Efficient Reinforcement Learning Development with RLzoo

Zihan Ding[1*], Tianyang Yu[2], Hongming Zhang[3], Yanhua Huang[4], Guo Li[5], Quancheng Guo[6], Luo Mai[6], Hao Dong[3]

1 Princeton University 2 Nanchang University 3 Peking University 4 Xiaohongshu Technology Co.

5 Imperial College London 6 University of Edinburgh

* speaker

Open-source Repo: https://github.com/tensorlayer/RLzoo

Recent Progress in Reinforcement Learning (RL)

AlphaGo

AlphaZero[1]

AlphaStar

OpenAI Five: Dota[2]

Quadrupedal Robot[3]

1. https://deepmind.com/blog/article/alphazero-shedding-new-light-grand-games-chess-shogi-and-go

2. https://openai.com/blog/openai-five/

3 .Lee, Joonho, et al. "Learning quadrupedal locomotion over challenging terrain." *Science robotics* 5.47 (2020).

Overview: Difficulties for a Reinforcement Learning Developer/Researcher

A typical procedure for developing with Deep Reinforcement Learning:
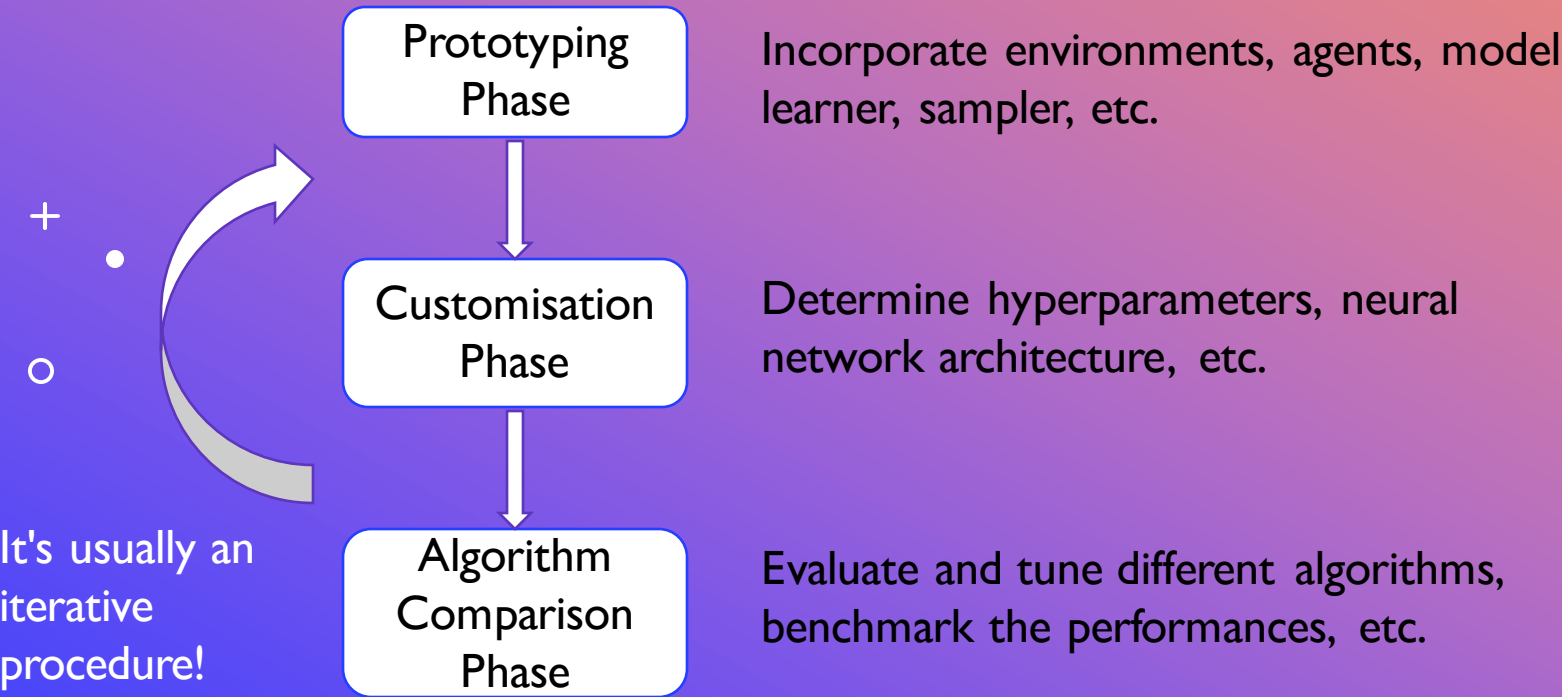
Difficulties:

Prototyping Phase — Incorporate environments, agents, model learner, sampler, etc. → 1. Hardness in hands-on coding for developers.

Customisation Phase — Determine hyperparameters, neural network architecture, etc. → 2. Require extensive efforts, effective evaluation framework and expert experience.

Algorithm Comparison Phase — Evaluate and tune different algorithms, benchmark the performances, etc. → 3. Require in-depth knowledge about DRL algorithms.

+
•
○

It's usually an iterative procedure!

