        class_ladder.append(classes)
    acc, _, nn_pre = NC_o(support_data, support_label,
                           query_data, query_label,
                           n_ways, n_shot,
                           beta = be, l2 = l2,
                           given_cen = protots[classes] if local else protots[:
→classes[-1]+1],
                           given_only = True,
                           brother = brother,
                           savefile = savefile+'_'+str(i) if brother else None,
                           savefile2 = None, # savefil2+'_'+str(i), # None, #
                           weights = [0.7, 0.3],
                           class_ladder = class_ladder,
                           acc_all = a
                           )
    nn_acc.append(acc)
    # if all classes up2now: local = False, and protots[:classes[-1]+1]
print('local:', local, '| beta:', be, '| l2:', l2)
if brother:
    for accs in nn_acc:
        print('\t'.join([str(i) for i in accs]))
else:
    print('\n'.join([str(i) for i in nn_acc]))
if forget:
```

```
avgf = forgetting(a, task_num)
print(avgf)
```

```
##### current_task: 0 #####
current classes [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17,
18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29]
[output] all classes 0 -> 29
0.8417
```

```
##### current_task: 1 #####
current classes [30, 31, 32, 33, 34]
[output] all classes 0 -> 34
0.7660
```

```
##### current_task: 2 #####
current classes [35, 36, 37, 38, 39]
[output] all classes 0 -> 39
0.7145
```

```
##### current_task: 3 #####
current classes [40, 41, 42, 43, 44]
[output] all classes 0 -> 44
0.6736
```

```
##### current_task: 4 #####
current classes [45, 46, 47, 48, 49]
[output] all classes 0 -> 49
0.6460
```

```
##### current_task: 5 #####
current classes [50, 51, 52, 53, 54]
[output] all classes 0 -> 54
0.6251
```

```
##### current_task: 6 #####
current classes [55, 56, 57, 58, 59]
[output] all classes 0 -> 59
0.5922
```

```
##### current_task: 7 #####
current classes [60, 61, 62, 63, 64]
[output] all classes 0 -> 64
0.5702
```

```
##### current_task: 8 #####
current classes [65, 66, 67, 68, 69]
[output] all classes 0 -> 69
```

0.5474

```
##### current_task: 9 #####
current classes [70, 71, 72, 73, 74]
[output] all classes 0 -> 74
0.5219
```

```
##### current_task: 10 #####
current classes [75, 76, 77, 78, 79]
[output] all classes 0 -> 79
0.5048
```

```
##### current_task: 11 #####
current classes [80, 81, 82, 83, 84]
[output] all classes 0 -> 84
0.4889
```

```
##### current_task: 12 #####
current classes [85, 86, 87, 88, 89]
[output] all classes 0 -> 89
0.4787
```

```
##### current_task: 13 #####
current classes [90, 91, 92, 93, 94]
[output] all classes 0 -> 94
0.4687
```

```
##### current_task: 14 #####
current classes [95, 96, 97, 98, 99]
[output] all classes 0 -> 99
0.4546
local: False | beta: 1.0 | 12: False
0.8416666666666667
0.766
0.7145
0.6735555555555556
0.646
0.6250909090909091
0.5921666666666666
0.5701538461538461
0.5474285714285714
0.5218666666666667
0.50475
0.4889411764705882
0.4786666666666667
0.4687368421052632
0.4546
[[0.84166667 0.          0.          0.          0.          0.
```

0.	0.	0.	0.	0.	0.
0.	0.	0.	]		
[0.79866667	0.57	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	]		
[0.77766667	0.498	0.552	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	]		
[0.758	0.454	0.506	0.554	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	]		
[0.74766667	0.432	0.488	0.526	0.528	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	]		
[0.73966667	0.418	0.482	0.514	0.484	0.54
0.	0.	0.	0.	0.	0.
0.	0.	0.	]		
[0.73033333	0.406	0.474	0.504	0.474	0.52
0.346	0.	0.	0.	0.	0.
0.	0.	0.	]		
[0.71666667	0.398	0.466	0.492	0.462	0.494
0.332	0.468	0.	0.	0.	0.
0.	0.	0.	]		
[0.713	0.374	0.452	0.48	0.46	0.49
0.33	0.456	0.344	0.	0.	0.
0.	0.	0.	]		
[0.709	0.352	0.452	0.476	0.454	0.486
0.32	0.408	0.324	0.302	0.	0.
0.	0.	0.	]		
[0.70366667	0.348	0.448	0.464	0.448	0.474
0.308	0.4	0.306	0.298	0.36	0.
0.	0.	0.	]		
[0.69333333	0.346	0.42	0.452	0.448	0.468
0.3	0.394	0.3	0.292	0.354	0.378
0.	0.	0.	]		
[0.68866667	0.342	0.398	0.43	0.428	0.468
0.29	0.39	0.294	0.292	0.348	0.368
0.436	0.	0.	]		
[0.68566667	0.328	0.392	0.428	0.424	0.45
0.288	0.384	0.28	0.282	0.344	0.36
0.412	0.42	0.	]		
[0.68566667	0.29	0.366	0.418	0.406	0.444
0.288	0.378	0.258	0.276	0.328	0.356
0.404	0.416	0.35	]]		

[0, 4.3000000000000004, 6.800000000000001, 8.188888888888888, 8.1, 8.160000000000002, 7.955555555555558, 8.157142857142857, 8.058333333333334, 8.474074074074078, 8.480000000000002, 8.530303030303035, 8.725000000000003, 8.938461538461542, 9.471428571428575]

```

[152]: def predict(model, x, voro=True):
        x = torch.from_numpy(x.astype(np.float32)).cuda()
        with torch.no_grad():
            predi = model.module.classifier(x)
            if voro:
                predi += - torch.sum((model.module.classifier.weight/2.)**2, dim=1)
        return predi

classes_all = []
test_share = []
paccS = []
for i in range(task_num + 1):
    support_data, support_label, query_data, query_label, n_ways, n_shot, \
    classes = \
        get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                      local = True, brother = brother)

    # load model:
    if brother:
        cls_01 = classes[-1]+1
        assert cls_01 % 4 == 0
        filename = path + '%d_model.pkl' % (int(cls_01/4))
    else:
        filename = path + '%d_model.pkl' % (classes[-1]+1)
    model = torch.load(filename)
    model.eval()
    print('> loaded base phase model from:', filename)
    num_param(model)
    # do prediction:
    min_cls = min(classes)
    if brother:
        pred = predict(model, query_data)
    else:
        pred = predict(model, query_data)[:,:,:4]
    pmax = torch.max(pred, dim=1)[1]
    pacc = np.mean(t2n(pmax) == query_label - min_cls)
    print(pacc)
    if brother:
        accs = acc_brother(t2n(pred), t2n(pmax), query_label - min_cls, \
    forLG=True)
        pacc = [pacc] + accs
        paccS.append(pacc)
        classes_all.append(classes)
        test_share.append(len(query_label))
print('all logistic locally:')
if brother:
    for accs in paccS:
        print('\t'.join([str(i) for i in accs]))

```

```
else:
    print('\n'.join([str(i) for i in paccS]))
```

```
##### current_task: 0 #####
[output] current classes [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15,
16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29]
all classes 0 -> 29
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/30_model.pkl
module.classifier.weight      torch.Size([120, 512])  61440   True
total: 61440
0.8496666666666667
```

```
##### current_task: 1 #####
[output] current classes [30, 31, 32, 33, 34]
all classes 0 -> 34
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
0.86
```

```
##### current_task: 2 #####
[output] current classes [35, 36, 37, 38, 39]
all classes 0 -> 39
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
0.912
```

```
##### current_task: 3 #####
[output] current classes [40, 41, 42, 43, 44]
all classes 0 -> 44
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
0.86
```

```
##### current_task: 4 #####
[output] current classes [45, 46, 47, 48, 49]
all classes 0 -> 49
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
0.946
```

```
##### current_task: 5 #####
[output] current classes [50, 51, 52, 53, 54]
all classes 0 -> 54
```



```
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.92
```

```
##### current_task: 6 #####
[output] current classes [55, 56, 57, 58, 59]
all classes 0 -> 59
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.902
```

```
##### current_task: 7 #####
[output] current classes [60, 61, 62, 63, 64]
all classes 0 -> 64
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.922
```

```
##### current_task: 8 #####
[output] current classes [65, 66, 67, 68, 69]
all classes 0 -> 69
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.86
```

```
##### current_task: 9 #####
[output] current classes [70, 71, 72, 73, 74]
all classes 0 -> 74
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.872
```

```
##### current_task: 10 #####
[output] current classes [75, 76, 77, 78, 79]
all classes 0 -> 79
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.864
```

```
##### current_task: 11 #####
[output] current classes [80, 81, 82, 83, 84]
all classes 0 -> 84
```

```

> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.908

##### current_task: 12 #####
[output] current classes [85, 86, 87, 88, 89]
all classes 0 -> 89
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.866

##### current_task: 13 #####
[output] current classes [90, 91, 92, 93, 94]
all classes 0 -> 94
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.928

##### current_task: 14 #####
[output] current classes [95, 96, 97, 98, 99]
all classes 0 -> 99
> loaded base phase model from:
../checkpoints/CIFAR100_30_14x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.936
all logistic locally:
0.8496666666666667
0.86
0.912
0.86
0.946
0.92
0.902
0.922
0.86
0.872
0.864
0.908
0.866
0.928
0.936

```

```

[153]: for i in range(task_num + 1):
        support_data, support_label, query_data, query_label, n_ways, n_shot, \
        classes = \
            get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                           local = True, brother = brother)

        pred_all = []
        for classes in classes_all:
            # load model:
            if brother:
                cls_01 = classes[-1]+1
                assert cls_01 % 4 == 0
                filename = path + '%d_model.pkl' % (int(cls_01/4))
            else:
                filename = path + '%d_model.pkl' % (classes[-1]+1)
            model = torch.load(filename)
            model.eval()
            print('> loaded base phase model from:', filename)
            num_param(model)
            # do prediction:
            min_cls = min(classes)
            if brother:
                pred = predict(model, query_data)
            else:
                pred = predict(model, query_data)[:,:4]
            pmax = torch.max(pred, dim=1)[1]
            # pacc = np.mean(t2n(pmax) == query_label - min_cls)
            # print(pacc)
            if brother:
                labs_01 = query_label[:4]//4
                acc_, sc_pre = merge_sc(t2n(pred), labs_01,
                                         mth='softmax', forLG=True, return_pre=True)
                min_cls = int(min_cls / 4)
                pred_all.append( (sc_pre + min_cls).tolist() )
            else:
                pred_all.append( (t2n(pmax) + min_cls).tolist() )
        pred_all = np.array(pred_all)
        print(pred_all.shape)

        if i == 0:
            pred_in_clique = copy.deepcopy(pred_all)
        else:
            pred_in_clique = np.hstack((pred_in_clique, pred_all))

```

##### current\_task: 0 #####

[output] current classes [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29]

all classes 0 -> 29

```

> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/30_model.pkl
module.classifier.weight      torch.Size([120, 512])  61440   True
total: 61440
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_30_14x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
(15, 3000)

```

```

##### current_task: 1 #####
[output] current classes [30, 31, 32, 33, 34]
all classes 0 -> 34
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/30_model.pkl
module.classifier.weight      torch.Size([120, 512])  61440   True
total: 61440
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_30_14x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True

```

```
total: 10240
(15, 500)
```

```
##### current_task: 2 #####
```

```
[output] current classes [35, 36, 37, 38, 39]
```

```
all classes 0 -> 39
```

```
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/30_model.pkl
module.classifier.weight      torch.Size([120, 512])  61440   True
total: 61440
```

```
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
```

```
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
```

```
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
```

```
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
```

```
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
```

```
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
```

```
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
```

```
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
```

```
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
```

```
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
```

```
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
```

```
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
```

```
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
```

```

> loaded base phase model from:
../checkpoints/CIFAR100_30_14x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(15, 500)

##### current_task: 3 #####
[output] current classes [40, 41, 42, 43, 44]
all classes 0 -> 44
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/30_model.pkl
module.classifier.weight      torch.Size([120, 512])   61440    True
total: 61440
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240

```

```

> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_30_14x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(15, 500)

##### current_task: 4 #####
[output] current classes [45, 46, 47, 48, 49]
all classes 0 -> 49
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/30_model.pkl
module.classifier.weight      torch.Size([120, 512])   61440    True
total: 61440
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240

```



```

> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_30_14x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(15, 500)

##### current_task: 5 #####
[output] current classes [50, 51, 52, 53, 54]
all classes 0 -> 54
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/30_model.pkl
module.classifier.weight      torch.Size([120, 512])   61440    True
total: 61440
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240

```

```

> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_30_14x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(15, 500)

##### current_task: 6 #####
[output] current classes [55, 56, 57, 58, 59]
all classes 0 -> 59
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/30_model.pkl
module.classifier.weight      torch.Size([120, 512])   61440    True
total: 61440
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240

```

```

> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_30_14x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(15, 500)

```

```
##### current_task: 7 #####
```

```
[output] current classes [60, 61, 62, 63, 64]
```

```
all classes 0 -> 64
```

```

> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/30_model.pkl
module.classifier.weight      torch.Size([120, 512])   61440    True
total: 61440
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240

```

```

> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_30_14x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(15, 500)

##### current_task: 8 #####
[output] current classes [65, 66, 67, 68, 69]
all classes 0 -> 69
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/30_model.pkl
module.classifier.weight      torch.Size([120, 512])   61440    True
total: 61440
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240

```

```

> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_30_14x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(15, 500)

```

```
##### current_task: 9 #####
```

```
[output] current classes [70, 71, 72, 73, 74]
```

```
all classes 0 -> 74
```

```

> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/30_model.pkl
module.classifier.weight      torch.Size([120, 512])   61440    True
total: 61440
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240

```

```

> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_30_14x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(15, 500)

##### current_task: 10 #####
[output] current classes [75, 76, 77, 78, 79]
all classes 0 -> 79
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/30_model.pkl
module.classifier.weight      torch.Size([120, 512])   61440    True
total: 61440
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240

```

```

> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_30_14x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(15, 500)

```

```
##### current_task: 11 #####
```

```
[output] current classes [80, 81, 82, 83, 84]
```

```
all classes 0 -> 84
```

```

> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/30_model.pkl
module.classifier.weight      torch.Size([120, 512])   61440    True
total: 61440
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240

```

```

> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_30_14x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(15, 500)

```

```
##### current_task: 12 #####
```

```
[output] current classes [85, 86, 87, 88, 89]
```

```
all classes 0 -> 89
```

```

> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/30_model.pkl
module.classifier.weight      torch.Size([120, 512])   61440    True
total: 61440
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240

```



```

> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_30_14x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(15, 500)

```

```
##### current_task: 13 #####
```

```
[output] current classes [90, 91, 92, 93, 94]
```

```
all classes 0 -> 94
```

```

> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/30_model.pkl
module.classifier.weight      torch.Size([120, 512])   61440    True
total: 61440
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240

```

```

> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_30_14x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(15, 500)

```

```
##### current_task: 14 #####
```

```
[output] current classes [95, 96, 97, 98, 99]
```

```
all classes 0 -> 99
```

```

> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/30_model.pkl
module.classifier.weight      torch.Size([120, 512])   61440    True
total: 61440
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240

```

```

> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_30_14x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(15, 500)

```

```
[157]: print('cliques by test samples:', pred_in_clique.shape)
```

```

# compute prototypes
be      = 0.8 # 1.
12      = True # False True

```

```

bias      = 0 # 0.05
protots   = np.mean(feats_trans(support_data_, beta=be, l2=12, bias=bias), axis=1)
query_pts = feats_trans(query_data_, beta=be, l2=12, bias=bias)
# acenss   = feats_trans(acens, beta=be, l2=12, bias=bias)
if brother:
    dist     = funbtch(query_pts, protots) # protots / acenss
else:
    dist     = fun(query_pts, protots) # protots / acenss

test_splt = [sum(test_share[:t+1]) for t in range(len(test_share))]

```

cliques by test samples: (15, 10000)

```

[158]: dist_in_clique = np.zeros_like(pred_in_clique, dtype=np.float32)
        for c_id, clique in enumerate(pred_in_clique):
            for s_id, samp in enumerate(clique):
                dist_in_clique[c_id][s_id] = dist[s_id][samp]

```

```

[159]: for i in range(task_num + 1):
        clique_dist = dist_in_clique[:i+1,:test_splt[i]]
        clique_pred = np.argmin(clique_dist, axis=0)
        merge_pred = [pred_in_clique[cli,s_id] for s_id, cli in
            ↪ enumerate(clique_pred)]
        merge_acc = np.mean(merge_pred == query_label_[:test_splt[i]])
        print(merge_acc)
    print('DaC:', 'beta:', be, '| l2:', l2)

```

```

0.8496666666666667
0.7757142857142857
0.723
0.6835555555555556
0.655
0.6361818181818182
0.6038333333333333
0.581076923076923
0.5601428571428572
0.5342666666666667
0.517
0.4988235294117647
0.4921111111111111
0.482
0.4679
DaC: beta: 0.8 | l2: True

```

```

[28]: print('===== Experiment Done! =====')

```

```

===== Experiment Done! =====

```

## iVoro-AC/AI on CIFAR-100 Dataset (14 Phases)

```
[99]: import matplotlib.pyplot as plt
import os
import pickle
import numpy as np
import pandas as pd
import seaborn as sns
import time
import sys
sys.path.append('../')
sys.path.append('../analysis/')
import copy
import platform
import json
import pickle
import random

import torch
from scipy.stats import mode
```

```
[129]: from ResNet import resnet18_cbam

data_name      = 'CIFAR100' # 'Subset' # 'Tiny' # 'CIFAR100' # 'MNIST'
total_nc       = 100 # 200 # 100 # 10
fg_nc          = 30 # 100 # 40 # 50 # 4
task_num       = 14 # 20 # 5 # 10 # 2

# constant params
class_set      = list(range(total_nc))
ROTATION       = True
EMB2D          = False
DESIGN         = True
virtual_class  = 4*total_nc if ROTATION else total_nc
suffix         = 'voro' # 'prob' 'voro'
assert (total_nc - fg_nc)%task_num == 0
task_size      = int((total_nc - fg_nc)/task_num)
file_name      =
    ↳data_name+'_'+str(fg_nc)+'_'+str(task_num)+'x'+str(task_size)+suffix
```

```
print(file_name)

brother      = True # True False
```

CIFAR100\_30\_14x5voro

```
[130]: save_path = '../checkpoints/'
path    = save_path + file_name + '/'
filename = path + '%d_model.pkl' % (fg_nc+0) # +5
model    = torch.load(filename)
model.eval()
print('> loaded base phase model from:', filename)
```

> loaded base phase model from: ../checkpoints/CIFAR100\_30\_14x5voro/30\_model.pkl

```
[131]: from voro_helper import num_param, t2n, \
        load_feat, sanity_check, \
        id2emb_, num_samp, merge_sc, funbtch

num_param(model)

# voronoi centers:
vcenter = t2n(model.module.classifier.weight.data / 2.)
print(vcenter.shape)
```

```
module.classifier.weight      torch.Size([120, 512])  61440   True
total: 61440
(120, 512)
```

```
[132]: '''
CIFAR:
    'CIFAR100_50_5x10_test.pkl'
    'CIFAR100_50_5x10_train.pkl'
    'CIFAR100_40_20x3_test.pkl'
    'CIFAR100_40_20x3_train.pkl'
more CIFAR:
    'CIFAR100_40_12x5_test.pkl'
    'CIFAR100_40_12x5_train.pkl'
    'CIFAR100_30_14x5_test.pkl'
    'CIFAR100_30_14x5_train.pkl'
    'CIFAR100_20_16x5_test.pkl'
    'CIFAR100_20_16x5_train.pkl'
    'CIFAR100_10_18x5_test.pkl'
    'CIFAR100_10_18x5_train.pkl'
Tiny:
    'Tiny_100_20x5_test.pkl'
    'Tiny_100_20x5_train.pkl'
TinyL3:
    'Tiny_100_5x20_test.pkl'
```

```

        'Tiny_100_5x20_train.pkl'
Subset:
        'Subset_50_10x5_test.pkl'
        'Subset_50_10x5_train.pkl'
'''
ffile = '../embedding/prob/' + 'CIFAR100_30_14x5_test.pkl' # prob probL3
data_phas, last_tsk = load_feat(ffile)

labs, embeds, outputs = data_phas[last_tsk][last_tsk]
false_id, pred_ = sanity_check(labs, embeds, outputs)

```

```

feature file: ../embedding/prob/CIFAR100_30_14x5_test.pkl
> loaded tasks: dict_keys([14])
> classes: [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18,
19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38,
39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58,
59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78,
79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98,
99]
> samples: 10000
> embedding: 512
> classification: 400
~ acc (single): 56.53%
~ acc (quadruple): 46.73%

```

```

[133]: ffile = '../embedding/prob/' + 'CIFAR100_30_14x5_train.pkl' # prob probL3
data_phas, last_tsk = load_feat(ffile)

labst, embedst, outputst = data_phas[last_tsk][last_tsk]
false_id, pred_ = sanity_check(labst, embedst, outputst)

```

```

feature file: ../embedding/prob/CIFAR100_30_14x5_train.pkl
> loaded tasks: dict_keys([14])
> classes: [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18,
19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38,
39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58,
59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78,
79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98,
99]
> samples: 50000
> embedding: 512
> classification: 400
~ acc (single): 65.09%
~ acc (quadruple): 55.79%

```

```

[134]: embs = id2emb_(labs, embeds, brother=brother)
embst = id2emb_(labst, embedst, brother=brother)

```

```
sam_max, sam_min = num_samp(embst)
print('> loading data done!')
```

```
0 500,1 500,2 500,3 500,4 500,5 500,6 500,7 500,8 500,9 500,10 500,11 500,12
500,13 500,14 500,15 500,16 500,17 500,18 500,19 500,20 500,21 500,22 500,23
500,24 500,25 500,26 500,27 500,28 500,29 500,30 500,31 500,32 500,33 500,34
500,35 500,36 500,37 500,38 500,39 500,40 500,41 500,42 500,43 500,44 500,45
500,46 500,47 500,48 500,49 500,50 500,51 500,52 500,53 500,54 500,55 500,56
500,57 500,58 500,59 500,60 500,61 500,62 500,63 500,64 500,65 500,66 500,67
500,68 500,69 500,70 500,71 500,72 500,73 500,74 500,75 500,76 500,77 500,78
500,79 500,80 500,81 500,82 500,83 500,84 500,85 500,86 500,87 500,88 500,89
500,90 500,91 500,92 500,93 500,94 500,95 500,96 500,97 500,98 500,99 500,100
500,101 500,102 500,103 500,104 500,105 500,106 500,107 500,108 500,109 500,110
500,111 500,112 500,113 500,114 500,115 500,116 500,117 500,118 500,119 500,120
500,121 500,122 500,123 500,124 500,125 500,126 500,127 500,128 500,129 500,130
500,131 500,132 500,133 500,134 500,135 500,136 500,137 500,138 500,139 500,140
500,141 500,142 500,143 500,144 500,145 500,146 500,147 500,148 500,149 500,150
500,151 500,152 500,153 500,154 500,155 500,156 500,157 500,158 500,159 500,160
500,161 500,162 500,163 500,164 500,165 500,166 500,167 500,168 500,169 500,170
500,171 500,172 500,173 500,174 500,175 500,176 500,177 500,178 500,179 500,180
500,181 500,182 500,183 500,184 500,185 500,186 500,187 500,188 500,189 500,190
500,191 500,192 500,193 500,194 500,195 500,196 500,197 500,198 500,199 500,200
500,201 500,202 500,203 500,204 500,205 500,206 500,207 500,208 500,209 500,210
500,211 500,212 500,213 500,214 500,215 500,216 500,217 500,218 500,219 500,220
500,221 500,222 500,223 500,224 500,225 500,226 500,227 500,228 500,229 500,230
500,231 500,232 500,233 500,234 500,235 500,236 500,237 500,238 500,239 500,240
500,241 500,242 500,243 500,244 500,245 500,246 500,247 500,248 500,249 500,250
500,251 500,252 500,253 500,254 500,255 500,256 500,257 500,258 500,259 500,260
500,261 500,262 500,263 500,264 500,265 500,266 500,267 500,268 500,269 500,270
500,271 500,272 500,273 500,274 500,275 500,276 500,277 500,278 500,279 500,280
500,281 500,282 500,283 500,284 500,285 500,286 500,287 500,288 500,289 500,290
500,291 500,292 500,293 500,294 500,295 500,296 500,297 500,298 500,299 500,300
500,301 500,302 500,303 500,304 500,305 500,306 500,307 500,308 500,309 500,310
500,311 500,312 500,313 500,314 500,315 500,316 500,317 500,318 500,319 500,320
500,321 500,322 500,323 500,324 500,325 500,326 500,327 500,328 500,329 500,330
500,331 500,332 500,333 500,334 500,335 500,336 500,337 500,338 500,339 500,340
500,341 500,342 500,343 500,344 500,345 500,346 500,347 500,348 500,349 500,350
500,351 500,352 500,353 500,354 500,355 500,356 500,357 500,358 500,359 500,360
500,361 500,362 500,363 500,364 500,365 500,366 500,367 500,368 500,369 500,370
500,371 500,372 500,373 500,374 500,375 500,376 500,377 500,378 500,379 500,380
500,381 500,382 500,383 500,384 500,385 500,386 500,387 500,388 500,389 500,390
500,391 500,392 500,393 500,394 500,395 500,396 500,397 500,398 500,399 500,
max samples: 500
min samples: 500
> loading data done!
```



```
[135]: for k,v in embst.items():
        if v.shape[0] < sam_max:
            rid = np.random.choice(v.shape[0], sam_max-v.shape[0], replace=False)
            print('filling', sam_max-v.shape[0], 'samples')
            embst[k] = np.vstack((v, v[rid]))
```

```
[136]: from voro_helper import get_task_data, feat_trans, NC_o, tsk_cls, fun,
        ↪acc_brother, forgetting

i = task_num
support_data_, support_label_, query_data_, query_label_, n_ways_, n_shot_, _ = \
    get_task_data(embst, embs, i, fg_nc, class_set, task_size, brother=brother)
```

```
##### current_task: 14 #####
current classes [380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395
396 397
398 399]
[output] all classes 0 -> 399
```

```
[137]: #%% =====
        ↪=====
be      = 1. # 1.
l2      = False # False True
protots = np.mean(feat_trans(support_data_, beta=be, l2=l2), axis=1)
```

```
[109]: i = 0
support_data, support_label, query_data, query_label, n_ways, n_shot, classes = \
    get_task_data(embst, embs, i, fg_nc, class_set, task_size, brother=brother)
acc, _, nn_pre = NC_o(support_data, support_label,
                      query_data, query_label,
                      n_ways, n_shot,
                      beta = be, l2 = l2,
                      given_cen = protots[classes], given_only = True,
                      brother = brother)
```

```
##### current_task: 0 #####
current classes [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17,
18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37,
38, 39]
[output] all classes 0 -> 39
0.8203
```

```
[138]: local      = False # True / False
nn_acc      = []
savefile = path+'NN' if brother else None # NN / NNp / NN3 / only saved NN
        ↪results!
```

```

savefil2 = path+'NN3'
forget    = True # True False # calculate forgetting
class_ladder = []
a         = []
for i in range(task_num + 1):
    support_data, support_label, query_data, query_label, n_ways, n_shot, \
    →classes = \
        get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                        local = local, brother = brother) # False
    if forget:
        class_ladder.append(classes)
    acc, _, nn_pre = NC_o(support_data, support_label,
                          query_data, query_label,
                          n_ways, n_shot,
                          beta = be, l2 = l2,
                          given_cen = protots[classes] if local else protots[:
    →classes[-1]+1],

                          given_only = True,
                          brother = brother,
                          savefile = savefile+'_'+str(i) if brother else None,
                          savefile2 = None, # savefil2+'_'+str(i), # None, #
                          weights = [0.7, 0.3],
                          class_ladder = class_ladder,
                          acc_all = a
                          )

    nn_acc.append(acc)
    # if all classes up2now: local = False, and protots[:classes[-1]+1]
print('local:', local, '| beta:', be, '| l2:', l2)
if brother:
    for accs in nn_acc:
        print('\t'.join([str(i) for i in accs]))
else:
    print('\n'.join([str(i) for i in nn_acc]))
if forget:
    avgf = forgetting(a, task_num)
    print(avgf)

```

##### current\_task: 0 #####

```

current classes [ 0  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15
16 17
18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35
36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53
54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71
72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89
90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107
108 109 110 111 112 113 114 115 116 117 118 119]

```

```

[output] all classes 0 -> 119
<<< loaded from: ../checkpoints/CIFAR100_30_14x5voro/NN_0.npy
0.7313

##### current_task: 1 #####
current classes [120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135
136 137
138 139]
[output] all classes 0 -> 139
<<< loaded from: ../checkpoints/CIFAR100_30_14x5voro/NN_1.npy
0.6623

##### current_task: 2 #####
current classes [140 141 142 143 144 145 146 147 148 149 150 151 152 153 154 155
156 157
158 159]
[output] all classes 0 -> 159
<<< loaded from: ../checkpoints/CIFAR100_30_14x5voro/NN_2.npy
0.6140

##### current_task: 3 #####
current classes [160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175
176 177
178 179]
[output] all classes 0 -> 179
<<< loaded from: ../checkpoints/CIFAR100_30_14x5voro/NN_3.npy
0.5689

##### current_task: 4 #####
current classes [180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195
196 197
198 199]
[output] all classes 0 -> 199
<<< loaded from: ../checkpoints/CIFAR100_30_14x5voro/NN_4.npy
0.5485

##### current_task: 5 #####
current classes [200 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215
216 217
218 219]
[output] all classes 0 -> 219
<<< loaded from: ../checkpoints/CIFAR100_30_14x5voro/NN_5.npy
0.5225

##### current_task: 6 #####
current classes [220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235
236 237
238 239]

```

```

[output] all classes 0 -> 239
<<< loaded from: ../checkpoints/CIFAR100_30_14x5voro/NN_6.npy
0.4949

##### current_task: 7 #####
current classes [240 241 242 243 244 245 246 247 248 249 250 251 252 253 254 255
256 257
258 259]
[output] all classes 0 -> 259
<<< loaded from: ../checkpoints/CIFAR100_30_14x5voro/NN_7.npy
0.4741

##### current_task: 8 #####
current classes [260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275
276 277
278 279]
[output] all classes 0 -> 279
<<< loaded from: ../checkpoints/CIFAR100_30_14x5voro/NN_8.npy
0.4561

##### current_task: 9 #####
current classes [280 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295
296 297
298 299]
[output] all classes 0 -> 299
<<< loaded from: ../checkpoints/CIFAR100_30_14x5voro/NN_9.npy
0.4343

##### current_task: 10 #####
current classes [300 301 302 303 304 305 306 307 308 309 310 311 312 313 314 315
316 317
318 319]
[output] all classes 0 -> 319
<<< loaded from: ../checkpoints/CIFAR100_30_14x5voro/NN_10.npy
0.4181

##### current_task: 11 #####
current classes [320 321 322 323 324 325 326 327 328 329 330 331 332 333 334 335
336 337
338 339]
[output] all classes 0 -> 339
<<< loaded from: ../checkpoints/CIFAR100_30_14x5voro/NN_11.npy
0.4015

##### current_task: 12 #####
current classes [340 341 342 343 344 345 346 347 348 349 350 351 352 353 354 355
356 357
358 359]

```

```

[output] all classes 0 -> 359
<<< loaded from: ../checkpoints/CIFAR100_30_14x5voro/NN_12.npy
0.3914

##### current_task: 13 #####
current classes [360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375
376 377
378 379]
[output] all classes 0 -> 379
<<< loaded from: ../checkpoints/CIFAR100_30_14x5voro/NN_13.npy
0.3836

##### current_task: 14 #####
current classes [380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395
396 397
398 399]
[output] all classes 0 -> 399
<<< loaded from: ../checkpoints/CIFAR100_30_14x5voro/NN_14.npy
0.3699
local: False | beta: 1.0 | l2: False
0.7313333333333333      0.9683333333333334      0.9463333333333334      0.945
0.9073333333333333
0.6622857142857143      0.92      0.6585714285714286      0.654
0.5905714285714285
0.614      0.87075 0.603      0.59925 0.5365
0.5689444444444445      0.8368888888888889      0.5673333333333334
0.5631111111111111      0.5208888888888888
0.5485      0.808      0.542      0.5376      0.4934
0.5225454545454545      0.7803636363636364      0.5325454545454545
0.5285454545454545      0.4812727272727273
0.494875      0.7393333333333333      0.5205      0.5165      0.472
0.47407692307692306      0.713076923076923      0.5041538461538462
0.5010769230769231      0.45815384615384613
0.45607142857142857      0.6857142857142857      0.488      0.48542857142857143
0.447
0.43433333333333335      0.6524      0.4697333333333334      0.4670666666666667
0.4281333333333333
0.4180625      0.632375      0.474625      0.4725      0.4345
0.4015      0.6105882352941177      0.4711764705882353      0.46858823529411764
0.4338823529411765
0.3914166666666667      0.6007777777777777      0.464      0.4623333333333333
0.4283333333333334
0.38355263157894737      0.5894736842105263      0.46042105263157895
0.45810526315789474      0.422421052631579
0.369925      0.569      0.4463      0.4442      0.4099
[[0.73133333 0.      0.      0.      0.
0.      0.      0.      0.      0.
0.      0.      0.      ]

```

[0.709	0.382	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	]		
[0.69191667	0.3505	0.41	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	]		
[0.67775	0.3225	0.3855	0.346	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	]		
[0.66725	0.3095	0.362	0.3225	0.4875	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	]		
[0.66175	0.303	0.3575	0.3185	0.442	0.3565
0.	0.	0.	0.	0.	0.
0.	0.	0.	]		
[0.6525	0.292	0.3535	0.31	0.427	0.3385
0.3025	0.	0.	0.	0.	0.
0.	0.	0.	]		
[0.64491667	0.287	0.3475	0.3	0.4185	0.3265
0.2995	0.3145	0.	0.	0.	0.
0.	0.	0.	]		
[0.64241667	0.2715	0.337	0.2955	0.416	0.3245
0.294	0.305	0.287	0.	0.	0.
0.	0.	0.	]		
[0.63891667	0.2625	0.336	0.293	0.413	0.3205
0.2805	0.2625	0.2775	0.236	0.	0.
0.	0.	0.	]		
[0.63566667	0.2595	0.332	0.288	0.4065	0.3145
0.272	0.259	0.2645	0.231	0.248	0.
0.	0.	0.	]		
[0.62741667	0.2585	0.31	0.281	0.405	0.307
0.26	0.255	0.262	0.229	0.2465	0.247
0.	0.	0.	]		
[0.6245	0.2565	0.297	0.265	0.3935	0.3055
0.2455	0.2535	0.2585	0.2275	0.244	0.238
0.314	0.	0.	]		
[0.6205	0.2545	0.2915	0.261	0.3915	0.2935
0.2415	0.2465	0.2545	0.2185	0.2425	0.2255
0.3	0.3435	0.	]		
[0.62025	0.228	0.268	0.255	0.3735	0.2885
0.2385	0.243	0.248	0.215	0.2335	0.2255
0.2995	0.3425	0.2185	]]		

[0, 2.2333333333333316, 3.5458333333333343, 4.5861111111111095,  
5.202083333333331, 5.481666666666666, 5.663888888888888, 5.598809523809523,  
5.555208333333332, 5.921296296296293, 5.9066666666666645, 5.999242424242423,  
6.1611111111111107, 6.314102564102561, 6.622023809523809]

```

[139]: def predict(model, x, voro=True):
        x = torch.from_numpy(x.astype(np.float32)).cuda()
        with torch.no_grad():
            predi = model.module.classifier(x)
        if voro:
            predi += - torch.sum((model.module.classifier.weight/2.)**2, dim=1)
        return predi

classes_all = []
test_share = []
paccS = []
for i in range(task_num + 1):
    support_data, support_label, query_data, query_label, n_ways, n_shot, \
    classes = \
        get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                        local = True, brother = brother)

    # load model:
    if brother:
        cls_01 = classes[-1]+1
        assert cls_01 % 4 == 0
        filename = path + '%d_model.pkl' % (int(cls_01/4))
    else:
        filename = path + '%d_model.pkl' % (classes[-1]+1)
    model = torch.load(filename)
    model.eval()
    print('> loaded base phase model from:', filename)
    num_param(model)
    # do prediction:
    min_cls = min(classes)
    if brother:
        pred = predict(model, query_data)
    else:
        pred = predict(model, query_data)[:,:,:4]
    pmax = torch.max(pred, dim=1)[1]
    pacc = np.mean(t2n(pmax) == query_label - min_cls)
    print(pacc)
    if brother:
        accs = acc_brother(t2n(pred), t2n(pmax), query_label - min_cls, \
    forLG=True)
        pacc = [pacc] + accs
        paccS.append(pacc)
        classes_all.append(classes)
        test_share.append(len(query_label))
print('all logistic locally:')
if brother:
    for accs in paccS:
        print('\t'.join([str(i) for i in accs]))

```

```

else:
    print('\n'.join([str(i) for i in paccS]))

```

```

##### current_task: 0 #####
[output] current classes [ 0  1  2  3  4  5  6  7  8  9 10 11 12
13 14 15 16 17
    18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35
    36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53
    54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71
    72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89
    90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107
    108 109 110 111 112 113 114 115 116 117 118 119]
all classes 0 -> 119
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/30_model.pkl
module.classifier.weight      torch.Size([120, 512])  61440   True
total: 61440
0.7385833333333334

##### current_task: 1 #####
[output] current classes [120 121 122 123 124 125 126 127 128 129 130 131 132
133 134 135 136 137
    138 139]
all classes 0 -> 139
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
0.6465

##### current_task: 2 #####
[output] current classes [140 141 142 143 144 145 146 147 148 149 150 151 152
153 154 155 156 157
    158 159]
all classes 0 -> 159
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
0.7115

##### current_task: 3 #####
[output] current classes [160 161 162 163 164 165 166 167 168 169 170 171 172
173 174 175 176 177
    178 179]
all classes 0 -> 179
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
0.6205

```



```
##### current_task: 4 #####
[output] current classes [180 181 182 183 184 185 186 187 188 189 190 191 192
193 194 195 196 197
198 199]
all classes 0 -> 199
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.842
```

```
##### current_task: 5 #####
[output] current classes [200 201 202 203 204 205 206 207 208 209 210 211 212
213 214 215 216 217
218 219]
all classes 0 -> 219
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.6735
```

```
##### current_task: 6 #####
[output] current classes [220 221 222 223 224 225 226 227 228 229 230 231 232
233 234 235 236 237
238 239]
all classes 0 -> 239
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.7965
```

```
##### current_task: 7 #####
[output] current classes [240 241 242 243 244 245 246 247 248 249 250 251 252
253 254 255 256 257
258 259]
all classes 0 -> 259
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.6665
```

```
##### current_task: 8 #####
[output] current classes [260 261 262 263 264 265 266 267 268 269 270 271 272
273 274 275 276 277
278 279]
all classes 0 -> 279
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
```

```

total: 10240
0.673

##### current_task: 9 #####
[output] current classes [280 281 282 283 284 285 286 287 288 289 290 291 292
293 294 295 296 297
298 299]
all classes 0 -> 299
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.6635

##### current_task: 10 #####
[output] current classes [300 301 302 303 304 305 306 307 308 309 310 311 312
313 314 315 316 317
318 319]
all classes 0 -> 319
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.5925

##### current_task: 11 #####
[output] current classes [320 321 322 323 324 325 326 327 328 329 330 331 332
333 334 335 336 337
338 339]
all classes 0 -> 339
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.666

##### current_task: 12 #####
[output] current classes [340 341 342 343 344 345 346 347 348 349 350 351 352
353 354 355 356 357
358 359]
all classes 0 -> 359
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.6555

##### current_task: 13 #####
[output] current classes [360 361 362 363 364 365 366 367 368 369 370 371 372
373 374 375 376 377
378 379]
all classes 0 -> 379

```

```
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.729
```

```
##### current_task: 14 #####
```

```
[output] current classes [380 381 382 383 384 385 386 387 388 389 390 391 392
393 394 395 396 397
398 399]
```

```
all classes 0 -> 399
```

```
> loaded base phase model from:
```

```
../checkpoints/CIFAR100_30_14x5voro/100_model.pkl
```

```
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.6745
```

```
all logistic locally:
```

```
0.7385833333333334      0.97      0.9806666666666667      0.0
0.9856666666666667
0.6465  0.96      0.918  0.0      0.992
0.7115  0.962  0.982  0.0      0.992
0.6205  0.954  0.994  0.0      0.988
0.842   0.994  0.974  0.0      0.996
0.6735  0.964  0.906  0.0      0.982
0.7965  0.976  0.97   0.0      0.99
0.6665  0.958  0.962  0.0      0.982
0.673   0.936  0.942  0.0      0.97
0.6635  0.948  0.968  0.0      0.984
0.5925  0.968  0.984  0.0      0.988
0.666   0.986  0.988  0.0      1.0
0.6555  0.95   0.928  0.0      0.96
0.729   0.982  0.936  0.0      0.99
0.6745  0.994  0.998  0.0      1.0
```

```
[140]: for i in range(task_num + 1):
        support_data, support_label, query_data, query_label, n_ways, n_shot, \
        classes = \
            get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                           local = True, brother = brother)
        pred_all = []
        for classes in classes_all:
            # load model:
            if brother:
                cls_01 = classes[-1]+1
                assert cls_01 % 4 == 0
                filename = path + '%d_model.pkl' % (int(cls_01/4))
            else:
                filename = path + '%d_model.pkl' % (classes[-1]+1)
```

```

model      = torch.load(filename)
model.eval()
print('> loaded base phase model from:', filename)
num_param(model)
# do prediction:
min_cls = min(classes)
if brother:
    pred = predict(model, query_data)
else:
    pred = predict(model, query_data)[:,:,:4]
pmax = torch.max(pred, dim=1)[1]
# pacc = np.mean(t2n(pmax) == query_label - min_cls)
# print(pacc)
if brother:
    labs_01 = query_label[:4]//4
    acc_, sc_pre = merge_sc(t2n(pred), labs_01,
                           mth='softmax', forLG=True, return_pre=True)
    min_cls = int(min_cls / 4)
    pred_all.append( (sc_pre + min_cls).tolist() )
else:
    pred_all.append( (t2n(pmax) + min_cls).tolist() )
pred_all = np.array(pred_all)
print(pred_all.shape)

if i == 0:
    pred_in_clique = copy.deepcopy(pred_all)
else:
    pred_in_clique = np.hstack((pred_in_clique, pred_all))

```

##### current\_task: 0 #####

[output] current classes [ 0 1 2 3 4 5 6 7 8 9 10 11 12  
13 14 15 16 17

18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35  
36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53  
54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71  
72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89  
90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107  
108 109 110 111 112 113 114 115 116 117 118 119]

all classes 0 -> 119

> loaded base phase model from: ../checkpoints/CIFAR100\_30\_14x5voro/30\_model.pkl

module.classifier.weight torch.Size([120, 512]) 61440 True

total: 61440

> loaded base phase model from: ../checkpoints/CIFAR100\_30\_14x5voro/35\_model.pkl

module.classifier.weight torch.Size([20, 512]) 10240 True

total: 10240

> loaded base phase model from: ../checkpoints/CIFAR100\_30\_14x5voro/40\_model.pkl

module.classifier.weight torch.Size([20, 512]) 10240 True

```

total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_30_14x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(15, 3000)

##### current_task: 1 #####
[output] current classes [120 121 122 123 124 125 126 127 128 129 130 131 132
133 134 135 136 137
138 139]
all classes 0 -> 139
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/30_model.pkl
module.classifier.weight      torch.Size([120, 512])    61440    True
total: 61440

```

```

> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_30_14x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(15, 500)

##### current_task: 2 #####
[output] current classes [140 141 142 143 144 145 146 147 148 149 150 151 152
153 154 155 156 157

```

```

158 159]
all classes 0 -> 159
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/30_model.pkl
module.classifier.weight      torch.Size([120, 512])    61440    True
total: 61440
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])     10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])     10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])     10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])     10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])     10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])     10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])     10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])     10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])     10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])     10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])     10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])     10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])     10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_30_14x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])     10240    True
total: 10240

```

(15, 500)

##### current\_task: 3 #####

[output] current classes [160 161 162 163 164 165 166 167 168 169 170 171 172  
173 174 175 176 177  
178 179]

all classes 0 -> 179

> loaded base phase model from: ../checkpoints/CIFAR100\_30\_14x5voro/30\_model.pkl  
module.classifier.weight torch.Size([120, 512]) 61440 True  
total: 61440

> loaded base phase model from: ../checkpoints/CIFAR100\_30\_14x5voro/35\_model.pkl  
module.classifier.weight torch.Size([20, 512]) 10240 True  
total: 10240

> loaded base phase model from: ../checkpoints/CIFAR100\_30\_14x5voro/40\_model.pkl  
module.classifier.weight torch.Size([20, 512]) 10240 True  
total: 10240

> loaded base phase model from: ../checkpoints/CIFAR100\_30\_14x5voro/45\_model.pkl  
module.classifier.weight torch.Size([20, 512]) 10240 True  
total: 10240

> loaded base phase model from: ../checkpoints/CIFAR100\_30\_14x5voro/50\_model.pkl  
module.classifier.weight torch.Size([20, 512]) 10240 True  
total: 10240

> loaded base phase model from: ../checkpoints/CIFAR100\_30\_14x5voro/55\_model.pkl  
module.classifier.weight torch.Size([20, 512]) 10240 True  
total: 10240

> loaded base phase model from: ../checkpoints/CIFAR100\_30\_14x5voro/60\_model.pkl  
module.classifier.weight torch.Size([20, 512]) 10240 True  
total: 10240

> loaded base phase model from: ../checkpoints/CIFAR100\_30\_14x5voro/65\_model.pkl  
module.classifier.weight torch.Size([20, 512]) 10240 True  
total: 10240

> loaded base phase model from: ../checkpoints/CIFAR100\_30\_14x5voro/70\_model.pkl  
module.classifier.weight torch.Size([20, 512]) 10240 True  
total: 10240

> loaded base phase model from: ../checkpoints/CIFAR100\_30\_14x5voro/75\_model.pkl  
module.classifier.weight torch.Size([20, 512]) 10240 True  
total: 10240

> loaded base phase model from: ../checkpoints/CIFAR100\_30\_14x5voro/80\_model.pkl  
module.classifier.weight torch.Size([20, 512]) 10240 True  
total: 10240

> loaded base phase model from: ../checkpoints/CIFAR100\_30\_14x5voro/85\_model.pkl  
module.classifier.weight torch.Size([20, 512]) 10240 True  
total: 10240

> loaded base phase model from: ../checkpoints/CIFAR100\_30\_14x5voro/90\_model.pkl  
module.classifier.weight torch.Size([20, 512]) 10240 True  
total: 10240

> loaded base phase model from: ../checkpoints/CIFAR100\_30\_14x5voro/95\_model.pkl  
module.classifier.weight torch.Size([20, 512]) 10240 True



```

total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_30_14x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(15, 500)

##### current_task: 4 #####
[output] current classes [180 181 182 183 184 185 186 187 188 189 190 191 192
193 194 195 196 197
198 199]
all classes 0 -> 199
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/30_model.pkl
module.classifier.weight      torch.Size([120, 512])   61440    True
total: 61440
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240

```

```

> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_30_14x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(15, 500)

##### current_task: 5 #####
[output] current classes [200 201 202 203 204 205 206 207 208 209 210 211 212
213 214 215 216 217
 218 219]
all classes 0 -> 219
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/30_model.pkl
module.classifier.weight      torch.Size([120, 512])   61440    True
total: 61440
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/80_model.pkl

```

```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_30_14x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(15, 500)

##### current_task: 6 #####
[output] current classes [220 221 222 223 224 225 226 227 228 229 230 231 232
233 234 235 236 237
238 239]
all classes 0 -> 239
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/30_model.pkl
module.classifier.weight      torch.Size([120, 512])   61440    True
total: 61440
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True

```

```

total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_30_14x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(15, 500)

```

```
##### current_task: 7 #####
```

```

[output] current classes [240 241 242 243 244 245 246 247 248 249 250 251 252
253 254 255 256 257
258 259]
all classes 0 -> 259
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/30_model.pkl
module.classifier.weight      torch.Size([120, 512])   61440    True
total: 61440
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240

```

```

> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_30_14x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(15, 500)

```

```
##### current_task: 8 #####
```

```

[output] current classes [260 261 262 263 264 265 266 267 268 269 270 271 272
273 274 275 276 277
278 279]

```

```
all classes 0 -> 279
```

```

> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/30_model.pkl
module.classifier.weight      torch.Size([120, 512])   61440    True
total: 61440
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/55_model.pkl

```

```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_30_14x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(15, 500)

```

```
##### current_task: 9 #####
```

```

[output] current classes [280 281 282 283 284 285 286 287 288 289 290 291 292
293 294 295 296 297
298 299]

```

```
all classes 0 -> 299
```

```

> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/30_model.pkl
module.classifier.weight      torch.Size([120, 512])    61440    True
total: 61440
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True

```

```

total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_30_14x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(15, 500)

##### current_task: 10 #####
[output] current classes [300 301 302 303 304 305 306 307 308 309 310 311 312
313 314 315 316 317
318 319]
all classes 0 -> 319
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/30_model.pkl
module.classifier.weight      torch.Size([120, 512])   61440    True
total: 61440
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240

```

```

> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_30_14x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(15, 500)

##### current_task: 11 #####
[output] current classes [320 321 322 323 324 325 326 327 328 329 330 331 332
333 334 335 336 337
338 339]
all classes 0 -> 339
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/30_model.pkl

```



```

module.classifier.weight      torch.Size([120, 512])  61440   True
total: 61440
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_30_14x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
(15, 500)

```

```
##### current_task: 12 #####
```

```

[output] current classes [340 341 342 343 344 345 346 347 348 349 350 351 352
353 354 355 356 357
358 359]
all classes 0 -> 359
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/30_model.pkl
module.classifier.weight      torch.Size([120, 512])  61440   True
total: 61440
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])   10240   True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_30_14x5voro/100_model.pkl

```

```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(15, 500)

```

```
##### current_task: 13 #####
```

```

[output] current classes [360 361 362 363 364 365 366 367 368 369 370 371 372
373 374 375 376 377
378 379]

```

```
all classes 0 -> 379
```

```
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/30_model.pkl
```

```

module.classifier.weight      torch.Size([120, 512])    61440    True
total: 61440

```

```
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/35_model.pkl
```

```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240

```

```
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/40_model.pkl
```

```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240

```

```
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/45_model.pkl
```

```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240

```

```
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/50_model.pkl
```

```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240

```

```
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/55_model.pkl
```

```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240

```

```
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/60_model.pkl
```

```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240

```

```
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/65_model.pkl
```

```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240

```

```
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/70_model.pkl
```

```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240

```

```
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/75_model.pkl
```

```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240

```

```
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/80_model.pkl
```

```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240

```

```
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/85_model.pkl
```

```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240

```

```
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/90_model.pkl
```

```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240

```

```

> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_30_14x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(15, 500)

##### current_task: 14 #####
[output] current classes [380 381 382 383 384 385 386 387 388 389 390 391 392
393 394 395 396 397
398 399]
all classes 0 -> 399
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/30_model.pkl
module.classifier.weight      torch.Size([120, 512])   61440    True
total: 61440
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/85_model.pkl

```

```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_30_14x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_30_14x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(15, 500)

```

```

[113]: print('cliques by test samples:', pred_in_clique.shape)

# compute prototypes
be      = 0.6 # 1.
l2      = True # False True
bias    = 0 # 0.05
protots = np.mean(feats_trans(support_data_, beta=be, l2=l2, bias=bias), axis=1)
query_pts = feats_trans(query_data_, beta=be, l2=l2, bias=bias)
# acenss = feats_trans(acens, beta=be, l2=l2, bias=bias)
if brother:
    dist = funbtch(query_pts, protots) # protots / acenss
else:
    dist = fun(query_pts, protots) # protots / acenss

test_splt = [sum(test_share[:t+1]) for t in range(len(test_share))]

```

cliques by test samples: (13, 10000)

```

[114]: dist_in_clique = np.zeros_like(pred_in_clique, dtype=np.float32)
for c_id, clique in enumerate(pred_in_clique):
    for s_id, samp in enumerate(clique):
        dist_in_clique[c_id][s_id] = dist[s_id][samp]

```

```

[128]: for i in range(task_num + 1):
        clique_dist = dist_in_clique[:i+1,:test_splt[i]]
        clique_pred = np.argmax(clique_dist, axis=0)
        merge_pred = [pred_in_clique[cli,s_id] for s_id, cli in
            →enumerate(clique_pred)]
        merge_acc = np.mean(merge_pred == query_label_[:test_splt[i]])
        print(merge_acc)
print('DaC:', 'beta:', be, '| l2:', l2)

```

```

[28]: print('===== Experiment Done! =====')

```

===== Experiment Done! =====

## iVoro on CIFAR-100 Dataset (16 Phases)

```
[99]: import matplotlib.pyplot as plt
import os
import pickle
import numpy as np
import pandas as pd
import seaborn as sns
import time
import sys
sys.path.append('../')
sys.path.append('../analysis/')
import copy
import platform
import json
import pickle
import random

import torch
from scipy.stats import mode
```

```
[160]: from ResNet import resnet18_cbam

data_name      = 'CIFAR100' # 'Subset' # 'Tiny' # 'CIFAR100' # 'MNIST'
total_nc       = 100 # 200 # 100 # 10
fg_nc          = 20 # 100 # 40 # 50 # 4
task_num       = 16 # 20 # 5 # 10 # 2

# constant params
class_set      = list(range(total_nc))
ROTATION       = True
EMB2D          = False
DESIGN         = True
virtual_class  = 4*total_nc if ROTATION else total_nc
suffix         = 'voro' # 'prob' 'voro'
assert (total_nc - fg_nc)%task_num == 0
task_size      = int((total_nc - fg_nc)/task_num)
file_name      =
    ↳data_name+'_'+str(fg_nc)+'_'+str(task_num)+'x'+str(task_size)+suffix
```

```
print(file_name)

brother      = False # True False
```

CIFAR100\_20\_16x5voro

```
[161]: save_path = '../checkpoints/'
path    = save_path + file_name + '/'
filename = path + '%d_model.pkl' % (fg_nc+0) # +5
model    = torch.load(filename)
model.eval()
print('> loaded base phase model from:', filename)
```

> loaded base phase model from: ../checkpoints/CIFAR100\_20\_16x5voro/20\_model.pkl

```
[162]: from voro_helper import num_param, t2n, \
        load_feat, sanity_check, \
        id2emb_, num_samp, merge_sc, funbtch

num_param(model)

# voronoi centers:
vcenter = t2n(model.module.classifier.weight.data / 2.)
print(vcenter.shape)
```

```
module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
(80, 512)
```

```
[163]: '''
CIFAR:
    'CIFAR100_50_5x10_test.pkl'
    'CIFAR100_50_5x10_train.pkl'
    'CIFAR100_40_20x3_test.pkl'
    'CIFAR100_40_20x3_train.pkl'
more CIFAR:
    'CIFAR100_40_12x5_test.pkl'
    'CIFAR100_40_12x5_train.pkl'
    'CIFAR100_30_14x5_test.pkl'
    'CIFAR100_30_14x5_train.pkl'
    'CIFAR100_20_16x5_test.pkl'
    'CIFAR100_20_16x5_train.pkl'
    'CIFAR100_10_18x5_test.pkl'
    'CIFAR100_10_18x5_train.pkl'
Tiny:
    'Tiny_100_20x5_test.pkl'
    'Tiny_100_20x5_train.pkl'
TinyL3:
    'Tiny_100_5x20_test.pkl'
```

```

    'Tiny_100_5x20_train.pkl'
Subset:
    'Subset_50_10x5_test.pkl'
    'Subset_50_10x5_train.pkl'
'''
ffile = '../embedding/prob/' + 'CIFAR100_20_16x5_test.pkl' # prob probL3
dataphas, last_tsk = load_feat(ffile)

labs, embeds, outputs = dataphas[last_tsk][last_tsk]
false_id, pred_ = sanity_check(labs, embeds, outputs)

```

```

feature file: ../embedding/prob/CIFAR100_20_16x5_test.pkl
> loaded tasks: dict_keys([16])
> classes: [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18,
19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38,
39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58,
59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78,
79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98,
99]
> samples: 10000
> embedding: 512
> classification: 400
~ acc (single): 50.72%
~ acc (quadruple): 40.03%

```

```

[164]: ffile = '../embedding/prob/' + 'CIFAR100_20_16x5_train.pkl' # prob probL3
dataphas, last_tsk = load_feat(ffile)

labst, embedst, outputst = dataphas[last_tsk][last_tsk]
false_id, pred_ = sanity_check(labst, embedst, outputst)

```

```

feature file: ../embedding/prob/CIFAR100_20_16x5_train.pkl
> loaded tasks: dict_keys([16])
> classes: [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18,
19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38,
39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58,
59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78,
79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98,
99]
> samples: 50000
> embedding: 512
> classification: 400
~ acc (single): 56.39%
~ acc (quadruple): 46.07%

```

```

[165]: embs = id2emb_(labs, embeds, brother=brother)
embst = id2emb_(labst, embedst, brother=brother)

```



```
sam_max, sam_min = num_samp(embst)
print('> loading data done!')
```

```
0 500,1 500,2 500,3 500,4 500,5 500,6 500,7 500,8 500,9 500,10 500,11 500,12
500,13 500,14 500,15 500,16 500,17 500,18 500,19 500,20 500,21 500,22 500,23
500,24 500,25 500,26 500,27 500,28 500,29 500,30 500,31 500,32 500,33 500,34
500,35 500,36 500,37 500,38 500,39 500,40 500,41 500,42 500,43 500,44 500,45
500,46 500,47 500,48 500,49 500,50 500,51 500,52 500,53 500,54 500,55 500,56
500,57 500,58 500,59 500,60 500,61 500,62 500,63 500,64 500,65 500,66 500,67
500,68 500,69 500,70 500,71 500,72 500,73 500,74 500,75 500,76 500,77 500,78
500,79 500,80 500,81 500,82 500,83 500,84 500,85 500,86 500,87 500,88 500,89
500,90 500,91 500,92 500,93 500,94 500,95 500,96 500,97 500,98 500,99 500,
max samples: 500
min samples: 500
> loading data done!
```

```
[166]: for k,v in embst.items():
        if v.shape[0] < sam_max:
            rid = np.random.choice(v.shape[0], sam_max-v.shape[0], replace=False)
            print('filling', sam_max-v.shape[0], 'samples')
            embst[k] = np.vstack((v, v[rid]))
```

```
[167]: from voro_helper import get_task_data, feat_trans, NC_o, tsk_cls, fun, \
        ↪acc_brother, forgetting

        i = task_num
        support_data_, support_label_, query_data_, query_label_, n_ways_, n_shot_, _ = \
            get_task_data(embst, embs, i, fg_nc, class_set, task_size, brother=brother)
```

```
##### current_task: 16 #####
current classes [95, 96, 97, 98, 99]
[output] all classes 0 -> 99
```

```
[168]: #%% =====
        ↪=====
        be = 1. # 1.
        l2 = False # False True
        protots = np.mean(feat_trans(support_data_, beta=be, l2=l2), axis=1)
```

```
[169]: i = 0
        support_data, support_label, query_data, query_label, n_ways, n_shot, classes = \
            get_task_data(embst, embs, i, fg_nc, class_set, task_size, brother=brother)
        acc, _, nn_pre = NC_o(support_data, support_label,
                               query_data, query_label,
                               n_ways, n_shot,
                               beta = be, l2 = l2,
                               given_cen = protots[classes], given_only = True,
```

```
brother = brother)
```

```
##### current_task: 0 #####  
current classes [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17,  
18, 19]  
[output] all classes 0 -> 19  
0.8595
```

```
[170]: local      = False # True / False  
nn_acc    = []  
savefile  = path+'NN' if brother else None # NN / NNp / NN3 / only saved NN  
→results!  
savefil2  = path+'NN3'  
forget    = True # True False # calculate forgetting  
class_ladder = []  
a         = []  
for i in range(task_num + 1):  
    support_data, support_label, query_data, query_label, n_ways, n_shot,   
→classes = \  
        get_task_data(embst, embs, i, fg_nc, class_set, task_size,  
                        local = local, brother = brother) # False  
    if forget:  
        class_ladder.append(classes)  
    acc, _, nn_pre = NC_o(support_data, support_label,  
                           query_data, query_label,  
                           n_ways, n_shot,  
                           beta = be, l2 = l2,  
                           given_cen = protots[classes] if local else protots[:  
→classes[-1]+1],  
                           given_only = True,  
                           brother = brother,  
                           savefile = savefile+'_'+str(i) if brother else None,  
                           savefile2 = None, # savefil2+'_'+str(i), # None, #  
                           weights = [0.7, 0.3],  
                           class_ladder = class_ladder,  
                           acc_all = a  
                           )  
    nn_acc.append(acc)  
    # if all classes up2now: local = False, and protots[:classes[-1]+1]  
print('local:', local, '| beta:', be, '| l2:', l2)  
if brother:  
    for accs in nn_acc:  
        print('\t'.join([str(i) for i in accs]))  
else:  
    print('\n'.join([str(i) for i in nn_acc]))  
if forget:
```

```
avgf = forgetting(a, task_num)
print(avgf)
```

```
##### current_task: 0 #####
current classes [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17,
18, 19]
[output] all classes 0 -> 19
0.8595
```

```
##### current_task: 1 #####
current classes [20, 21, 22, 23, 24]
[output] all classes 0 -> 24
0.7832
```

```
##### current_task: 2 #####
current classes [25, 26, 27, 28, 29]
[output] all classes 0 -> 29
0.7170
```

```
##### current_task: 3 #####
current classes [30, 31, 32, 33, 34]
[output] all classes 0 -> 34
0.6569
```

```
##### current_task: 4 #####
current classes [35, 36, 37, 38, 39]
[output] all classes 0 -> 39
0.6050
```

```
##### current_task: 5 #####
current classes [40, 41, 42, 43, 44]
[output] all classes 0 -> 44
0.5758
```

```
##### current_task: 6 #####
current classes [45, 46, 47, 48, 49]
[output] all classes 0 -> 49
0.5502
```

```
##### current_task: 7 #####
current classes [50, 51, 52, 53, 54]
[output] all classes 0 -> 54
0.5342
```

```
##### current_task: 8 #####
current classes [55, 56, 57, 58, 59]
[output] all classes 0 -> 59
```

0.5075

```
##### current_task: 9 #####
current classes [60, 61, 62, 63, 64]
[output] all classes 0 -> 64
0.4877
```

```
##### current_task: 10 #####
current classes [65, 66, 67, 68, 69]
[output] all classes 0 -> 69
0.4691
```

```
##### current_task: 11 #####
current classes [70, 71, 72, 73, 74]
[output] all classes 0 -> 74
0.4467
```

```
##### current_task: 12 #####
current classes [75, 76, 77, 78, 79]
[output] all classes 0 -> 79
0.4324
```

```
##### current_task: 13 #####
current classes [80, 81, 82, 83, 84]
[output] all classes 0 -> 84
0.4186
```

```
##### current_task: 14 #####
current classes [85, 86, 87, 88, 89]
[output] all classes 0 -> 89
0.4106
```

```
##### current_task: 15 #####
current classes [90, 91, 92, 93, 94]
[output] all classes 0 -> 94
0.4045
```

```
##### current_task: 16 #####
current classes [95, 96, 97, 98, 99]
[output] all classes 0 -> 99
0.3906
local: False | beta: 1.0 | l2: False
0.8595
0.7832
0.717
0.6568571428571428
0.605
0.5757777777777778
```

0.5502  
 0.5341818181818182  
 0.5075  
 0.4876923076923077  
 0.46914285714285714  
 0.4466666666666666  
 0.432375  
 0.41858823529411765  
 0.41055555555555556  
 0.4045263157894737  
 0.3906  
 [[0.8595 0. 0. 0. 0. 0. 0. 0. 0.  
 0. 0. 0. 0. 0. 0. 0. ]  
 [0.804 0.7 0. 0. 0. 0. 0. 0. 0. 0.  
 0. 0. 0. 0. 0. 0. 0. ]  
 [0.777 0.636 0.558 0. 0. 0. 0. 0. 0. 0.  
 0. 0. 0. 0. 0. 0. 0. ]  
 [0.7635 0.614 0.514 0.416 0. 0. 0. 0. 0. 0.  
 0. 0. 0. 0. 0. 0. 0. ]  
 [0.739 0.59 0.498 0.36 0.436 0. 0. 0. 0. 0.  
 0. 0. 0. 0. 0. 0. 0. ]  
 [0.731 0.566 0.46 0.338 0.426 0.468 0. 0. 0. 0.  
 0. 0. 0. 0. 0. 0. 0. ]  
 [0.721 0.562 0.426 0.324 0.412 0.448 0.446 0. 0. 0.  
 0. 0. 0. 0. 0. 0. 0. ]  
 [0.7135 0.56 0.41 0.32 0.402 0.442 0.4 0.488 0. 0.  
 0. 0. 0. 0. 0. 0. 0. ]  
 [0.706 0.554 0.406 0.304 0.402 0.428 0.39 0.47 0.312 0.  
 0. 0. 0. 0. 0. 0. 0. ]  
 [0.695 0.5 0.402 0.292 0.386 0.422 0.376 0.432 0.306 0.444  
 0. 0. 0. 0. 0. 0. 0. ]  
 [0.6905 0.492 0.392 0.272 0.38 0.418 0.37 0.428 0.298 0.428  
 0.328 0. 0. 0. 0. 0. 0. 0. ]  
 [0.689 0.466 0.384 0.262 0.374 0.414 0.364 0.416 0.288 0.4  
 0.31 0.266 0. 0. 0. 0. 0. 0. ]  
 [0.687 0.462 0.384 0.256 0.37 0.4 0.356 0.402 0.284 0.398  
 0.294 0.258 0.306 0. 0. 0. 0. 0. ]  
 [0.6805 0.458 0.366 0.256 0.348 0.396 0.34 0.392 0.27 0.398  
 0.292 0.256 0.304 0.318 0. 0. 0. 0. ]  
 [0.68 0.444 0.352 0.254 0.334 0.374 0.338 0.392 0.258 0.398  
 0.286 0.254 0.3 0.292 0.394 0. 0. 0. ]  
 [0.679 0.444 0.342 0.252 0.324 0.37 0.336 0.378 0.256 0.374  
 0.28 0.238 0.3 0.28 0.388 0.408 0. 0. ]  
 [0.6785 0.442 0.336 0.228 0.288 0.364 0.332 0.37 0.256 0.364  
 0.272 0.236 0.294 0.28 0.38 0.408 0.248 ]]  
 [0, 5.549999999999999, 7.324999999999998, 7.533333333333337, 8.662500000000001,  
 8.970000000000002, 9.075, 9.085714285714287, 8.89375, 9.694444444444446,  
 9.590000000000003, 9.895454545454548, 9.754166666666668, 9.77692307692308,

9.925000000000002, 9.99, 10.11875]

```
[171]: def predict(model, x, voro=True):
        x = torch.from_numpy(x.astype(np.float32)).cuda()
        with torch.no_grad():
            predi = model.module.classifier(x)
        if voro:
            predi += - torch.sum((model.module.classifier.weight/2.)**2, dim=1)
        return predi

classes_all = []
test_share = []
paccS = []
for i in range(task_num + 1):
    support_data, support_label, query_data, query_label, n_ways, n_shot, \
    →classes = \
        get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                        local = True, brother = brother)

    # load model:
    if brother:
        cls_01 = classes[-1]+1
        assert cls_01 % 4 == 0
        filename = path + '%d_model.pkl' % (int(cls_01/4))
    else:
        filename = path + '%d_model.pkl' % (classes[-1]+1)
    model = torch.load(filename)
    model.eval()
    print('> loaded base phase model from:', filename)
    num_param(model)
    # do prediction:
    min_cls = min(classes)
    if brother:
        pred = predict(model, query_data)
    else:
        pred = predict(model, query_data)[:,:,:4]
    pmax = torch.max(pred, dim=1)[1]
    pacc = np.mean(t2n(pmax) == query_label - min_cls)
    print(pacc)
    if brother:
        accs = acc_brother(t2n(pred), t2n(pmax), query_label - min_cls, \
    →forLG=True)
        pacc = [pacc] + accs
    paccS.append(pacc)
    classes_all.append(classes)
    test_share.append(len(query_label))
print('all logistic locally:')
if brother:
```

```

    for accs in paccS:
        print('\t'.join([str(i) for i in accs]))
    else:
        print('\n'.join([str(i) for i in paccS]))

```

##### current\_task: 0 #####

[output] current classes [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19]

all classes 0 -> 19

> loaded base phase model from: ../checkpoints/CIFAR100\_20\_16x5voro/20\_model.pkl

module.classifier.weight      torch.Size([80, 512])      40960      True

total: 40960

0.871

##### current\_task: 1 #####

[output] current classes [20, 21, 22, 23, 24]

all classes 0 -> 24

> loaded base phase model from: ../checkpoints/CIFAR100\_20\_16x5voro/25\_model.pkl

module.classifier.weight      torch.Size([20, 512])      10240      True

total: 10240

0.938

##### current\_task: 2 #####

[output] current classes [25, 26, 27, 28, 29]

all classes 0 -> 29

> loaded base phase model from: ../checkpoints/CIFAR100\_20\_16x5voro/30\_model.pkl

module.classifier.weight      torch.Size([20, 512])      10240      True

total: 10240

0.83

##### current\_task: 3 #####

[output] current classes [30, 31, 32, 33, 34]

all classes 0 -> 34

> loaded base phase model from: ../checkpoints/CIFAR100\_20\_16x5voro/35\_model.pkl

module.classifier.weight      torch.Size([20, 512])      10240      True

total: 10240

0.86

##### current\_task: 4 #####

[output] current classes [35, 36, 37, 38, 39]

all classes 0 -> 39

> loaded base phase model from: ../checkpoints/CIFAR100\_20\_16x5voro/40\_model.pkl

module.classifier.weight      torch.Size([20, 512])      10240      True

total: 10240

0.896

##### current\_task: 5 #####

```

[output] current classes [40, 41, 42, 43, 44]
all classes 0 -> 44
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.852

##### current_task: 6 #####
[output] current classes [45, 46, 47, 48, 49]
all classes 0 -> 49
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.92

##### current_task: 7 #####
[output] current classes [50, 51, 52, 53, 54]
all classes 0 -> 54
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.898

##### current_task: 8 #####
[output] current classes [55, 56, 57, 58, 59]
all classes 0 -> 59
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.898

##### current_task: 9 #####
[output] current classes [60, 61, 62, 63, 64]
all classes 0 -> 64
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.918

##### current_task: 10 #####
[output] current classes [65, 66, 67, 68, 69]
all classes 0 -> 69
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.86

##### current_task: 11 #####

```



```

[output] current classes [70, 71, 72, 73, 74]
all classes 0 -> 74
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.866

##### current_task: 12 #####
[output] current classes [75, 76, 77, 78, 79]
all classes 0 -> 79
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.846

##### current_task: 13 #####
[output] current classes [80, 81, 82, 83, 84]
all classes 0 -> 84
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.91

##### current_task: 14 #####
[output] current classes [85, 86, 87, 88, 89]
all classes 0 -> 89
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.868

##### current_task: 15 #####
[output] current classes [90, 91, 92, 93, 94]
all classes 0 -> 94
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.912

##### current_task: 16 #####
[output] current classes [95, 96, 97, 98, 99]
all classes 0 -> 99
> loaded base phase model from:
../checkpoints/CIFAR100_20_16x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.916
all logistic locally:

```

0.871  
0.938  
0.83  
0.86  
0.896  
0.852  
0.92  
0.898  
0.898  
0.918  
0.86  
0.866  
0.846  
0.91  
0.868  
0.912  
0.916

```
[172]: for i in range(task_num + 1):
        support_data, support_label, query_data, query_label, n_ways, n_shot, \
        classes = \
            get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                          local = True, brother = brother)
    pred_all = []
    for classes in classes_all:
        # load model:
        if brother:
            cls_01 = classes[-1]+1
            assert cls_01 % 4 == 0
            filename = path + '%d_model.pkl' % (int(cls_01/4))
        else:
            filename = path + '%d_model.pkl' % (classes[-1]+1)
        model = torch.load(filename)
        model.eval()
        print('> loaded base phase model from:', filename)
        num_param(model)
        # do prediction:
        min_cls = min(classes)
        if brother:
            pred = predict(model, query_data)
        else:
            pred = predict(model, query_data)[:,:,:4]
        pmax = torch.max(pred, dim=1)[1]
        # pacc = np.mean(t2n(pmax) == query_label - min_cls)
        # print(pacc)
        if brother:
            labs_01 = query_label[:4]//4
```

```

        acc_, sc_pre = merge_sc(t2n(pred), labs_01,
                                mth='softmax', forLG=True, return_pre=True)
        min_cls = int(min_cls / 4)
        pred_all.append( (sc_pre + min_cls).tolist() )
    else:
        pred_all.append( (t2n(pmax) + min_cls).tolist() )
pred_all = np.array(pred_all)
print(pred_all.shape)

if i == 0:
    pred_in_clique = copy.deepcopy(pred_all)
else:
    pred_in_clique = np.hstack((pred_in_clique, pred_all))

```

##### current\_task: 0 #####

[output] current classes [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19]

all classes 0 -> 19

> loaded base phase model from: ../checkpoints/CIFAR100\_20\_16x5voro/20\_model.pkl

module.classifier.weight torch.Size([80, 512]) 40960 True

total: 40960

> loaded base phase model from: ../checkpoints/CIFAR100\_20\_16x5voro/25\_model.pkl

module.classifier.weight torch.Size([20, 512]) 10240 True

total: 10240

> loaded base phase model from: ../checkpoints/CIFAR100\_20\_16x5voro/30\_model.pkl

module.classifier.weight torch.Size([20, 512]) 10240 True

total: 10240

> loaded base phase model from: ../checkpoints/CIFAR100\_20\_16x5voro/35\_model.pkl

module.classifier.weight torch.Size([20, 512]) 10240 True

total: 10240

> loaded base phase model from: ../checkpoints/CIFAR100\_20\_16x5voro/40\_model.pkl

module.classifier.weight torch.Size([20, 512]) 10240 True

total: 10240

> loaded base phase model from: ../checkpoints/CIFAR100\_20\_16x5voro/45\_model.pkl

module.classifier.weight torch.Size([20, 512]) 10240 True

total: 10240

> loaded base phase model from: ../checkpoints/CIFAR100\_20\_16x5voro/50\_model.pkl

module.classifier.weight torch.Size([20, 512]) 10240 True

total: 10240

> loaded base phase model from: ../checkpoints/CIFAR100\_20\_16x5voro/55\_model.pkl

module.classifier.weight torch.Size([20, 512]) 10240 True

total: 10240

> loaded base phase model from: ../checkpoints/CIFAR100\_20\_16x5voro/60\_model.pkl

module.classifier.weight torch.Size([20, 512]) 10240 True

total: 10240

> loaded base phase model from: ../checkpoints/CIFAR100\_20\_16x5voro/65\_model.pkl

module.classifier.weight torch.Size([20, 512]) 10240 True

```

total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_20_16x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(17, 2000)

```

```
##### current_task: 1 #####
```

```
[output] current classes [20, 21, 22, 23, 24]
```

```
all classes 0 -> 24
```

```

> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/20_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/25_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/30_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True

```

```

total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_20_16x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(17, 500)

```

```
##### current_task: 2 #####
```

```
[output] current classes [25, 26, 27, 28, 29]
```

```
all classes 0 -> 29
```

```

> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/20_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/25_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/30_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True

```

```

total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_20_16x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(17, 500)

##### current_task: 3 #####
[output] current classes [30, 31, 32, 33, 34]
all classes 0 -> 34
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/20_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960    True

```

```

total: 40960
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/25_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/30_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_20_16x5voro/100_model.pkl

```

```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(17, 500)

##### current_task: 4 #####
[output] current classes [35, 36, 37, 38, 39]
all classes 0 -> 39
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/20_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/25_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/30_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True

```



```

total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_20_16x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(17, 500)

##### current_task: 5 #####
[output] current classes [40, 41, 42, 43, 44]
all classes 0 -> 44
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/20_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/25_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/30_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True

```

```

total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_20_16x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(17, 500)

```

```
##### current_task: 6 #####
```

```
[output] current classes [45, 46, 47, 48, 49]
```

```
all classes 0 -> 49
```

```

> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/20_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/25_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/30_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True

```

```

total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_20_16x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(17, 500)

```

```
##### current_task: 7 #####
```

```
[output] current classes [50, 51, 52, 53, 54]
```

```
all classes 0 -> 54
```

```

> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/20_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/25_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/30_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True

```

```

total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_20_16x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(17, 500)

```

```
##### current_task: 8 #####
```

```
[output] current classes [55, 56, 57, 58, 59]
```

```
all classes 0 -> 59
```

```

> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/20_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/25_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True

```

```

total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/30_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_20_16x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(17, 500)

```

```

##### current_task: 9 #####
[output] current classes [60, 61, 62, 63, 64]
all classes 0 -> 64
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/20_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/25_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/30_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True

```

```

total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_20_16x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(17, 500)

##### current_task: 10 #####
[output] current classes [65, 66, 67, 68, 69]
all classes 0 -> 69
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/20_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/25_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/30_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True

```

```

total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_20_16x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(17, 500)

```

```
##### current_task: 11 #####
```

```
[output] current classes [70, 71, 72, 73, 74]
```

```
all classes 0 -> 74
```

```

> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/20_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/25_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/30_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True

```



```

total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_20_16x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(17, 500)

```

```
##### current_task: 12 #####
```

```
[output] current classes [75, 76, 77, 78, 79]
```

```
all classes 0 -> 79
```

```

> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/20_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/25_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/30_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True

```

```

total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_20_16x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(17, 500)

##### current_task: 13 #####
[output] current classes [80, 81, 82, 83, 84]
all classes 0 -> 84
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/20_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/25_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/30_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True

```

```

total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_20_16x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(17, 500)

```

```
##### current_task: 14 #####
```

```
[output] current classes [85, 86, 87, 88, 89]
```

```

all classes 0 -> 89
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/20_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/25_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/30_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True

```

```

total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_20_16x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(17, 500)

##### current_task: 15 #####
[output] current classes [90, 91, 92, 93, 94]
all classes 0 -> 94
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/20_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/25_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/30_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True

```

```

total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_20_16x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(17, 500)

```

```
##### current_task: 16 #####
```

```
[output] current classes [95, 96, 97, 98, 99]
```

```
all classes 0 -> 99
```

```

> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/20_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/25_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/30_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True

```

```

total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_20_16x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(17, 500)

```

```

[173]: print('cliques by test samples:', pred_in_clique.shape)

# compute prototypes
be      = 0.8 # 1.
l2      = True # False True
bias    = 0 # 0.05
protots = np.mean(feats_trans(support_data_, beta=be, l2=l2, bias=bias), axis=1)
query_pts = feats_trans(query_data_, beta=be, l2=l2, bias=bias)
# acenss = feats_trans(acens, beta=be, l2=l2, bias=bias)
if brother:
    dist = funbtch(query_pts, protots) # protots / acenss
else:
    dist = fun(query_pts, protots) # protots / acenss

test_splt = [sum(test_share[:t+1]) for t in range(len(test_share))]

```

cliques by test samples: (17, 10000)

```

[174]: dist_in_clique = np.zeros_like(pred_in_clique, dtype=np.float32)
for c_id, clique in enumerate(pred_in_clique):
    for s_id, samp in enumerate(clique):
        dist_in_clique[c_id][s_id] = dist[s_id][samp]

```

```
[175]: for i in range(task_num + 1):
        clique_dist = dist_in_clique[:,i+1,:test_splt[i]]
        clique_pred = np.argmin(clique_dist, axis=0)
        merge_pred = [pred_in_clique[cli,s_id] for s_id, cli in
        →enumerate(clique_pred)]
        merge_acc = np.mean(merge_pred == query_label_[:test_splt[i]])
        print(merge_acc)
    print('DaC:', 'beta:', be, '| l2:', l2)
```

```
0.871
0.7944
0.727
0.6728571428571428
0.623
0.5911111111111111
0.5662
0.5487272727272727
0.5241666666666667
0.5066153846153846
0.489
0.4656
0.45025
0.43470588235294116
0.42833333333333334
0.4211578947368421
0.4066
DaC: beta: 0.8 | l2: True
```

```
[28]: print('==== Experiment Done! =====')
```

```
===== Experiment Done! =====
```



## iVoro-AC/AI on CIFAR-100 Dataset (16 Phases)

```
[99]: import matplotlib.pyplot as plt
import os
import pickle
import numpy as np
import pandas as pd
import seaborn as sns
import time
import sys
sys.path.append('../')
sys.path.append('../analysis/')
import copy
import platform
import json
import pickle
import random

import torch
from scipy.stats import mode
```

```
[176]: from ResNet import resnet18_cbam

data_name      = 'CIFAR100' # 'Subset' # 'Tiny' # 'CIFAR100' # 'MNIST'
total_nc       = 100 # 200 # 100 # 10
fg_nc          = 20 # 100 # 40 # 50 # 4
task_num       = 16 # 20 # 5 # 10 # 2

# constant params
class_set      = list(range(total_nc))
ROTATION       = True
EMB2D          = False
DESIGN         = True
virtual_class  = 4*total_nc if ROTATION else total_nc
suffix         = 'voro' # 'prob' 'voro'
assert (total_nc - fg_nc)%task_num == 0
task_size      = int((total_nc - fg_nc)/task_num)
file_name      =
    ↳data_name+'_'+str(fg_nc)+'_'+str(task_num)+'x'+str(task_size)+suffix
```

```
print(file_name)

brother      = True # True False
```

CIFAR100\_20\_16x5voro

```
[177]: save_path = '../checkpoints/'
path    = save_path + file_name + '/'
filename = path + '%d_model.pkl' % (fg_nc+0) # +5
model    = torch.load(filename)
model.eval()
print('> loaded base phase model from:', filename)
```

> loaded base phase model from: ../checkpoints/CIFAR100\_20\_16x5voro/20\_model.pkl

```
[178]: from voro_helper import num_param, t2n, \
        load_feat, sanity_check, \
        id2emb_, num_samp, merge_sc, funbtch

num_param(model)

# voronoi centers:
vcenter = t2n(model.module.classifier.weight.data / 2.)
print(vcenter.shape)
```

```
module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
(80, 512)
```

```
[179]: '''
CIFAR:
    'CIFAR100_50_5x10_test.pkl'
    'CIFAR100_50_5x10_train.pkl'
    'CIFAR100_40_20x3_test.pkl'
    'CIFAR100_40_20x3_train.pkl'
more CIFAR:
    'CIFAR100_40_12x5_test.pkl'
    'CIFAR100_40_12x5_train.pkl'
    'CIFAR100_30_14x5_test.pkl'
    'CIFAR100_30_14x5_train.pkl'
    'CIFAR100_20_16x5_test.pkl'
    'CIFAR100_20_16x5_train.pkl'
    'CIFAR100_10_18x5_test.pkl'
    'CIFAR100_10_18x5_train.pkl'
Tiny:
    'Tiny_100_20x5_test.pkl'
    'Tiny_100_20x5_train.pkl'
TinyL3:
    'Tiny_100_5x20_test.pkl'
```

```

    'Tiny_100_5x20_train.pkl'
Subset:
    'Subset_50_10x5_test.pkl'
    'Subset_50_10x5_train.pkl'
'''
ffile = '../embedding/prob/' + 'CIFAR100_20_16x5_test.pkl' # prob probL3
data_phas, last_tsk = load_feat(ffile)

labs, embeds, outputs = data_phas[last_tsk][last_tsk]
false_id, pred_ = sanity_check(labs, embeds, outputs)

```

```

feature file: ../embedding/prob/CIFAR100_20_16x5_test.pkl
> loaded tasks: dict_keys([16])
> classes: [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18,
19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38,
39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58,
59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78,
79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98,
99]
> samples: 10000
> embedding: 512
> classification: 400
~ acc (single): 50.72%
~ acc (quadruple): 40.03%

```

```

[180]: ffile = '../embedding/prob/' + 'CIFAR100_20_16x5_train.pkl' # prob probL3
data_phas, last_tsk = load_feat(ffile)

labst, embedst, outputst = data_phas[last_tsk][last_tsk]
false_id, pred_ = sanity_check(labst, embedst, outputst)

```

```

feature file: ../embedding/prob/CIFAR100_20_16x5_train.pkl
> loaded tasks: dict_keys([16])
> classes: [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18,
19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38,
39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58,
59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78,
79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98,
99]
> samples: 50000
> embedding: 512
> classification: 400
~ acc (single): 56.39%
~ acc (quadruple): 46.07%

```

```

[181]: embs = id2emb_(labs, embeds, brother=brother)
embst = id2emb_(labst, embedst, brother=brother)

```

```
sam_max, sam_min = num_samp(embst)
print('> loading data done!')
```

```
0 500,1 500,2 500,3 500,4 500,5 500,6 500,7 500,8 500,9 500,10 500,11 500,12
500,13 500,14 500,15 500,16 500,17 500,18 500,19 500,20 500,21 500,22 500,23
500,24 500,25 500,26 500,27 500,28 500,29 500,30 500,31 500,32 500,33 500,34
500,35 500,36 500,37 500,38 500,39 500,40 500,41 500,42 500,43 500,44 500,45
500,46 500,47 500,48 500,49 500,50 500,51 500,52 500,53 500,54 500,55 500,56
500,57 500,58 500,59 500,60 500,61 500,62 500,63 500,64 500,65 500,66 500,67
500,68 500,69 500,70 500,71 500,72 500,73 500,74 500,75 500,76 500,77 500,78
500,79 500,80 500,81 500,82 500,83 500,84 500,85 500,86 500,87 500,88 500,89
500,90 500,91 500,92 500,93 500,94 500,95 500,96 500,97 500,98 500,99 500,100
500,101 500,102 500,103 500,104 500,105 500,106 500,107 500,108 500,109 500,110
500,111 500,112 500,113 500,114 500,115 500,116 500,117 500,118 500,119 500,120
500,121 500,122 500,123 500,124 500,125 500,126 500,127 500,128 500,129 500,130
500,131 500,132 500,133 500,134 500,135 500,136 500,137 500,138 500,139 500,140
500,141 500,142 500,143 500,144 500,145 500,146 500,147 500,148 500,149 500,150
500,151 500,152 500,153 500,154 500,155 500,156 500,157 500,158 500,159 500,160
500,161 500,162 500,163 500,164 500,165 500,166 500,167 500,168 500,169 500,170
500,171 500,172 500,173 500,174 500,175 500,176 500,177 500,178 500,179 500,180
500,181 500,182 500,183 500,184 500,185 500,186 500,187 500,188 500,189 500,190
500,191 500,192 500,193 500,194 500,195 500,196 500,197 500,198 500,199 500,200
500,201 500,202 500,203 500,204 500,205 500,206 500,207 500,208 500,209 500,210
500,211 500,212 500,213 500,214 500,215 500,216 500,217 500,218 500,219 500,220
500,221 500,222 500,223 500,224 500,225 500,226 500,227 500,228 500,229 500,230
500,231 500,232 500,233 500,234 500,235 500,236 500,237 500,238 500,239 500,240
500,241 500,242 500,243 500,244 500,245 500,246 500,247 500,248 500,249 500,250
500,251 500,252 500,253 500,254 500,255 500,256 500,257 500,258 500,259 500,260
500,261 500,262 500,263 500,264 500,265 500,266 500,267 500,268 500,269 500,270
500,271 500,272 500,273 500,274 500,275 500,276 500,277 500,278 500,279 500,280
500,281 500,282 500,283 500,284 500,285 500,286 500,287 500,288 500,289 500,290
500,291 500,292 500,293 500,294 500,295 500,296 500,297 500,298 500,299 500,300
500,301 500,302 500,303 500,304 500,305 500,306 500,307 500,308 500,309 500,310
500,311 500,312 500,313 500,314 500,315 500,316 500,317 500,318 500,319 500,320
500,321 500,322 500,323 500,324 500,325 500,326 500,327 500,328 500,329 500,330
500,331 500,332 500,333 500,334 500,335 500,336 500,337 500,338 500,339 500,340
500,341 500,342 500,343 500,344 500,345 500,346 500,347 500,348 500,349 500,350
500,351 500,352 500,353 500,354 500,355 500,356 500,357 500,358 500,359 500,360
500,361 500,362 500,363 500,364 500,365 500,366 500,367 500,368 500,369 500,370
500,371 500,372 500,373 500,374 500,375 500,376 500,377 500,378 500,379 500,380
500,381 500,382 500,383 500,384 500,385 500,386 500,387 500,388 500,389 500,390
500,391 500,392 500,393 500,394 500,395 500,396 500,397 500,398 500,399 500,
max samples: 500
min samples: 500
> loading data done!
```

```
[182]: for k,v in embst.items():
        if v.shape[0] < sam_max:
            rid = np.random.choice(v.shape[0], sam_max-v.shape[0], replace=False)
            print('filling', sam_max-v.shape[0], 'samples')
            embst[k] = np.vstack((v, v[rid]))
```

```
[183]: from voro_helper import get_task_data, feat_trans, NC_o, tsk_cls, fun,
        ↪acc_brother, forgetting

i = task_num
support_data_, support_label_, query_data_, query_label_, n_ways_, n_shot_, _ = \
    get_task_data(embst, embs, i, fg_nc, class_set, task_size, brother=brother)
```

```
##### current_task: 16 #####
current classes [380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395
396 397
398 399]
[output] all classes 0 -> 399
```

```
[184]: #%% =====
        ↪=====

be         = 1. # 1.
l2         = False # False True
protots    = np.mean(feat_trans(support_data_, beta=be, l2=l2), axis=1)
```

```
[186]: i = 0
support_data, support_label, query_data, query_label, n_ways, n_shot, classes = \
    get_task_data(embst, embs, i, fg_nc, class_set, task_size, brother=brother)
acc, _, nn_pre = NC_o(support_data, support_label,
                      query_data, query_label,
                      n_ways, n_shot,
                      beta = be, l2 = l2,
                      given_cen = protots[classes], given_only = True,
                      brother = brother)
```

```
[187]: local      = False # True / False
nn_acc      = []
savefile = path+'NN' if brother else None # NN / NNp / NN3 / only saved NN
        ↪results!
savefil2 = path+'NN3'
forget      = True # True False # calculate forgetting
class_ladder = []
a           = []
for i in range(task_num + 1):
    support_data, support_label, query_data, query_label, n_ways, n_shot,
        ↪classes = \
```

```

        get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                      local = local, brother = brother) # False
    if forget:
        class_ladder.append(classes)
    acc, _, nn_pre = NC_o(support_data, support_label,
                        query_data, query_label,
                        n_ways, n_shot,
                        beta = be, l2 = l2,
                        given_cen = protots[classes] if local else protots[:
→classes[-1]+1],

                        given_only = True,
                        brother = brother,
                        savefile = savefile+'_'+str(i) if brother else None,
                        savefile2 = None, # savefile2+'_'+str(i), # None, #
                        weights = [0.7, 0.3],
                        class_ladder = class_ladder,
                        acc_all = a
                        )

    nn_acc.append(acc)
    # if all classes up2now: local = False, and protots[:classes[-1]+1]
print('local:', local, '| beta:', be, '| l2:', l2)
if brother:
    for accs in nn_acc:
        print('\t'.join([str(i) for i in accs]))
else:
    print('\n'.join([str(i) for i in nn_acc]))
if forget:
    avgf = forgetting(a, task_num)
    print(avgf)

```

```

##### current_task: 0 #####
current classes [ 0  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20
21 22 23
24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47
48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71
72 73 74 75 76 77 78 79]
[output] all classes 0 -> 79
<<< loaded from: ../checkpoints/CIFAR100_20_16x5voro/NN_0.npy
0.7516

```

```

##### current_task: 1 #####
current classes [80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99]
[output] all classes 0 -> 99
<<< loaded from: ../checkpoints/CIFAR100_20_16x5voro/NN_1.npy
0.6605

```

```

##### current_task: 2 #####

```

```
current classes [100 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115
116 117
118 119]
```

```
[output] all classes 0 -> 119
```

```
<<< loaded from: ../checkpoints/CIFAR100_20_16x5voro/NN_2.npy
0.5915
```

```
##### current_task: 3 #####
```

```
current classes [120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135
136 137
138 139]
```

```
[output] all classes 0 -> 139
```

```
<<< loaded from: ../checkpoints/CIFAR100_20_16x5voro/NN_3.npy
0.5336
```

```
##### current_task: 4 #####
```

```
current classes [140 141 142 143 144 145 146 147 148 149 150 151 152 153 154 155
156 157
158 159]
```

```
[output] all classes 0 -> 159
```

```
<<< loaded from: ../checkpoints/CIFAR100_20_16x5voro/NN_4.npy
0.4924
```

```
##### current_task: 5 #####
```

```
current classes [160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175
176 177
178 179]
```

```
[output] all classes 0 -> 179
```

```
<<< loaded from: ../checkpoints/CIFAR100_20_16x5voro/NN_5.npy
0.4573
```

```
##### current_task: 6 #####
```

```
current classes [180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195
196 197
198 199]
```

```
[output] all classes 0 -> 199
```

```
<<< loaded from: ../checkpoints/CIFAR100_20_16x5voro/NN_6.npy
0.4421
```

```
##### current_task: 7 #####
```

```
current classes [200 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215
216 217
218 219]
```

```
[output] all classes 0 -> 219
```

```
<<< loaded from: ../checkpoints/CIFAR100_20_16x5voro/NN_7.npy
0.4258
```

```
##### current_task: 8 #####
```

```

current classes [220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235
236 237
238 239]
[output] all classes 0 -> 239
<<< loaded from: ../checkpoints/CIFAR100_20_16x5voro/NN_8.npy
0.4070

##### current_task: 9 #####
current classes [240 241 242 243 244 245 246 247 248 249 250 251 252 253 254 255
256 257
258 259]
[output] all classes 0 -> 259
<<< loaded from: ../checkpoints/CIFAR100_20_16x5voro/NN_9.npy
0.3925

##### current_task: 10 #####
current classes [260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275
276 277
278 279]
[output] all classes 0 -> 279
<<< loaded from: ../checkpoints/CIFAR100_20_16x5voro/NN_10.npy
0.3781

##### current_task: 11 #####
current classes [280 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295
296 297
298 299]
[output] all classes 0 -> 299
<<< loaded from: ../checkpoints/CIFAR100_20_16x5voro/NN_11.npy
0.3595

##### current_task: 12 #####
current classes [300 301 302 303 304 305 306 307 308 309 310 311 312 313 314 315
316 317
318 319]
[output] all classes 0 -> 319
<<< loaded from: ../checkpoints/CIFAR100_20_16x5voro/NN_12.npy
0.3472

##### current_task: 13 #####
current classes [320 321 322 323 324 325 326 327 328 329 330 331 332 333 334 335
336 337
338 339]
[output] all classes 0 -> 339
<<< loaded from: ../checkpoints/CIFAR100_20_16x5voro/NN_13.npy
0.3347

##### current_task: 14 #####

```



```
current classes [340 341 342 343 344 345 346 347 348 349 350 351 352 353 354 355
356 357
358 359]
```

```
[output] all classes 0 -> 359
```

```
<<< loaded from: ../checkpoints/CIFAR100_20_16x5voro/NN_14.npy
0.3268
```

```
##### current_task: 15 #####
```

```
current classes [360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375
376 377
378 379]
```

```
[output] all classes 0 -> 379
```

```
<<< loaded from: ../checkpoints/CIFAR100_20_16x5voro/NN_15.npy
0.3208
```

```
##### current_task: 16 #####
```

```
current classes [380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395
396 397
398 399]
```

```
[output] all classes 0 -> 399
```

```
<<< loaded from: ../checkpoints/CIFAR100_20_16x5voro/NN_16.npy
0.3081
```

```
local: False | beta: 1.0 | l2: False
```

```
0.751625      0.979    0.9475  0.944    0.8815
```

```
0.6605  0.924    0.7044  0.6956  0.5516
```

```
0.5915  0.876    0.6206666666666667    0.6103333333333333    0.493
```

```
0.5335714285714286    0.8091428571428572    0.5777142857142857
```

```
0.5682857142857143    0.47114285714285714
```

```
0.492375    0.75775  0.5635  0.5555  0.46675
```

```
0.45727777777777778    0.714    0.5397777777777778    0.5322222222222223
```

```
0.4662222222222222
```

```
0.44215  0.6884  0.519    0.5134  0.4488
```

```
0.42577272727272725    0.6629090909090909    0.5089090909090909
```

```
0.5032727272727273    0.438
```

```
0.4070416666666667    0.6346666666666667    0.4988333333333333
```

```
0.4928333333333333    0.4345
```

```
0.3924615384615385    0.6150769230769231    0.48815384615384616
```

```
0.48353846153846153    0.4286153846153846
```

```
0.37807142857142856    0.5902857142857143    0.4735714285714286
```

```
0.4677142857142857    0.4157142857142857
```

```
0.3595333333333333    0.5644  0.4550666666666667    0.4498666666666667
```

```
0.3998666666666667
```

```
0.34715625    0.54625  0.45925  0.453625    0.405125
```

```
0.3347058823529412    0.5283529411764706    0.45423529411764707
```

```
0.44882352941176473    0.4027058823529412
```

```
0.3268333333333333    0.5243333333333333    0.4435555555555555
```

```
0.4391111111111111    0.3993333333333333
```

```
0.3208421052631579    0.5131578947368421    0.4361052631578947
```

0.4318947368421053	0.39021052631578945						
0.3081	0.4893	0.4187	0.4156	0.3765			
[0.751625	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.
0.]							
[0.721875	0.415	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.
0.]							
[0.690375	0.367	0.4205	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.
0.]							
[0.676125	0.3545	0.39	0.286	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.
0.]							
[0.6545	0.346	0.372	0.268	0.335	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.
0.]							
[0.647375	0.336	0.3405	0.2545	0.324	0.271	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.
0.]							
[0.63775	0.329	0.3195	0.2425	0.304	0.2585	0.417	0.
0.	0.	0.	0.	0.	0.	0.	0.
0.]							
[0.631375	0.325	0.3145	0.2385	0.2975	0.256	0.375	0.3515
0.	0.	0.	0.	0.	0.	0.	0.
0.]							
[0.6175	0.323	0.3105	0.2305	0.2935	0.249	0.3665	0.336
0.3055	0.	0.	0.	0.	0.	0.	0.
0.]							
[0.611	0.3045	0.3065	0.228	0.2885	0.243	0.358	0.3205
0.303	0.306	0.	0.	0.	0.	0.	0.
0.]							
[0.607875	0.3	0.3015	0.216	0.281	0.2395	0.3545	0.3185
0.298	0.3	0.2525	0.	0.	0.	0.	0.
0.]							
[0.605875	0.2825	0.299	0.21	0.2795	0.2365	0.3535	0.307
0.289	0.2685	0.243	0.201	0.	0.	0.	0.
0.]							
[0.604	0.2755	0.294	0.2075	0.275	0.2285	0.3525	0.3005
0.2845	0.2655	0.2345	0.1955	0.225	0.	0.	0.
0.]							
[0.59775	0.272	0.2855	0.2065	0.258	0.2215	0.3495	0.294
0.2715	0.263	0.233	0.1915	0.2225	0.2305	0.	0.
0.]							
[0.59575	0.2655	0.2765	0.2055	0.2425	0.2085	0.346	0.292
0.259	0.263	0.229	0.191	0.219	0.2175	0.285	0.
0.]							
[0.59425	0.2645	0.266	0.203	0.2395	0.207	0.343	0.2795

```

0.2575  0.2505  0.2245  0.1775  0.2175  0.2035  0.274  0.3115
0.      ]
[0.59375 0.2635  0.265  0.184  0.214  0.2055  0.326  0.2715
0.2555  0.247  0.221  0.1765  0.213  0.2035  0.2715  0.311
0.1585  ]]
[0, 2.9749999999999943, 5.4625, 5.549999999999999, 5.815624999999999,
6.114999999999997, 6.464583333333332, 6.546428571428571, 6.5140625,
6.5569444444444445, 6.4225, 6.702272727272727, 6.626041666666666,
6.702884615384612, 6.838392857142857, 7.009166666666666, 7.139843749999998]

```

```

[188]: def predict(model, x, voro=True):
        x = torch.from_numpy(x.astype(np.float32)).cuda()
        with torch.no_grad():
            predi = model.module.classifier(x)
        if voro:
            predi += - torch.sum((model.module.classifier.weight/2.)**2, dim=1)
        return predi

classes_all = []
test_share = []
paccS = []
for i in range(task_num + 1):
    support_data, support_label, query_data, query_label, n_ways, n_shot, \
    classes = \
        get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                        local = True, brother = brother)

    # load model:
    if brother:
        cls_01 = classes[-1]+1
        assert cls_01 % 4 == 0
        filename = path + '%d_model.pkl' % (int(cls_01/4))
    else:
        filename = path + '%d_model.pkl' % (classes[-1]+1)
    model = torch.load(filename)
    model.eval()
    print('> loaded base phase model from:', filename)
    num_param(model)
    # do prediction:
    min_cls = min(classes)
    if brother:
        pred = predict(model, query_data)
    else:
        pred = predict(model, query_data)[:,:,:4]
    pmax = torch.max(pred, dim=1)[1]
    pacc = np.mean(t2n(pmax) == query_label - min_cls)
    print(pacc)
    if brother:

```

```

        accs = acc_brother(t2n(pred), t2n(pmax), query_label - min_cls,
→forLG=True)
        pacc = [pacc] + accs
        paccS.append(pacc)
        classes_all.append(classes)
        test_share.append(len(query_label))
print('all logistic locally:')
if brother:
    for accs in paccS:
        print('\t'.join([str(i) for i in accs]))
else:
    print('\n'.join([str(i) for i in paccS]))

```

##### current\_task: 0 #####

[output] current classes [ 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17  
18 19 20 21 22 23

24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47

48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71

72 73 74 75 76 77 78 79]

all classes 0 -> 79

> loaded base phase model from: ../checkpoints/CIFAR100\_20\_16x5voro/20\_model.pkl

module.classifier.weight torch.Size([80, 512]) 40960 True

total: 40960

0.7605

##### current\_task: 1 #####

[output] current classes [80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97  
98 99]

all classes 0 -> 99

> loaded base phase model from: ../checkpoints/CIFAR100\_20\_16x5voro/25\_model.pkl

module.classifier.weight torch.Size([20, 512]) 10240 True

total: 10240

0.6415

##### current\_task: 2 #####

[output] current classes [100 101 102 103 104 105 106 107 108 109 110 111 112  
113 114 115 116 117

118 119]

all classes 0 -> 119

> loaded base phase model from: ../checkpoints/CIFAR100\_20\_16x5voro/30\_model.pkl

module.classifier.weight torch.Size([20, 512]) 10240 True

total: 10240

0.655

##### current\_task: 3 #####

[output] current classes [120 121 122 123 124 125 126 127 128 129 130 131 132  
133 134 135 136 137

```

138 139]
all classes 0 -> 139
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.645

##### current_task: 4 #####
[output] current classes [140 141 142 143 144 145 146 147 148 149 150 151 152
153 154 155 156 157
158 159]
all classes 0 -> 159
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.7155

##### current_task: 5 #####
[output] current classes [160 161 162 163 164 165 166 167 168 169 170 171 172
173 174 175 176 177
178 179]
all classes 0 -> 179
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.614

##### current_task: 6 #####
[output] current classes [180 181 182 183 184 185 186 187 188 189 190 191 192
193 194 195 196 197
198 199]
all classes 0 -> 199
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.815

##### current_task: 7 #####
[output] current classes [200 201 202 203 204 205 206 207 208 209 210 211 212
213 214 215 216 217
218 219]
all classes 0 -> 219
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.6715

##### current_task: 8 #####

```

```

[output] current classes [220 221 222 223 224 225 226 227 228 229 230 231 232
233 234 235 236 237
238 239]
all classes 0 -> 239
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.787

```

```

##### current_task: 9 #####
[output] current classes [240 241 242 243 244 245 246 247 248 249 250 251 252
253 254 255 256 257
258 259]
all classes 0 -> 259
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.6495

```

```

##### current_task: 10 #####
[output] current classes [260 261 262 263 264 265 266 267 268 269 270 271 272
273 274 275 276 277
278 279]
all classes 0 -> 279
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.6415

```

```

##### current_task: 11 #####
[output] current classes [280 281 282 283 284 285 286 287 288 289 290 291 292
293 294 295 296 297
298 299]
all classes 0 -> 299
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.6295

```

```

##### current_task: 12 #####
[output] current classes [300 301 302 303 304 305 306 307 308 309 310 311 312
313 314 315 316 317
318 319]
all classes 0 -> 319
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.589

```

```

##### current_task: 13 #####
[output] current classes [320 321 322 323 324 325 326 327 328 329 330 331 332
333 334 335 336 337
338 339]
all classes 0 -> 339
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.6965

##### current_task: 14 #####
[output] current classes [340 341 342 343 344 345 346 347 348 349 350 351 352
353 354 355 356 357
358 359]
all classes 0 -> 359
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.6395

##### current_task: 15 #####
[output] current classes [360 361 362 363 364 365 366 367 368 369 370 371 372
373 374 375 376 377
378 379]
all classes 0 -> 379
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.7015

##### current_task: 16 #####
[output] current classes [380 381 382 383 384 385 386 387 388 389 390 391 392
393 394 395 396 397
398 399]
all classes 0 -> 399
> loaded base phase model from:
../checkpoints/CIFAR100_20_16x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.6525
all logistic locally:
0.7605  0.978  0.9815  0.0    0.9835
0.6415  0.998  0.998  0.0    1.0
0.655   0.934  0.836  0.0    0.962
0.645   0.95  0.854  0.0    0.986
0.7155  0.97   0.98   0.0    0.998
0.614   0.952  0.994  0.0    0.986

```

0.815	0.976	0.922	0.0	0.996
0.6715	0.974	0.944	0.0	0.99
0.787	0.988	0.982	0.0	0.996
0.6495	0.962	0.962	0.0	0.982
0.6415	0.94	0.906	0.0	0.966
0.6295	0.93	0.934	0.0	0.984
0.589	0.958	0.984	0.0	0.986
0.6965	0.992	1.0	0.0	1.0
0.6395	0.952	0.878	0.002	0.97
0.7015	0.968	0.98	0.0	0.994
0.6525	0.986	0.998	0.0	1.0

```
[189]: for i in range(task_num + 1):
        support_data, support_label, query_data, query_label, n_ways, n_shot, \
        classes = \
            get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                          local = True, brother = brother)

        pred_all = []
        for classes in classes_all:
            # load model:
            if brother:
                cls_01 = classes[-1]+1
                assert cls_01 % 4 == 0
                filename = path + '%d_model.pkl' % (int(cls_01/4))
            else:
                filename = path + '%d_model.pkl' % (classes[-1]+1)
            model = torch.load(filename)
            model.eval()
            print('> loaded base phase model from:', filename)
            num_param(model)
            # do prediction:
            min_cls = min(classes)
            if brother:
                pred = predict(model, query_data)
            else:
                pred = predict(model, query_data)[:,:,:4]
            pmax = torch.max(pred, dim=1)[1]
            # pacc = np.mean(t2n(pmax) == query_label - min_cls)
            # print(pacc)
            if brother:
                labs_01 = query_label[:4]//4
                acc_, sc_pre = merge_sc(t2n(pred), labs_01,
                                         mth='softmax', forLG=True, return_pre=True)
                min_cls = int(min_cls / 4)
                pred_all.append( (sc_pre + min_cls).tolist() )
            else:
                pred_all.append( (t2n(pmax) + min_cls).tolist() )
```



```

pred_all = np.array(pred_all)
print(pred_all.shape)

if i == 0:
    pred_in_clique = copy.deepcopy(pred_all)
else:
    pred_in_clique = np.hstack((pred_in_clique, pred_all))

```

##### current\_task: 0 #####

```

[output] current classes [ 0  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17
18 19 20 21 22 23
24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47
48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71
72 73 74 75 76 77 78 79]
all classes 0 -> 79
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/20_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/25_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/30_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True

```

```

total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_20_16x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(17, 2000)

```

```
##### current_task: 1 #####
```

```

[output] current classes [80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97
98 99]
all classes 0 -> 99
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/20_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/25_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/30_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/55_model.pkl

```

```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_20_16x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(17, 500)

```

##### current\_task: 2 #####

```

[output] current classes [100 101 102 103 104 105 106 107 108 109 110 111 112
113 114 115 116 117
118 119]
all classes 0 -> 119
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/20_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/25_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/30_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True

```

```

total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_20_16x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(17, 500)

##### current_task: 3 #####
[output] current classes [120 121 122 123 124 125 126 127 128 129 130 131 132
133 134 135 136 137
138 139]
all classes 0 -> 139

```

```

> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/20_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/25_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/30_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240

```

```

> loaded base phase model from:
../checkpoints/CIFAR100_20_16x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(17, 500)

##### current_task: 4 #####
[output] current classes [140 141 142 143 144 145 146 147 148 149 150 151 152
153 154 155 156 157
158 159]
all classes 0 -> 159
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/20_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/25_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/30_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/80_model.pkl

```

```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_20_16x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(17, 500)

```

##### current\_task: 5 #####

```

[output] current classes [160 161 162 163 164 165 166 167 168 169 170 171 172
173 174 175 176 177
178 179]
all classes 0 -> 179
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/20_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/25_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/30_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True

```

```

total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_20_16x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(17, 500)

```

```
##### current_task: 6 #####
```

```

[output] current classes [180 181 182 183 184 185 186 187 188 189 190 191 192
193 194 195 196 197
198 199]

```

```
all classes 0 -> 199
```

```

> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/20_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/25_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/30_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240

```



```

> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_20_16x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(17, 500)

```

```
##### current_task: 7 #####
```

```

[output] current classes [200 201 202 203 204 205 206 207 208 209 210 211 212
213 214 215 216 217
218 219]

```

```
all classes 0 -> 219
```

```

> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/20_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/25_model.pkl

```

```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/30_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_20_16x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240

```

(17, 500)

##### current\_task: 8 #####

[output] current classes [220 221 222 223 224 225 226 227 228 229 230 231 232  
233 234 235 236 237  
238 239]

all classes 0 -> 239

> loaded base phase model from: ../checkpoints/CIFAR100\_20\_16x5voro/20\_model.pkl  
module.classifier.weight torch.Size([80, 512]) 40960 True  
total: 40960

> loaded base phase model from: ../checkpoints/CIFAR100\_20\_16x5voro/25\_model.pkl  
module.classifier.weight torch.Size([20, 512]) 10240 True  
total: 10240

> loaded base phase model from: ../checkpoints/CIFAR100\_20\_16x5voro/30\_model.pkl  
module.classifier.weight torch.Size([20, 512]) 10240 True  
total: 10240

> loaded base phase model from: ../checkpoints/CIFAR100\_20\_16x5voro/35\_model.pkl  
module.classifier.weight torch.Size([20, 512]) 10240 True  
total: 10240

> loaded base phase model from: ../checkpoints/CIFAR100\_20\_16x5voro/40\_model.pkl  
module.classifier.weight torch.Size([20, 512]) 10240 True  
total: 10240

> loaded base phase model from: ../checkpoints/CIFAR100\_20\_16x5voro/45\_model.pkl  
module.classifier.weight torch.Size([20, 512]) 10240 True  
total: 10240

> loaded base phase model from: ../checkpoints/CIFAR100\_20\_16x5voro/50\_model.pkl  
module.classifier.weight torch.Size([20, 512]) 10240 True  
total: 10240

> loaded base phase model from: ../checkpoints/CIFAR100\_20\_16x5voro/55\_model.pkl  
module.classifier.weight torch.Size([20, 512]) 10240 True  
total: 10240

> loaded base phase model from: ../checkpoints/CIFAR100\_20\_16x5voro/60\_model.pkl  
module.classifier.weight torch.Size([20, 512]) 10240 True  
total: 10240

> loaded base phase model from: ../checkpoints/CIFAR100\_20\_16x5voro/65\_model.pkl  
module.classifier.weight torch.Size([20, 512]) 10240 True  
total: 10240

> loaded base phase model from: ../checkpoints/CIFAR100\_20\_16x5voro/70\_model.pkl  
module.classifier.weight torch.Size([20, 512]) 10240 True  
total: 10240

> loaded base phase model from: ../checkpoints/CIFAR100\_20\_16x5voro/75\_model.pkl  
module.classifier.weight torch.Size([20, 512]) 10240 True  
total: 10240

> loaded base phase model from: ../checkpoints/CIFAR100\_20\_16x5voro/80\_model.pkl  
module.classifier.weight torch.Size([20, 512]) 10240 True  
total: 10240

> loaded base phase model from: ../checkpoints/CIFAR100\_20\_16x5voro/85\_model.pkl  
module.classifier.weight torch.Size([20, 512]) 10240 True

```

total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_20_16x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(17, 500)

##### current_task: 9 #####
[output] current classes [240 241 242 243 244 245 246 247 248 249 250 251 252
253 254 255 256 257
258 259]
all classes 0 -> 259
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/20_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/25_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/30_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240

```

```

> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_20_16x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(17, 500)

```

```
##### current_task: 10 #####
```

```

[output] current classes [260 261 262 263 264 265 266 267 268 269 270 271 272
273 274 275 276 277
278 279]

```

```
all classes 0 -> 279
```

```

> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/20_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/25_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/30_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/50_model.pkl

```

```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_20_16x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(17, 500)

```

```
##### current_task: 11 #####
```

```

[output] current classes [280 281 282 283 284 285 286 287 288 289 290 291 292
293 294 295 296 297
298 299]

```

```
all classes 0 -> 299
```

```

> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/20_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/25_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/30_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True

```

```

total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_20_16x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(17, 500)

```

```
##### current_task: 12 #####
```

```
[output] current classes [300 301 302 303 304 305 306 307 308 309 310 311 312
```

```

313 314 315 316 317
318 319]
all classes 0 -> 319
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/20_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/25_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/30_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240

```



```

> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_20_16x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(17, 500)

##### current_task: 13 #####
[output] current classes [320 321 322 323 324 325 326 327 328 329 330 331 332
333 334 335 336 337
338 339]
all classes 0 -> 339
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/20_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/25_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/30_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/75_model.pkl

```

```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_20_16x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(17, 500)

```

##### current\_task: 14 #####

```

[output] current classes [340 341 342 343 344 345 346 347 348 349 350 351 352
353 354 355 356 357
358 359]
all classes 0 -> 359
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/20_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/25_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/30_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True

```

```

total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_20_16x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(17, 500)

```

```
##### current_task: 15 #####
```

```

[output] current classes [360 361 362 363 364 365 366 367 368 369 370 371 372
373 374 375 376 377
378 379]

```

```
all classes 0 -> 379
```

```

> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/20_model.pkl
module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/25_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/30_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240

```

```

> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_20_16x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(17, 500)

##### current_task: 16 #####
[output] current classes [380 381 382 383 384 385 386 387 388 389 390 391 392
393 394 395 396 397
398 399]
all classes 0 -> 399
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/20_model.pkl

```

```

module.classifier.weight      torch.Size([80, 512])    40960    True
total: 40960
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/25_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/30_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_20_16x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:

```

```

../checkpoints/CIFAR100_20_16x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(17, 500)

```

```

[173]: print('cliques by test samples:', pred_in_clique.shape)

# compute prototypes
be      = 0.8 # 1.
l2      = True # False True
bias    = 0 # 0.05
protots = np.mean(feats_trans(support_data_, beta=be, l2=l2, bias=bias), axis=1)
query_pts = feats_trans(query_data_, beta=be, l2=l2, bias=bias)
# acenss  = feats_trans(acens, beta=be, l2=l2, bias=bias)
if brother:
    dist      = funbtch(query_pts, protots) # protots / acenss
else:
    dist      = fun(query_pts, protots) # protots / acenss

test_splt = [sum(test_share[:t+1]) for t in range(len(test_share))]

```

cliques by test samples: (17, 10000)

```

[174]: dist_in_clique = np.zeros_like(pred_in_clique, dtype=np.float32)
for c_id, clique in enumerate(pred_in_clique):
    for s_id, samp in enumerate(clique):
        dist_in_clique[c_id][s_id] = dist[s_id][samp]

```

```

[190]: for i in range(task_num + 1):
        clique_dist = dist_in_clique[:i+1,:test_splt[i]]
        clique_pred = np.argmax(clique_dist, axis=0)
        merge_pred = [pred_in_clique[cli,s_id] for s_id, cli in
→enumerate(clique_pred)]
        merge_acc = np.mean(merge_pred == query_label_[:test_splt[i]])
        print(merge_acc)
print('DaC:', 'beta:', be, '| l2:', l2)

```

```

[28]: print('===== Experiment Done! =====')

```

===== Experiment Done! =====

## iVoro on CIFAR-100 Dataset (18 Phases)

```
[99]: import matplotlib.pyplot as plt
import os
import pickle
import numpy as np
import pandas as pd
import seaborn as sns
import time
import sys
sys.path.append('../')
sys.path.append('../analysis/')
import copy
import platform
import json
import pickle
import random

import torch
from scipy.stats import mode
```

```
[203]: from ResNet import resnet18_cbam

data_name      = 'CIFAR100' # 'Subset' # 'Tiny' # 'CIFAR100' # 'MNIST'
total_nc       = 100 # 200 # 100 # 10
fg_nc          = 10 # 100 # 40 # 50 # 4
task_num       = 18 # 20 # 5 # 10 # 2

# constant params
class_set      = list(range(total_nc))
ROTATION       = True
EMB2D         = False
DESIGN         = True
virtual_class  = 4*total_nc if ROTATION else total_nc
suffix         = 'voro' # 'prob' 'voro'
assert (total_nc - fg_nc)%task_num == 0
task_size      = int((total_nc - fg_nc)/task_num)
file_name      =
    ↳data_name+'_'+str(fg_nc)+'_'+str(task_num)+'x'+str(task_size)+suffix
```

```
print(file_name)

brother      = False # True False
```

CIFAR100\_10\_18x5voro

```
[204]: save_path = '../checkpoints/'
path    = save_path + file_name + '/'
filename = path + '%d_model.pkl' % (fg_nc+0) # +5
model    = torch.load(filename)
model.eval()
print('> loaded base phase model from:', filename)
```

> loaded base phase model from: ../checkpoints/CIFAR100\_10\_18x5voro/10\_model.pkl

```
[205]: from voro_helper import num_param, t2n, \
        load_feat, sanity_check, \
        id2emb_, num_samp, merge_sc, funbtch

num_param(model)

# voronoi centers:
vcenter = t2n(model.module.classifier.weight.data / 2.)
print(vcenter.shape)
```

```
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
(40, 512)
```

```
[206]: '''
CIFAR:
    'CIFAR100_50_5x10_test.pkl'
    'CIFAR100_50_5x10_train.pkl'
    'CIFAR100_40_20x3_test.pkl'
    'CIFAR100_40_20x3_train.pkl'
more CIFAR:
    'CIFAR100_40_12x5_test.pkl'
    'CIFAR100_40_12x5_train.pkl'
    'CIFAR100_30_14x5_test.pkl'
    'CIFAR100_30_14x5_train.pkl'
    'CIFAR100_20_16x5_test.pkl'
    'CIFAR100_20_16x5_train.pkl'
    'CIFAR100_10_18x5_test.pkl'
    'CIFAR100_10_18x5_train.pkl'
Tiny:
    'Tiny_100_20x5_test.pkl'
    'Tiny_100_20x5_train.pkl'
TinyL3:
    'Tiny_100_5x20_test.pkl'
```



```

    'Tiny_100_5x20_train.pkl'
Subset:
    'Subset_50_10x5_test.pkl'
    'Subset_50_10x5_train.pkl'
'''
ffile = '../embedding/prob/' + 'CIFAR100_10_18x5_test.pkl' # prob probL3
data_phas, last_tsk = load_feat(ffile)

labs, embeds, outputs = data_phas[last_tsk][last_tsk]
false_id, pred_ = sanity_check(labs, embeds, outputs)

```

```

feature file: ../embedding/prob/CIFAR100_10_18x5_test.pkl
> loaded tasks: dict_keys([18])
> classes: [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18,
19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38,
39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58,
59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78,
79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98,
99]
> samples: 10000
> embedding: 512
> classification: 400
~ acc (single): 41.44%
~ acc (quadruple): 30.72%

```

```

[207]: ffile = '../embedding/prob/' + 'CIFAR100_10_18x5_train.pkl' # prob probL3
data_phas, last_tsk = load_feat(ffile)

labst, embedst, outputst = data_phas[last_tsk][last_tsk]
false_id, pred_ = sanity_check(labst, embedst, outputst)

```

```

feature file: ../embedding/prob/CIFAR100_10_18x5_train.pkl
> loaded tasks: dict_keys([18])
> classes: [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18,
19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38,
39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58,
59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78,
79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98,
99]
> samples: 50000
> embedding: 512
> classification: 400
~ acc (single): 44.67%
~ acc (quadruple): 33.86%

```

```

[208]: embs = id2emb_(labs, embeds, brother=brother)
embst = id2emb_(labst, embedst, brother=brother)

```

```

sam_max, sam_min = num_samp(embst)
print('> loading data done!')

```

```

0 500,1 500,2 500,3 500,4 500,5 500,6 500,7 500,8 500,9 500,10 500,11 500,12
500,13 500,14 500,15 500,16 500,17 500,18 500,19 500,20 500,21 500,22 500,23
500,24 500,25 500,26 500,27 500,28 500,29 500,30 500,31 500,32 500,33 500,34
500,35 500,36 500,37 500,38 500,39 500,40 500,41 500,42 500,43 500,44 500,45
500,46 500,47 500,48 500,49 500,50 500,51 500,52 500,53 500,54 500,55 500,56
500,57 500,58 500,59 500,60 500,61 500,62 500,63 500,64 500,65 500,66 500,67
500,68 500,69 500,70 500,71 500,72 500,73 500,74 500,75 500,76 500,77 500,78
500,79 500,80 500,81 500,82 500,83 500,84 500,85 500,86 500,87 500,88 500,89
500,90 500,91 500,92 500,93 500,94 500,95 500,96 500,97 500,98 500,99 500,
max samples: 500
min samples: 500
> loading data done!

```

```

[209]: for k,v in embst.items():
        if v.shape[0] < sam_max:
            rid = np.random.choice(v.shape[0], sam_max-v.shape[0], replace=False)
            print('filling', sam_max-v.shape[0], 'samples')
            embst[k] = np.vstack((v, v[rid]))

```

```

[210]: from voro_helper import get_task_data, feat_trans, NC_o, tsk_cls, fun, \
        ↪acc_brother, forgetting

i = task_num
support_data_, support_label_, query_data_, query_label_, n_ways_, n_shot_, _ = \
    get_task_data(embst, embs, i, fg_nc, class_set, task_size, brother=brother)

```

```

##### current_task: 18 #####
current classes [95, 96, 97, 98, 99]
[output] all classes 0 -> 99

```

```

[211]: #%% =====
        ↪=====
be      = 1. # 1.
l2      = False # False True
protots = np.mean(feat_trans(support_data_, beta=be, l2=l2), axis=1)

```

```

[212]: i = 0
support_data, support_label, query_data, query_label, n_ways, n_shot, classes = \
    get_task_data(embst, embs, i, fg_nc, class_set, task_size, brother=brother)
acc, _, nn_pre = NC_o(support_data, support_label,
                      query_data, query_label,
                      n_ways, n_shot,
                      beta = be, l2 = l2,
                      given_cen = protots[classes], given_only = True,

```

```
brother = brother)
```

```
##### current_task: 0 #####  
current classes [0, 1, 2, 3, 4, 5, 6, 7, 8, 9]  
[output] all classes 0 -> 9  
0.9330
```

```
[213]: local      = False # True / False  
nn_acc   = []  
savefile = path+'NN' if brother else None # NN / NNp / NN3 / only saved NN  
→results!  
savefil2 = path+'NN3'  
forget    = True # True False # calculate forgetting  
class_ladder = []  
a         = []  
for i in range(task_num + 1):  
    support_data, support_label, query_data, query_label, n_ways, n_shot,   
→classes = \  
        get_task_data(embst, embs, i, fg_nc, class_set, task_size,  
                        local = local, brother = brother) # False  
    if forget:  
        class_ladder.append(classes)  
    acc, _, nn_pre = NC_o(support_data, support_label,  
                          query_data, query_label,  
                          n_ways, n_shot,  
                          beta = be, l2 = l2,  
                          given_cen = protots[classes] if local else protots[:  
→classes[-1]+1],  
                          given_only = True,  
                          brother = brother,  
                          savefile = savefile+'_'+str(i) if brother else None,  
                          savefile2 = None, # savefil2+'_'+str(i), # None, #  
                          weights = [0.7, 0.3],  
                          class_ladder = class_ladder,  
                          acc_all = a  
                          )  
    nn_acc.append(acc)  
    # if all classes up2now: local = False, and protots[:classes[-1]+1]  
print('local:', local, '| beta:', be, '| l2:', l2)  
if brother:  
    for accs in nn_acc:  
        print('\t'.join([str(i) for i in accs]))  
else:  
    print('\n'.join([str(i) for i in nn_acc]))  
if forget:  
    avgf = forgetting(a, task_num)
```

```
print(avgf)
```

```
##### current_task: 0 #####  
current classes [0, 1, 2, 3, 4, 5, 6, 7, 8, 9]  
[output] all classes 0 -> 9  
0.9330
```

```
##### current_task: 1 #####  
current classes [10, 11, 12, 13, 14]  
[output] all classes 0 -> 14  
0.7520
```

```
##### current_task: 2 #####  
current classes [15, 16, 17, 18, 19]  
[output] all classes 0 -> 19  
0.6245
```

```
##### current_task: 3 #####  
current classes [20, 21, 22, 23, 24]  
[output] all classes 0 -> 24  
0.5716
```

```
##### current_task: 4 #####  
current classes [25, 26, 27, 28, 29]  
[output] all classes 0 -> 29  
0.5043
```

```
##### current_task: 5 #####  
current classes [30, 31, 32, 33, 34]  
[output] all classes 0 -> 34  
0.4551
```

```
##### current_task: 6 #####  
current classes [35, 36, 37, 38, 39]  
[output] all classes 0 -> 39  
0.4133
```

```
##### current_task: 7 #####  
current classes [40, 41, 42, 43, 44]  
[output] all classes 0 -> 44  
0.3900
```

```
##### current_task: 8 #####  
current classes [45, 46, 47, 48, 49]  
[output] all classes 0 -> 49  
0.3676
```

```
##### current_task: 9 #####  
current classes [50, 51, 52, 53, 54]  
[output] all classes 0 -> 54  
0.3585
```

```
##### current_task: 10 #####  
current classes [55, 56, 57, 58, 59]  
[output] all classes 0 -> 59  
0.3362
```

```
##### current_task: 11 #####  
current classes [60, 61, 62, 63, 64]  
[output] all classes 0 -> 64  
0.3252
```

```
##### current_task: 12 #####  
current classes [65, 66, 67, 68, 69]  
[output] all classes 0 -> 69  
0.3123
```

```
##### current_task: 13 #####  
current classes [70, 71, 72, 73, 74]  
[output] all classes 0 -> 74  
0.2973
```

```
##### current_task: 14 #####  
current classes [75, 76, 77, 78, 79]  
[output] all classes 0 -> 79  
0.2853
```

```
##### current_task: 15 #####  
current classes [80, 81, 82, 83, 84]  
[output] all classes 0 -> 84  
0.2764
```

```
##### current_task: 16 #####  
current classes [85, 86, 87, 88, 89]  
[output] all classes 0 -> 89  
0.2689
```

```
##### current_task: 17 #####  
current classes [90, 91, 92, 93, 94]  
[output] all classes 0 -> 94  
0.2633
```

```
##### current_task: 18 #####  
current classes [95, 96, 97, 98, 99]  
[output] all classes 0 -> 99
```

```

0.2511
local: False | beta: 1.0 | l2: False
0.933
0.752
0.6245
0.5716
0.5043333333333333
0.4551428571428571
0.41325
0.39
0.3676
0.35854545454545456
0.33616666666666667
0.3252307692307692
0.3122857142857143
0.29733333333333334
0.28525
0.2763529411764706
0.2688888888888889
0.26326315789473687
0.2511
[[0.933 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0.
  0. 0. 0. 0. 0. 0. 0. ]
[0.821 0.614 0. 0. 0. 0. 0. 0. 0. 0. 0. 0.
  0. 0. 0. 0. 0. 0. 0. ]
[0.794 0.498 0.412 0. 0. 0. 0. 0. 0. 0. 0. 0.
  0. 0. 0. 0. 0. 0. 0. ]
[0.757 0.43 0.35 0.564 0. 0. 0. 0. 0. 0. 0. 0.
  0. 0. 0. 0. 0. 0. 0. ]
[0.74 0.368 0.294 0.516 0.368 0. 0. 0. 0. 0. 0. 0.
  0. 0. 0. 0. 0. 0. 0. ]
[0.735 0.358 0.248 0.484 0.348 0.278 0. 0. 0. 0. 0. 0.
  0. 0. 0. 0. 0. 0. 0. ]
[0.734 0.31 0.226 0.474 0.332 0.242 0.254 0. 0. 0. 0. 0.
  0. 0. 0. 0. 0. 0. 0. ]
[0.731 0.3 0.21 0.458 0.312 0.228 0.238 0.302 0. 0. 0. 0.
  0. 0. 0. 0. 0. 0. 0. ]
[0.715 0.276 0.204 0.452 0.28 0.212 0.23 0.292 0.3 0. 0. 0.
  0. 0. 0. 0. 0. 0. 0. ]
[0.699 0.24 0.202 0.448 0.28 0.204 0.226 0.282 0.274 0.39 0. 0.
  0. 0. 0. 0. 0. 0. 0. ]
[0.696 0.194 0.194 0.442 0.278 0.202 0.226 0.266 0.264 0.378 0.198 0.
  0. 0. 0. 0. 0. 0. 0. ]
[0.693 0.182 0.194 0.398 0.272 0.188 0.216 0.258 0.262 0.354 0.194 0.324
  0. 0. 0. 0. 0. 0. 0. ]
[0.693 0.18 0.19 0.39 0.27 0.18 0.212 0.248 0.262 0.354 0.184 0.314
  0.202 0. 0. 0. 0. 0. 0. ]
[0.691 0.174 0.19 0.384 0.266 0.17 0.212 0.246 0.262 0.348 0.182 0.248

```

```

0.192 0.204 0.    0.    0.    0.    0.    ]
[0.69  0.166 0.184 0.378 0.258 0.164 0.208 0.226 0.262 0.332 0.18  0.242
0.164 0.204 0.216 0.    0.    0.    0.    ]
[0.688 0.146 0.18  0.374 0.246 0.164 0.204 0.222 0.252 0.314 0.168 0.23
0.162 0.192 0.216 0.252 0.    0.    0.    ]
[0.688 0.138 0.17  0.368 0.234 0.162 0.198 0.2   0.248 0.314 0.158 0.228
0.156 0.192 0.21  0.232 0.256 0.    0.    ]
[0.687 0.13  0.166 0.352 0.232 0.16  0.196 0.2   0.248 0.304 0.154 0.218
0.154 0.172 0.208 0.224 0.208 0.302 0.    ]
[0.687 0.128 0.162 0.348 0.232 0.134 0.174 0.198 0.24  0.298 0.154 0.212
0.136 0.172 0.204 0.224 0.204 0.302 0.126]]
[0, 11.200000000000001, 12.75, 14.066666666666668, 15.125, 14.360000000000001,
14.183333333333334, 13.514285714285714, 13.299999999999997, 13.0, 12.75,
12.745454545454545, 12.166666666666667, 12.107692307692309, 12.035714285714286,
12.006666666666667, 11.968750000000000, 12.082352941176472, 12.000000000000002]

```

```

[214]: def predict(model, x, voro=True):
        x = torch.from_numpy(x.astype(np.float32)).cuda()
        with torch.no_grad():
            predi = model.module.classifier(x)
        if voro:
            predi += - torch.sum((model.module.classifier.weight/2.)**2, dim=1)
        return predi

classes_all = []
test_share = []
paccS = []
for i in range(task_num + 1):
    support_data, support_label, query_data, query_label, n_ways, n_shot, \
    → classes = \
        get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                        local = True, brother = brother)

    # load model:
    if brother:
        cls_01 = classes[-1]+1
        assert cls_01 % 4 == 0
        filename = path + '%d_model.pkl' % (int(cls_01/4))
    else:
        filename = path + '%d_model.pkl' % (classes[-1]+1)
    model = torch.load(filename)
    model.eval()
    print('> loaded base phase model from:', filename)
    num_param(model)
    # do prediction:
    min_cls = min(classes)
    if brother:
        pred = predict(model, query_data)

```

```

else:
    pred = predict(model, query_data)[:,:,:4]
    pmax = torch.max(pred, dim=1)[1]
    pacc = np.mean(t2n(pmax) == query_label - min_cls)
    print(pacc)
    if brother:
        accs = acc_brother(t2n(pred), t2n(pmax), query_label - min_cls,
→forLG=True)
        pacc = [pacc] + accs
        paccS.append(pacc)
        classes_all.append(classes)
        test_share.append(len(query_label))
print('all logistic locally:')
if brother:
    for accs in paccS:
        print('\t'.join([str(i) for i in accs]))
else:
    print('\n'.join([str(i) for i in paccS]))

```

##### current\_task: 0 #####

[output] current classes [0, 1, 2, 3, 4, 5, 6, 7, 8, 9]

all classes 0 -> 9

> loaded base phase model from: ../checkpoints/CIFAR100\_10\_18x5voro/10\_model.pkl

module.classifier.weight          torch.Size([40, 512])    20480    True

total: 20480

0.929

##### current\_task: 1 #####

[output] current classes [10, 11, 12, 13, 14]

all classes 0 -> 14

> loaded base phase model from: ../checkpoints/CIFAR100\_10\_18x5voro/15\_model.pkl

module.classifier.weight          torch.Size([20, 512])    10240    True

total: 10240

0.828

##### current\_task: 2 #####

[output] current classes [15, 16, 17, 18, 19]

all classes 0 -> 19

> loaded base phase model from: ../checkpoints/CIFAR100\_10\_18x5voro/20\_model.pkl

module.classifier.weight          torch.Size([20, 512])    10240    True

total: 10240

0.832

##### current\_task: 3 #####

[output] current classes [20, 21, 22, 23, 24]

all classes 0 -> 24

> loaded base phase model from: ../checkpoints/CIFAR100\_10\_18x5voro/25\_model.pkl



```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.914

##### current_task: 4 #####
[output] current classes [25, 26, 27, 28, 29]
all classes 0 -> 29
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/30_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.784

##### current_task: 5 #####
[output] current classes [30, 31, 32, 33, 34]
all classes 0 -> 34
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.794

##### current_task: 6 #####
[output] current classes [35, 36, 37, 38, 39]
all classes 0 -> 39
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.832

##### current_task: 7 #####
[output] current classes [40, 41, 42, 43, 44]
all classes 0 -> 44
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.76

##### current_task: 8 #####
[output] current classes [45, 46, 47, 48, 49]
all classes 0 -> 49
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.89

##### current_task: 9 #####
[output] current classes [50, 51, 52, 53, 54]
all classes 0 -> 54
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/55_model.pkl

```

```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.86

##### current_task: 10 #####
[output] current classes [55, 56, 57, 58, 59]
all classes 0 -> 59
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.804

##### current_task: 11 #####
[output] current classes [60, 61, 62, 63, 64]
all classes 0 -> 64
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.84

##### current_task: 12 #####
[output] current classes [65, 66, 67, 68, 69]
all classes 0 -> 69
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.806

##### current_task: 13 #####
[output] current classes [70, 71, 72, 73, 74]
all classes 0 -> 74
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.828

##### current_task: 14 #####
[output] current classes [75, 76, 77, 78, 79]
all classes 0 -> 79
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.812

##### current_task: 15 #####
[output] current classes [80, 81, 82, 83, 84]
all classes 0 -> 84
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/85_model.pkl

```

```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.87

##### current_task: 16 #####
[output] current classes [85, 86, 87, 88, 89]
all classes 0 -> 89
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.794

##### current_task: 17 #####
[output] current classes [90, 91, 92, 93, 94]
all classes 0 -> 94
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.87

##### current_task: 18 #####
[output] current classes [95, 96, 97, 98, 99]
all classes 0 -> 99
> loaded base phase model from:
../checkpoints/CIFAR100_10_18x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.838
all logistic locally:
0.929
0.828
0.832
0.914
0.784
0.794
0.832
0.76
0.89
0.86
0.804
0.84
0.806
0.828
0.812
0.87
0.794
0.87
0.838

```

```

[215]: for i in range(task_num + 1):
        support_data, support_label, query_data, query_label, n_ways, n_shot, \
        classes = \
            get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                           local = True, brother = brother)

        pred_all = []
        for classes in classes_all:
            # load model:
            if brother:
                cls_01 = classes[-1]+1
                assert cls_01 % 4 == 0
                filename = path + '%d_model.pkl' % (int(cls_01/4))
            else:
                filename = path + '%d_model.pkl' % (classes[-1]+1)
            model = torch.load(filename)
            model.eval()
            print('> loaded base phase model from:', filename)
            num_param(model)
            # do prediction:
            min_cls = min(classes)
            if brother:
                pred = predict(model, query_data)
            else:
                pred = predict(model, query_data)[:,:,:4]
            pmax = torch.max(pred, dim=1)[1]
            # pacc = np.mean(t2n(pmax) == query_label - min_cls)
            # print(pacc)
            if brother:
                labs_01 = query_label[:4]//4
                acc_, sc_pre = merge_sc(t2n(pred), labs_01,
                                         mth='softmax', forLG=True, return_pre=True)
                min_cls = int(min_cls / 4)
                pred_all.append( (sc_pre + min_cls).tolist() )
            else:
                pred_all.append( (t2n(pmax) + min_cls).tolist() )
        pred_all = np.array(pred_all)
        print(pred_all.shape)

        if i == 0:
            pred_in_clique = copy.deepcopy(pred_all)
        else:
            pred_in_clique = np.hstack((pred_in_clique, pred_all))

```

##### current\_task: 0 #####

[output] current classes [0, 1, 2, 3, 4, 5, 6, 7, 8, 9]

all classes 0 -> 9

> loaded base phase model from: ../checkpoints/CIFAR100\_10\_18x5voro/10\_model.pkl

```

module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/15_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/20_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/25_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/30_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/90_model.pkl

```

```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_10_18x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(19, 1000)

##### current_task: 1 #####
[output] current classes [10, 11, 12, 13, 14]
all classes 0 -> 14
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/10_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/15_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/20_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/25_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/30_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/65_model.pkl

```

```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_10_18x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(19, 500)

##### current_task: 2 #####
[output] current classes [15, 16, 17, 18, 19]
all classes 0 -> 19
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/10_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/15_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/20_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/25_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/30_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/40_model.pkl

```

```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_10_18x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(19, 500)

##### current_task: 3 #####
[output] current classes [20, 21, 22, 23, 24]
all classes 0 -> 24
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/10_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/15_model.pkl

```



[illegible]

```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_10_18x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(19, 500)

##### current_task: 4 #####
[output] current classes [25, 26, 27, 28, 29]
all classes 0 -> 29
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/10_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/15_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/20_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/25_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/30_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/70_model.pkl

```

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module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_10_18x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(19, 500)

```

##### current\_task: 5 #####

[output] current classes [30, 31, 32, 33, 34]

all classes 0 -> 34

```

> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/10_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/15_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/20_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/25_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/30_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/45_model.pkl

```

```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_10_18x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(19, 500)

##### current_task: 6 #####
[output] current classes [35, 36, 37, 38, 39]
all classes 0 -> 39
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/10_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/15_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/20_model.pkl

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```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/25_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/30_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:

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```

../checkpoints/CIFAR100_10_18x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(19, 500)

##### current_task: 7 #####
[output] current classes [40, 41, 42, 43, 44]
all classes 0 -> 44
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/10_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/15_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/20_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/25_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/30_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/75_model.pkl

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```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_10_18x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(19, 500)

##### current_task: 8 #####
[output] current classes [45, 46, 47, 48, 49]
all classes 0 -> 49
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/10_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/15_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/20_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/25_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/30_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/50_model.pkl

```

```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_10_18x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(19, 500)

```

```
##### current_task: 9 #####
```

```
[output] current classes [50, 51, 52, 53, 54]
```

```
all classes 0 -> 54
```

```

> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/10_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/15_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/20_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/25_model.pkl

```



```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/30_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_10_18x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240

```

(19, 500)

```
##### current_task: 10 #####
[output] current classes [55, 56, 57, 58, 59]
all classes 0 -> 59
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/10_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/15_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/20_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/25_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/30_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/80_model.pkl
```

```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_10_18x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(19, 500)

##### current_task: 11 #####
[output] current classes [60, 61, 62, 63, 64]
all classes 0 -> 64
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/10_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/15_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/20_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/25_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/30_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/55_model.pkl

```

```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_10_18x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(19, 500)

```

```
##### current_task: 12 #####
```

```
[output] current classes [65, 66, 67, 68, 69]
```

```
all classes 0 -> 69
```

```

> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/10_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/15_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/20_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/25_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/30_model.pkl

```

```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_10_18x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(19, 500)

```

```
##### current_task: 13 #####
```

```

[output] current classes [70, 71, 72, 73, 74]
all classes 0 -> 74
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/10_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/15_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/20_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/25_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/30_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/85_model.pkl

```

```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_10_18x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(19, 500)

##### current_task: 14 #####
[output] current classes [75, 76, 77, 78, 79]
all classes 0 -> 79
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/10_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/15_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/20_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/25_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/30_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/60_model.pkl

```

```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_10_18x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(19, 500)

##### current_task: 15 #####
[output] current classes [80, 81, 82, 83, 84]
all classes 0 -> 84
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/10_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/15_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/20_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/25_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/30_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/35_model.pkl

```



```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_10_18x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(19, 500)

##### current_task: 16 #####
[output] current classes [85, 86, 87, 88, 89]
all classes 0 -> 89
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/10_model.pkl

```

```

module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/15_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/20_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/25_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/30_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/90_model.pkl

```

```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_10_18x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(19, 500)

##### current_task: 17 #####
[output] current classes [90, 91, 92, 93, 94]
all classes 0 -> 94
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/10_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/15_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/20_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/25_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/30_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/65_model.pkl

```

```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_10_18x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(19, 500)

```

##### current\_task: 18 #####

[output] current classes [95, 96, 97, 98, 99]

all classes 0 -> 99

```

> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/10_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/15_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/20_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/25_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/30_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/40_model.pkl

```

```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_10_18x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(19, 500)

```

```
[219]: print('cliques by test samples:', pred_in_clique.shape)
```

```

# compute prototypes
be      = 0.4 # 1.
l2      = True # False True
bias    = 0 # 0.05

```

```

protots    = np.mean(feats_trans(support_data_, beta=be, l2=l2, bias=bias), axis=1)
query_pts  = feat_trans(query_data_, beta=be, l2=l2, bias=bias)
# acenss    = feat_trans(acens, beta=be, l2=l2, bias=bias)
if brother:
    dist     = funbtch(query_pts, protots) # protots / acenss
else:
    dist     = fun(query_pts, protots) # protots / acenss

test_splt = [sum(test_share[:t+1]) for t in range(len(test_share))]

```

cliques by test samples: (19, 10000)

```

[220]: dist_in_clique = np.zeros_like(pred_in_clique, dtype=np.float32)
for c_id, clique in enumerate(pred_in_clique):
    for s_id, samp in enumerate(clique):
        dist_in_clique[c_id][s_id] = dist[s_id][samp]

```

```

[221]: for i in range(task_num + 1):
        clique_dist = dist_in_clique[:i+1,:test_splt[i]]
        clique_pred = np.argmax(clique_dist, axis=0)
        merge_pred = [pred_in_clique[cli,s_id] for s_id, cli in
            →enumerate(clique_pred)]
        merge_acc    = np.mean(merge_pred == query_label_[:test_splt[i]])
        print(merge_acc)
print('DaC:', 'beta:', be, '| l2:', l2)

```

```

0.929
0.7666666666666667
0.6505
0.5964
0.5296666666666666
0.4868571428571429
0.44525
0.4195555555555557
0.3984
0.3890909090909091
0.3645
0.3507692307692308
0.334
0.3184
0.305375
0.29505882352941176
0.2893333333333333
0.2825263157894737
0.2685
DaC: beta: 0.4 | l2: True

```

```

[28]: print('===== Experiment Done! =====')

```

===== Experiment Done! =====

## iVoro-AC/AI on CIFAR-100 Dataset (18 Phases)

```
[99]: import matplotlib.pyplot as plt
import os
import pickle
import numpy as np
import pandas as pd
import seaborn as sns
import time
import sys
sys.path.append('../')
sys.path.append('../analysis/')
import copy
import platform
import json
import pickle
import random

import torch
from scipy.stats import mode
```

```
[191]: from ResNet import resnet18_cbam

data_name      = 'CIFAR100' # 'Subset' # 'Tiny' # 'CIFAR100' # 'MNIST'
total_nc       = 100 # 200 # 100 # 10
fg_nc          = 10 # 100 # 40 # 50 # 4
task_num       = 18 # 20 # 5 # 10 # 2

# constant params
class_set      = list(range(total_nc))
ROTATION       = True
EMB2D          = False
DESIGN         = True
virtual_class  = 4*total_nc if ROTATION else total_nc
suffix         = 'voro' # 'prob' 'voro'
assert (total_nc - fg_nc)%task_num == 0
task_size      = int((total_nc - fg_nc)/task_num)
file_name      =
    ↳data_name+'_'+str(fg_nc)+'_'+str(task_num)+'x'+str(task_size)+suffix
```



```
print(file_name)

brother      = True # True False
```

CIFAR100\_10\_18x5voro

```
[192]: save_path = '../checkpoints/'
path    = save_path + file_name + '/'
filename = path + '%d_model.pkl' % (fg_nc+0) # +5
model   = torch.load(filename)
model.eval()
print('> loaded base phase model from:', filename)
```

> loaded base phase model from: ../checkpoints/CIFAR100\_10\_18x5voro/10\_model.pkl

```
[193]: from voro_helper import num_param, t2n, \
        load_feat, sanity_check, \
        id2emb_, num_samp, merge_sc, funbtch

num_param(model)

# voronoi centers:
vcenter = t2n(model.module.classifier.weight.data / 2.)
print(vcenter.shape)
```

```
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
(40, 512)
```

```
[194]: '''
CIFAR:
    'CIFAR100_50_5x10_test.pkl'
    'CIFAR100_50_5x10_train.pkl'
    'CIFAR100_40_20x3_test.pkl'
    'CIFAR100_40_20x3_train.pkl'
more CIFAR:
    'CIFAR100_40_12x5_test.pkl'
    'CIFAR100_40_12x5_train.pkl'
    'CIFAR100_30_14x5_test.pkl'
    'CIFAR100_30_14x5_train.pkl'
    'CIFAR100_20_16x5_test.pkl'
    'CIFAR100_20_16x5_train.pkl'
    'CIFAR100_10_18x5_test.pkl'
    'CIFAR100_10_18x5_train.pkl'
Tiny:
    'Tiny_100_20x5_test.pkl'
    'Tiny_100_20x5_train.pkl'
TinyL3:
    'Tiny_100_5x20_test.pkl'
```

```

    'Tiny_100_5x20_train.pkl'
Subset:
    'Subset_50_10x5_test.pkl'
    'Subset_50_10x5_train.pkl'
'''
ffile = '../embedding/prob/' + 'CIFAR100_10_18x5_test.pkl' # prob probL3
data_phas, last_tsk = load_feat(ffile)

labs, embeds, outputs = data_phas[last_tsk][last_tsk]
false_id, pred_ = sanity_check(labs, embeds, outputs)

```

```

feature file: ../embedding/prob/CIFAR100_10_18x5_test.pkl
> loaded tasks: dict_keys([18])
> classes: [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18,
19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38,
39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58,
59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78,
79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98,
99]
> samples: 10000
> embedding: 512
> classification: 400
~ acc (single): 41.44%
~ acc (quadruple): 30.72%

```

```

[195]: ffile = '../embedding/prob/' + 'CIFAR100_10_18x5_train.pkl' # prob probL3
data_phas, last_tsk = load_feat(ffile)

labst, embedst, outputst = data_phas[last_tsk][last_tsk]
false_id, pred_ = sanity_check(labst, embedst, outputst)

```

```

feature file: ../embedding/prob/CIFAR100_10_18x5_train.pkl
> loaded tasks: dict_keys([18])
> classes: [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18,
19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38,
39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58,
59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78,
79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98,
99]
> samples: 50000
> embedding: 512
> classification: 400
~ acc (single): 44.67%
~ acc (quadruple): 33.86%

```

```

[196]: embs = id2emb_(labs, embeds, brother=brother)
embst = id2emb_(labst, embedst, brother=brother)

```

```
sam_max, sam_min = num_samp(embst)
print('> loading data done!')
```

```
0 500,1 500,2 500,3 500,4 500,5 500,6 500,7 500,8 500,9 500,10 500,11 500,12
500,13 500,14 500,15 500,16 500,17 500,18 500,19 500,20 500,21 500,22 500,23
500,24 500,25 500,26 500,27 500,28 500,29 500,30 500,31 500,32 500,33 500,34
500,35 500,36 500,37 500,38 500,39 500,40 500,41 500,42 500,43 500,44 500,45
500,46 500,47 500,48 500,49 500,50 500,51 500,52 500,53 500,54 500,55 500,56
500,57 500,58 500,59 500,60 500,61 500,62 500,63 500,64 500,65 500,66 500,67
500,68 500,69 500,70 500,71 500,72 500,73 500,74 500,75 500,76 500,77 500,78
500,79 500,80 500,81 500,82 500,83 500,84 500,85 500,86 500,87 500,88 500,89
500,90 500,91 500,92 500,93 500,94 500,95 500,96 500,97 500,98 500,99 500,100
500,101 500,102 500,103 500,104 500,105 500,106 500,107 500,108 500,109 500,110
500,111 500,112 500,113 500,114 500,115 500,116 500,117 500,118 500,119 500,120
500,121 500,122 500,123 500,124 500,125 500,126 500,127 500,128 500,129 500,130
500,131 500,132 500,133 500,134 500,135 500,136 500,137 500,138 500,139 500,140
500,141 500,142 500,143 500,144 500,145 500,146 500,147 500,148 500,149 500,150
500,151 500,152 500,153 500,154 500,155 500,156 500,157 500,158 500,159 500,160
500,161 500,162 500,163 500,164 500,165 500,166 500,167 500,168 500,169 500,170
500,171 500,172 500,173 500,174 500,175 500,176 500,177 500,178 500,179 500,180
500,181 500,182 500,183 500,184 500,185 500,186 500,187 500,188 500,189 500,190
500,191 500,192 500,193 500,194 500,195 500,196 500,197 500,198 500,199 500,200
500,201 500,202 500,203 500,204 500,205 500,206 500,207 500,208 500,209 500,210
500,211 500,212 500,213 500,214 500,215 500,216 500,217 500,218 500,219 500,220
500,221 500,222 500,223 500,224 500,225 500,226 500,227 500,228 500,229 500,230
500,231 500,232 500,233 500,234 500,235 500,236 500,237 500,238 500,239 500,240
500,241 500,242 500,243 500,244 500,245 500,246 500,247 500,248 500,249 500,250
500,251 500,252 500,253 500,254 500,255 500,256 500,257 500,258 500,259 500,260
500,261 500,262 500,263 500,264 500,265 500,266 500,267 500,268 500,269 500,270
500,271 500,272 500,273 500,274 500,275 500,276 500,277 500,278 500,279 500,280
500,281 500,282 500,283 500,284 500,285 500,286 500,287 500,288 500,289 500,290
500,291 500,292 500,293 500,294 500,295 500,296 500,297 500,298 500,299 500,300
500,301 500,302 500,303 500,304 500,305 500,306 500,307 500,308 500,309 500,310
500,311 500,312 500,313 500,314 500,315 500,316 500,317 500,318 500,319 500,320
500,321 500,322 500,323 500,324 500,325 500,326 500,327 500,328 500,329 500,330
500,331 500,332 500,333 500,334 500,335 500,336 500,337 500,338 500,339 500,340
500,341 500,342 500,343 500,344 500,345 500,346 500,347 500,348 500,349 500,350
500,351 500,352 500,353 500,354 500,355 500,356 500,357 500,358 500,359 500,360
500,361 500,362 500,363 500,364 500,365 500,366 500,367 500,368 500,369 500,370
500,371 500,372 500,373 500,374 500,375 500,376 500,377 500,378 500,379 500,380
500,381 500,382 500,383 500,384 500,385 500,386 500,387 500,388 500,389 500,390
500,391 500,392 500,393 500,394 500,395 500,396 500,397 500,398 500,399 500,
max samples: 500
min samples: 500
> loading data done!
```

```
[197]: for k,v in embst.items():
        if v.shape[0] < sam_max:
            rid = np.random.choice(v.shape[0], sam_max-v.shape[0], replace=False)
            print('filling', sam_max-v.shape[0], 'samples')
            embst[k] = np.vstack((v, v[rid]))
```

```
[198]: from voro_helper import get_task_data, feat_trans, NC_o, tsk_cls, fun,
        ↪acc_brother, forgetting

i = task_num
support_data_, support_label_, query_data_, query_label_, n_ways_, n_shot_, _ = \
    get_task_data(embst, embs, i, fg_nc, class_set, task_size, brother=brother)
```

```
##### current_task: 18 #####
current classes [380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395
396 397
398 399]
[output] all classes 0 -> 399
```

```
[199]: #%% =====
        ↪=====

be         = 1. # 1.
l2         = False # False True
protots    = np.mean(feat_trans(support_data_, beta=be, l2=l2), axis=1)
```

```
[186]: i = 0
support_data, support_label, query_data, query_label, n_ways, n_shot, classes = \
    get_task_data(embst, embs, i, fg_nc, class_set, task_size, brother=brother)
acc, _, nn_pre = NC_o(support_data, support_label,
                      query_data, query_label,
                      n_ways, n_shot,
                      beta = be, l2 = l2,
                      given_cen = protots[classes], given_only = True,
                      brother = brother)
```

```
[200]: local      = False # True / False
nn_acc      = []
savefile = path+'NN' if brother else None # NN / NNp / NN3 / only saved NN
        ↪results!
savefil2 = path+'NN3'
forget      = True # True False # calculate forgetting
class_ladder = []
a           = []
for i in range(task_num + 1):
    support_data, support_label, query_data, query_label, n_ways, n_shot,
        ↪classes = \
```

```

        get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                      local = local, brother = brother) # False
    if forget:
        class_ladder.append(classes)
    acc, _, nn_pre = NC_o(support_data, support_label,
                        query_data, query_label,
                        n_ways, n_shot,
                        beta = be, l2 = l2,
                        given_cen = protots[classes] if local else protots[:
→classes[-1]+1],

                        given_only = True,
                        brother = brother,
                        savefile = savefile+'_'+str(i) if brother else None,
                        savefile2 = None, # savefile2+'_'+str(i), # None, #
                        weights = [0.7, 0.3],
                        class_ladder = class_ladder,
                        acc_all = a
                        )

    nn_acc.append(acc)
    # if all classes up2now: local = False, and protots[:classes[-1]+1]
print('local:', local, '| beta:', be, '| l2:', l2)
if brother:
    for accs in nn_acc:
        print('\t'.join([str(i) for i in accs]))
else:
    print('\n'.join([str(i) for i in nn_acc]))
if forget:
    avgf = forgetting(a, task_num)
    print(avgf)

```

```

##### current_task: 0 #####
current classes [ 0  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20
21 22 23
 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39]
[output] all classes 0 -> 39
<<< loaded from: ../checkpoints/CIFAR100_10_18x5voro/NN_0.npy
0.8067

```

```

##### current_task: 1 #####
current classes [40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59]
[output] all classes 0 -> 59
<<< loaded from: ../checkpoints/CIFAR100_10_18x5voro/NN_1.npy
0.6125

```

```

##### current_task: 2 #####
current classes [60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79]
[output] all classes 0 -> 79

```

```

<<< loaded from: ../checkpoints/CIFAR100_10_18x5voro/NN_2.npy
0.5012

##### current_task: 3 #####
current classes [80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99]
[output] all classes 0 -> 99
<<< loaded from: ../checkpoints/CIFAR100_10_18x5voro/NN_3.npy
0.4344

##### current_task: 4 #####
current classes [100 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115
116 117
118 119]
[output] all classes 0 -> 119
<<< loaded from: ../checkpoints/CIFAR100_10_18x5voro/NN_4.npy
0.3822

##### current_task: 5 #####
current classes [120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135
136 137
138 139]
[output] all classes 0 -> 139
<<< loaded from: ../checkpoints/CIFAR100_10_18x5voro/NN_5.npy
0.3451

##### current_task: 6 #####
current classes [140 141 142 143 144 145 146 147 148 149 150 151 152 153 154 155
156 157
158 159]
[output] all classes 0 -> 159
<<< loaded from: ../checkpoints/CIFAR100_10_18x5voro/NN_6.npy
0.3144

##### current_task: 7 #####
current classes [160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175
176 177
178 179]
[output] all classes 0 -> 179
<<< loaded from: ../checkpoints/CIFAR100_10_18x5voro/NN_7.npy
0.2897

##### current_task: 8 #####
current classes [180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195
196 197
198 199]
[output] all classes 0 -> 199
<<< loaded from: ../checkpoints/CIFAR100_10_18x5voro/NN_8.npy
0.2771

```

```
##### current_task: 9 #####
current classes [200 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215
216 217
218 219]
[output] all classes 0 -> 219
<<< loaded from: ../checkpoints/CIFAR100_10_18x5voro/NN_9.npy
0.2676
```

```
##### current_task: 10 #####
current classes [220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235
236 237
238 239]
[output] all classes 0 -> 239
<<< loaded from: ../checkpoints/CIFAR100_10_18x5voro/NN_10.npy
0.2517
```

```
##### current_task: 11 #####
current classes [240 241 242 243 244 245 246 247 248 249 250 251 252 253 254 255
256 257
258 259]
[output] all classes 0 -> 259
<<< loaded from: ../checkpoints/CIFAR100_10_18x5voro/NN_11.npy
0.2416
```

```
##### current_task: 12 #####
current classes [260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275
276 277
278 279]
[output] all classes 0 -> 279
<<< loaded from: ../checkpoints/CIFAR100_10_18x5voro/NN_12.npy
0.2315
```

```
##### current_task: 13 #####
current classes [280 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295
296 297
298 299]
[output] all classes 0 -> 299
<<< loaded from: ../checkpoints/CIFAR100_10_18x5voro/NN_13.npy
0.2191
```

```
##### current_task: 14 #####
current classes [300 301 302 303 304 305 306 307 308 309 310 311 312 313 314 315
316 317
318 319]
[output] all classes 0 -> 319
<<< loaded from: ../checkpoints/CIFAR100_10_18x5voro/NN_14.npy
0.2099
```

```
##### current_task: 15 #####
current classes [320 321 322 323 324 325 326 327 328 329 330 331 332 333 334 335
336 337
338 339]
[output] all classes 0 -> 339
<<< loaded from: ../checkpoints/CIFAR100_10_18x5voro/NN_15.npy
0.2022
```

```
##### current_task: 16 #####
current classes [340 341 342 343 344 345 346 347 348 349 350 351 352 353 354 355
356 357
358 359]
[output] all classes 0 -> 359
<<< loaded from: ../checkpoints/CIFAR100_10_18x5voro/NN_16.npy
0.1972
```

```
##### current_task: 17 #####
current classes [360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375
376 377
378 379]
[output] all classes 0 -> 379
<<< loaded from: ../checkpoints/CIFAR100_10_18x5voro/NN_17.npy
0.1931
```

```
##### current_task: 18 #####
current classes [380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395
396 397
398 399]
[output] all classes 0 -> 399
<<< loaded from: ../checkpoints/CIFAR100_10_18x5voro/NN_18.npy
0.1850
```

```
local: False | beta: 1.0 | l2: False
0.80675 0.994 0.992 0.991 0.984
0.6125 0.8973333333333333 0.49066666666666664 0.47866666666666667
0.30933333333333335
0.50125 0.7605 0.424 0.4115 0.293
0.4344 0.7052 0.4444 0.44 0.3648
0.38225 0.6166666666666667 0.4226666666666667 0.417 0.355
0.34514285714285714 0.5608571428571428 0.40085714285714286 0.394
0.334
0.314375 0.5075 0.37875 0.373 0.32175
0.2897222222222222 0.4666666666666667 0.3791111111111111
0.37355555555555553 0.32577777777777778
0.27705 0.4436 0.3524 0.3466 0.304
0.2676363636363636 0.434 0.3503636363636364 0.346
0.31636363636363635
0.2517083333333333 0.4058333333333333 0.3408333333333333 0.336
```



0.3105  
 0.24157692307692308      0.3910769230769231      0.3386153846153846  
 0.3336923076923077      0.31138461538461537  
 0.2315   0.37257142857142855      0.3067142857142857      0.30314285714285716  
 0.2814285714285714  
 0.21906666666666666      0.35213333333333335      0.2968   0.29333333333333333  
 0.27133333333333333  
 0.209875      0.337625      0.298   0.294625      0.2705  
 0.20223529411764707      0.3275294117647059      0.2952941176470588  
 0.2918823529411765      0.2688235294117647  
 0.19722222222222222      0.32211111111111111      0.297   0.29422222222222222  
 0.27055555555555555  
 0.19310526315789472      0.312   0.2903157894736842      0.28757894736842105  
 0.26442105263157895  
 0.184975      0.2968   0.2819   0.2795   0.2573  
 [[0.80675   0.   0.   0.   0.   0.   0.   0.   0.  
   0.   0.   0.   0.   0.   0.   0.   0.   0.  
   0.   ]  
 [0.7245   0.3885   0.   0.   0.   0.   0.   0.   0.  
   0.   0.   0.   0.   0.   0.   0.   0.   0.  
   0.   ]  
 [0.69575   0.309   0.3045   0.   0.   0.   0.   0.   0.  
   0.   0.   0.   0.   0.   0.   0.   0.   0.  
   0.   ]  
 [0.67175   0.2955   0.2815   0.2515   0.   0.   0.   0.   0.  
   0.   0.   0.   0.   0.   0.   0.   0.   0.  
   0.   ]  
 [0.651   0.243   0.237   0.228   0.2835   0.   0.   0.   0.  
   0.   0.   0.   0.   0.   0.   0.   0.   0.  
   0.   ]  
 [0.6425   0.2385   0.209   0.21   0.264   0.2095   0.   0.   0.  
   0.   0.   0.   0.   0.   0.   0.   0.   0.  
   0.   ]  
 [0.6405   0.2025   0.197   0.2065   0.258   0.2015   0.1685   0.   0.  
   0.   0.   0.   0.   0.   0.   0.   0.   0.  
   0.   ]  
 [0.63675   0.196   0.19   0.1965   0.24   0.1915   0.1615   0.1585   0.  
   0.   0.   0.   0.   0.   0.   0.   0.   0.  
   0.   ]  
 [0.61725   0.1755   0.186   0.191   0.225   0.179   0.1465   0.1515   0.2815  
   0.   0.   0.   0.   0.   0.   0.   0.   0.  
   0.   ]  
 [0.6065   0.1625   0.184   0.1885   0.2195   0.1725   0.1435   0.15   0.2595  
   0.251   0.   0.   0.   0.   0.   0.   0.   0.  
   0.   ]  
 [0.6025   0.13   0.1745   0.1865   0.215   0.1725   0.1395   0.145   0.255  
   0.2295   0.168   0.   0.   0.   0.   0.   0.   0.  
   0.   ]

```

[0.6      0.1285  0.1735  0.1665  0.2135  0.1665  0.137   0.141   0.251
 0.217   0.1645  0.1815  0.      0.      0.      0.      0.      0.
 0.      ]
[0.6      0.1265  0.17   0.1645  0.2035  0.16   0.136   0.1385  0.247
 0.2165  0.158   0.1715  0.149   0.      0.      0.      0.      0.
 0.      ]
[0.5975  0.125   0.1685  0.159   0.2     0.157   0.1345  0.137   0.2445
 0.207   0.1515  0.138   0.1405  0.1285  0.      0.      0.      0.
 0.      ]
[0.59675 0.118   0.1655  0.154   0.1885  0.1535  0.133   0.1285  0.2405
 0.2015  0.1475  0.1345  0.1305  0.1245  0.1445  0.      0.      0.
 0.      ]
[0.594   0.1     0.1635  0.1525  0.1775  0.153   0.1285  0.1235  0.2365
 0.187   0.137   0.131   0.128   0.1215  0.143   0.1675  0.      0.
 0.      ]
[0.594   0.0955  0.1525  0.1515  0.1645  0.1525  0.124   0.1175  0.2285
 0.187   0.1265  0.1305  0.1225  0.1215  0.1385  0.1525  0.1965  0.
 0.      ]
[0.593   0.0905  0.15   0.1465  0.157   0.1515  0.1225  0.1175  0.2275
 0.1775  0.122   0.123   0.12   0.1125  0.1355  0.1435  0.1705  0.2155
 0.      ]
[0.593   0.089   0.1475  0.145   0.156   0.1365  0.112   0.115   0.215
 0.175   0.119   0.121   0.1155  0.112   0.132   0.1435  0.168   0.214
 0.0975 ]]
[0, 8.224999999999999, 9.525, 8.366666666666669, 9.80625, 9.415,
8.970833333333333, 8.578571428571427, 8.74375, 8.513888888888888, 8.5375,
8.297727272727272, 8.010416666666666, 8.017307692307691, 7.9571428571428555,
7.991666666666666, 8.0203125, 8.110294117647058, 8.031944444444445]

```

```

[201]: def predict(model, x, voro=True):
        x = torch.from_numpy(x.astype(np.float32)).cuda()
        with torch.no_grad():
            predi = model.module.classifier(x)
        if voro:
            predi += - torch.sum((model.module.classifier.weight/2.）**2, dim=1)
        return predi

classes_all = []
test_share = []
paccS = []
for i in range(task_num + 1):
    support_data, support_label, query_data, query_label, n_ways, n_shot, \
    →classes = \
        get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                        local = True, brother = brother)

    # load model:
    if brother:

```

```

        cls_01 = classes[-1]+1
        assert cls_01 % 4 == 0
        filename = path + '%d_model.pkl' % (int(cls_01/4))
    else:
        filename = path + '%d_model.pkl' % (classes[-1]+1)
    model = torch.load(filename)
    model.eval()
    print('> loaded base phase model from:', filename)
    num_param(model)
    # do prediction:
    min_cls = min(classes)
    if brother:
        pred = predict(model, query_data)
    else:
        pred = predict(model, query_data)[:,:,:4]
    pmax = torch.max(pred, dim=1)[1]
    pacc = np.mean(t2n(pmax) == query_label - min_cls)
    print(pacc)
    if brother:
        accs = acc_brother(t2n(pred), t2n(pmax), query_label - min_cls,
→forLG=True)
        pacc = [pacc] + accs
        paccS.append(pacc)
        classes_all.append(classes)
        test_share.append(len(query_label))
print('all logistic locally:')
if brother:
    for accs in paccS:
        print('\t'.join([str(i) for i in accs]))
else:
    print('\n'.join([str(i) for i in paccS]))

```

##### current\_task: 0 #####

```

[output] current classes [ 0  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17
18 19 20 21 22 23
24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39]
all classes 0 -> 39
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/10_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
0.80875

```

##### current\_task: 1 #####

```

[output] current classes [40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57
58 59]
all classes 0 -> 59
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/15_model.pkl

```

```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.59

##### current_task: 2 #####
[output] current classes [60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77
78 79]
all classes 0 -> 79
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/20_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.6015

##### current_task: 3 #####
[output] current classes [80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97
98 99]
all classes 0 -> 99
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/25_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.566

##### current_task: 4 #####
[output] current classes [100 101 102 103 104 105 106 107 108 109 110 111 112
113 114 115 116 117
118 119]
all classes 0 -> 119
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/30_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.5835

##### current_task: 5 #####
[output] current classes [120 121 122 123 124 125 126 127 128 129 130 131 132
133 134 135 136 137
138 139]
all classes 0 -> 139
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.5515

##### current_task: 6 #####
[output] current classes [140 141 142 143 144 145 146 147 148 149 150 151 152
153 154 155 156 157
158 159]
all classes 0 -> 159
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/40_model.pkl

```

```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.5985

##### current_task: 7 #####
[output] current classes [160 161 162 163 164 165 166 167 168 169 170 171 172
173 174 175 176 177
178 179]
all classes 0 -> 179
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.472

##### current_task: 8 #####
[output] current classes [180 181 182 183 184 185 186 187 188 189 190 191 192
193 194 195 196 197
198 199]
all classes 0 -> 199
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.743

##### current_task: 9 #####
[output] current classes [200 201 202 203 204 205 206 207 208 209 210 211 212
213 214 215 216 217
218 219]
all classes 0 -> 219
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.6095

##### current_task: 10 #####
[output] current classes [220 221 222 223 224 225 226 227 228 229 230 231 232
233 234 235 236 237
238 239]
all classes 0 -> 239
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.639

##### current_task: 11 #####
[output] current classes [240 241 242 243 244 245 246 247 248 249 250 251 252
253 254 255 256 257
258 259]

```

```

all classes 0 -> 259
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.517

##### current_task: 12 #####
[output] current classes [260 261 262 263 264 265 266 267 268 269 270 271 272
273 274 275 276 277
278 279]
all classes 0 -> 279
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.5685

##### current_task: 13 #####
[output] current classes [280 281 282 283 284 285 286 287 288 289 290 291 292
293 294 295 296 297
298 299]
all classes 0 -> 299
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.576

##### current_task: 14 #####
[output] current classes [300 301 302 303 304 305 306 307 308 309 310 311 312
313 314 315 316 317
318 319]
all classes 0 -> 319
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.494

##### current_task: 15 #####
[output] current classes [320 321 322 323 324 325 326 327 328 329 330 331 332
333 334 335 336 337
338 339]
all classes 0 -> 339
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.6025

##### current_task: 16 #####
[output] current classes [340 341 342 343 344 345 346 347 348 349 350 351 352

```

```

353 354 355 356 357
358 359]
all classes 0 -> 359
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.5625

```

```

##### current_task: 17 #####
[output] current classes [360 361 362 363 364 365 366 367 368 369 370 371 372
373 374 375 376 377
378 379]
all classes 0 -> 379
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.65

```

```

##### current_task: 18 #####
[output] current classes [380 381 382 383 384 385 386 387 388 389 390 391 392
393 394 395 396 397
398 399]
all classes 0 -> 399
> loaded base phase model from:
../checkpoints/CIFAR100_10_18x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
0.533

```

```

all logistic locally:
0.80875 0.993  0.991  0.0    0.997
0.59    0.972  0.944  0.0    0.984
0.6015  0.886  0.864  0.0    0.956
0.566   0.984  1.0    0.0    1.0
0.5835  0.93   0.864  0.0    0.956
0.5515  0.906  0.77   0.0    0.966
0.5985  0.934  0.908  0.0    0.99
0.472   0.888  0.944  0.0    0.934
0.743   0.97   0.876  0.0    0.992
0.6095  0.908  0.95   0.0    0.936
0.639   0.922  0.886  0.0    0.978
0.517   0.928  0.95   0.0    0.962
0.5685  0.852  0.826  0.004  0.96
0.576   0.922  0.924  0.0    0.982
0.494   0.856  0.972  0.0    0.948
0.6025  0.98   0.938  0.0    0.992
0.5625  0.928  0.804  0.006  0.96
0.65    0.944  0.806  0.0    0.988
0.533   0.936  0.982  0.0    0.994

```

```

[202]: for i in range(task_num + 1):
        support_data, support_label, query_data, query_label, n_ways, n_shot, \
        classes = \
            get_task_data(embst, embs, i, fg_nc, class_set, task_size,
                          local = True, brother = brother)

        pred_all = []
        for classes in classes_all:
            # load model:
            if brother:
                cls_01 = classes[-1]+1
                assert cls_01 % 4 == 0
                filename = path + '%d_model.pkl' % (int(cls_01/4))
            else:
                filename = path + '%d_model.pkl' % (classes[-1]+1)
            model = torch.load(filename)
            model.eval()
            print('> loaded base phase model from:', filename)
            num_param(model)
            # do prediction:
            min_cls = min(classes)
            if brother:
                pred = predict(model, query_data)
            else:
                pred = predict(model, query_data)[:,:4]
            pmax = torch.max(pred, dim=1)[1]
            # pacc = np.mean(t2n(pmax) == query_label - min_cls)
            # print(pacc)
            if brother:
                labs_01 = query_label[:4]//4
                acc_, sc_pre = merge_sc(t2n(pred), labs_01,
                                         mth='softmax', forLG=True, return_pre=True)
                min_cls = int(min_cls / 4)
                pred_all.append( (sc_pre + min_cls).tolist() )
            else:
                pred_all.append( (t2n(pmax) + min_cls).tolist() )
        pred_all = np.array(pred_all)
        print(pred_all.shape)

        if i == 0:
            pred_in_clique = copy.deepcopy(pred_all)
        else:
            pred_in_clique = np.hstack((pred_in_clique, pred_all))

```

##### current\_task: 0 #####

[output] current classes [ 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17  
18 19 20 21 22 23  
24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39]



```

all classes 0 -> 39
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/10_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/15_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/20_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/25_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/30_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True

```

```

total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_10_18x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(19, 1000)

##### current_task: 1 #####
[output] current classes [40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57
58 59]
all classes 0 -> 59
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/10_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/15_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/20_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/25_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/30_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/60_model.pkl

```

```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_10_18x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(19, 500)

##### current_task: 2 #####
[output] current classes [60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77
78 79]
all classes 0 -> 79
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/10_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/15_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/20_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/25_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/30_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240

```

```

> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_10_18x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(19, 500)

##### current_task: 3 #####
[output] current classes [80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97
98 99]

```

```

all classes 0 -> 99
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/10_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/15_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/20_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/25_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/30_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True

```

```

total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_10_18x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(19, 500)

##### current_task: 4 #####
[output] current classes [100 101 102 103 104 105 106 107 108 109 110 111 112
113 114 115 116 117
118 119]
all classes 0 -> 119
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/10_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/15_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/20_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/25_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/30_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240

```

```

> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_10_18x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(19, 500)

```

```
##### current_task: 5 #####
```

```

[output] current classes [120 121 122 123 124 125 126 127 128 129 130 131 132
133 134 135 136 137
138 139]

```

```
all classes 0 -> 139
```

```

> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/10_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/15_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/20_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/25_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/30_model.pkl

```

```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_10_18x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(19, 500)

```

```
##### current_task: 6 #####
```



```

[output] current classes [140 141 142 143 144 145 146 147 148 149 150 151 152
153 154 155 156 157
158 159]
all classes 0 -> 159
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/10_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/15_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/20_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/25_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/30_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True

```

```

total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_10_18x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(19, 500)

```

```
##### current_task: 7 #####
```

```

[output] current classes [160 161 162 163 164 165 166 167 168 169 170 171 172
173 174 175 176 177
178 179]

```

```
all classes 0 -> 179
```

```

> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/10_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/15_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/20_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/25_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/30_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240

```

```

> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_10_18x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(19, 500)

```

```
##### current_task: 8 #####
```

```

[output] current classes [180 181 182 183 184 185 186 187 188 189 190 191 192
193 194 195 196 197
198 199]

```

```
all classes 0 -> 199
```

```

> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/10_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/15_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/20_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/25_model.pkl

```

```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/30_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_10_18x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240

```

(19, 500)

##### current\_task: 9 #####

[output] current classes [200 201 202 203 204 205 206 207 208 209 210 211 212  
213 214 215 216 217  
218 219]

all classes 0 -> 219

> loaded base phase model from: ../checkpoints/CIFAR100\_10\_18x5voro/10\_model.pkl  
module.classifier.weight torch.Size([40, 512]) 20480 True  
total: 20480

> loaded base phase model from: ../checkpoints/CIFAR100\_10\_18x5voro/15\_model.pkl  
module.classifier.weight torch.Size([20, 512]) 10240 True  
total: 10240

> loaded base phase model from: ../checkpoints/CIFAR100\_10\_18x5voro/20\_model.pkl  
module.classifier.weight torch.Size([20, 512]) 10240 True  
total: 10240

> loaded base phase model from: ../checkpoints/CIFAR100\_10\_18x5voro/25\_model.pkl  
module.classifier.weight torch.Size([20, 512]) 10240 True  
total: 10240

> loaded base phase model from: ../checkpoints/CIFAR100\_10\_18x5voro/30\_model.pkl  
module.classifier.weight torch.Size([20, 512]) 10240 True  
total: 10240

> loaded base phase model from: ../checkpoints/CIFAR100\_10\_18x5voro/35\_model.pkl  
module.classifier.weight torch.Size([20, 512]) 10240 True  
total: 10240

> loaded base phase model from: ../checkpoints/CIFAR100\_10\_18x5voro/40\_model.pkl  
module.classifier.weight torch.Size([20, 512]) 10240 True  
total: 10240

> loaded base phase model from: ../checkpoints/CIFAR100\_10\_18x5voro/45\_model.pkl  
module.classifier.weight torch.Size([20, 512]) 10240 True  
total: 10240

> loaded base phase model from: ../checkpoints/CIFAR100\_10\_18x5voro/50\_model.pkl  
module.classifier.weight torch.Size([20, 512]) 10240 True  
total: 10240

> loaded base phase model from: ../checkpoints/CIFAR100\_10\_18x5voro/55\_model.pkl  
module.classifier.weight torch.Size([20, 512]) 10240 True  
total: 10240

> loaded base phase model from: ../checkpoints/CIFAR100\_10\_18x5voro/60\_model.pkl  
module.classifier.weight torch.Size([20, 512]) 10240 True  
total: 10240

> loaded base phase model from: ../checkpoints/CIFAR100\_10\_18x5voro/65\_model.pkl  
module.classifier.weight torch.Size([20, 512]) 10240 True  
total: 10240

> loaded base phase model from: ../checkpoints/CIFAR100\_10\_18x5voro/70\_model.pkl  
module.classifier.weight torch.Size([20, 512]) 10240 True  
total: 10240

> loaded base phase model from: ../checkpoints/CIFAR100\_10\_18x5voro/75\_model.pkl  
module.classifier.weight torch.Size([20, 512]) 10240 True

```

total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_10_18x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(19, 500)

```

```
##### current_task: 10 #####
```

```

[output] current classes [220 221 222 223 224 225 226 227 228 229 230 231 232
233 234 235 236 237
238 239]

```

```
all classes 0 -> 239
```

```

> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/10_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/15_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/20_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/25_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/30_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240

```

```

> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_10_18x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(19, 500)

```

```
##### current_task: 11 #####
```

```

[output] current classes [240 241 242 243 244 245 246 247 248 249 250 251 252
253 254 255 256 257
258 259]

```

```
all classes 0 -> 259
```

```

> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/10_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/15_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/20_model.pkl

```

```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/25_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/30_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:

```



```

../checkpoints/CIFAR100_10_18x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(19, 500)

##### current_task: 12 #####
[output] current classes [260 261 262 263 264 265 266 267 268 269 270 271 272
273 274 275 276 277
278 279]
all classes 0 -> 279
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/10_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/15_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/20_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/25_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/30_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True

```

```

total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_10_18x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(19, 500)

```

```
##### current_task: 13 #####
```

```

[output] current classes [280 281 282 283 284 285 286 287 288 289 290 291 292
293 294 295 296 297
298 299]
all classes 0 -> 299
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/10_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/15_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/20_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/25_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/30_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240

```

```

> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_10_18x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(19, 500)

##### current_task: 14 #####
[output] current classes [300 301 302 303 304 305 306 307 308 309 310 311 312
313 314 315 316 317
318 319]
all classes 0 -> 319
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/10_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/15_model.pkl

```

[illegible]

```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_10_18x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(19, 500)

##### current_task: 15 #####
[output] current classes [320 321 322 323 324 325 326 327 328 329 330 331 332
333 334 335 336 337
338 339]
all classes 0 -> 339
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/10_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/15_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/20_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/25_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/30_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True

```

```

total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_10_18x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(19, 500)

```

```
##### current_task: 16 #####
```

```

[output] current classes [340 341 342 343 344 345 346 347 348 349 350 351 352
353 354 355 356 357
358 359]
all classes 0 -> 359
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/10_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/15_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/20_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/25_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/30_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240

```

```

> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_10_18x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(19, 500)

##### current_task: 17 #####
[output] current classes [360 361 362 363 364 365 366 367 368 369 370 371 372
373 374 375 376 377
378 379]
all classes 0 -> 379
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/10_model.pkl

```

```

module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/15_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/20_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/25_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/30_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/90_model.pkl

```



```

module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_10_18x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(19, 500)

##### current_task: 18 #####
[output] current classes [380 381 382 383 384 385 386 387 388 389 390 391 392
393 394 395 396 397
398 399]
all classes 0 -> 399
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/10_model.pkl
module.classifier.weight      torch.Size([40, 512])    20480    True
total: 20480
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/15_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/20_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/25_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/30_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/35_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/40_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/45_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/50_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/55_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/60_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True

```

```

total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/65_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/70_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/75_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/80_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/85_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/90_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from: ../checkpoints/CIFAR100_10_18x5voro/95_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
> loaded base phase model from:
../checkpoints/CIFAR100_10_18x5voro/100_model.pkl
module.classifier.weight      torch.Size([20, 512])    10240    True
total: 10240
(19, 500)

```

```

[173]: print('cliques by test samples:', pred_in_clique.shape)

# compute prototypes
be      = 0.8 # 1.
l2      = True # False True
bias    = 0 # 0.05
protots = np.mean(feats_trans(support_data_, beta=be, l2=l2, bias=bias), axis=1)
query_pts = feats_trans(query_data_, beta=be, l2=l2, bias=bias)
# acenss  = feats_trans(acens, beta=be, l2=l2, bias=bias)
if brother:
    dist      = funbtch(query_pts, protots) # protots / acenss
else:
    dist      = fun(query_pts, protots) # protots / acenss

test_splt = [sum(test_share[:t+1]) for t in range(len(test_share))]

```

cliques by test samples: (17, 10000)

```

[174]: dist_in_clique = np.zeros_like(pred_in_clique, dtype=np.float32)
for c_id, clique in enumerate(pred_in_clique):

```

```

for s_id, samp in enumerate(clique):
    dist_in_clique[c_id][s_id] = dist[s_id][samp]

```

```

[190]: for i in range(task_num + 1):
        clique_dist = dist_in_clique[:i+1,:test_splt[i]]
        clique_pred = np.argmin(clique_dist, axis=0)
        merge_pred = [pred_in_clique[cli,s_id] for s_id, cli in
        ↪enumerate(clique_pred)]
        merge_acc = np.mean(merge_pred == query_label_[:test_splt[i]])
        print(merge_acc)
    print('DaC:', 'beta:', be, '| 12:', 12)

```

```

[28]: print('===== Experiment Done! =====')

```

```

===== Experiment Done! =====

```