RLzoo Characteristics:

Difficulties:

1. High-level yet flexible APIs for declaring DRL agents

1. Hardness in hands-on coding for developers.

2. Automatic constructing process for DRL agents

2. Require extensive efforts, effective evaluation framework and expert experience.

3. DRL model zoo

3. Require in-depth knowledge about DRL algorithms.

1. High-level yet Flexible APIs

An example launch script with RLzoo (less than 10 lines):

```python
from rlzoo.common.env_wrappers import build_env
from rlzoo.common.utils import call_default_params
from rlzoo.algorithms import TD3

env_type = 'classic_control'
env_name = 'Pendulum-v0'
env = build_env ( env_name, env_type) # Build environment
alg_params, learn_params = call_default_params(env,env_type, 'TD3') # Create configuration
agent = TD3(**alg_params) # Construct agent
agent.learn(env, 'train', **learn_params) # Launch training
```

API table:

Function	Description
env = **build_env**(*EnvName, EnvType*)	Return the built environment instantiation with the name and type of it.
alg_params, learn_params = **call_default_params**(*env, EnvType, AlgName*)	Return two dictionaries of default hyper-parameters w.r.t. environments and algorithms.
agent = eval(*AlgName*+'(**alg_params*)') *agent*.**learn**(*env, mode*='train', *render*=False, **learn_params*)	Instantiate the class of DRL agent. Launch training/testing process with the agent.

By applying three adaptor modules:

    * observation adaptor
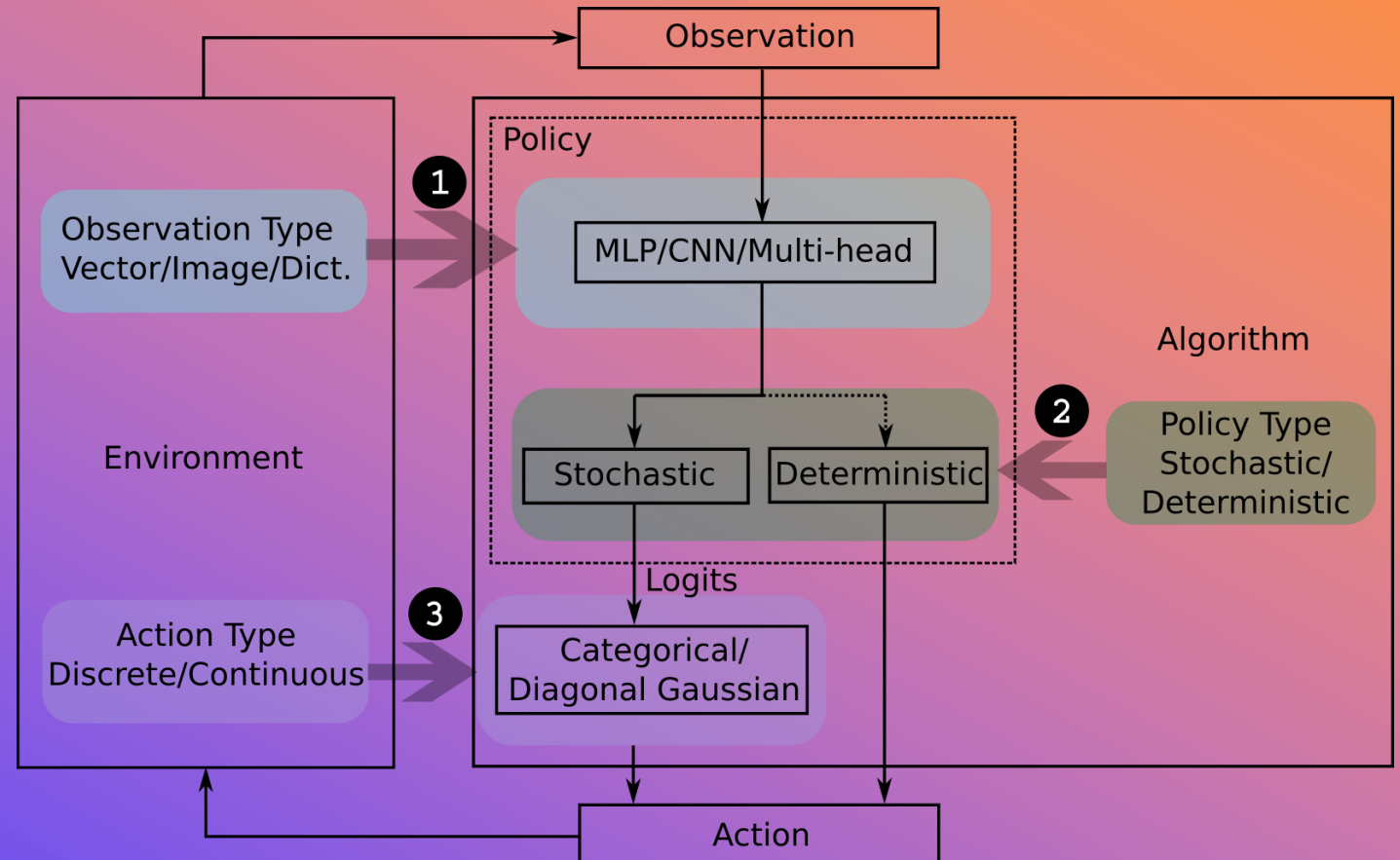
    * policy adaptor

    * action adaptor

3. DRL Model Zoo

Implemented DRL algorithms in RLzoo (more than 10 types):

DQN, double DQN, dueling DQN, noisy DQN, distributed DQN;
Hindsight experience replay (HER), DDPG, TD3, SAC, A2C, A3C, PPO, DPPO, TRPO, etc.

+

•

Comparison against other libraries: (in terms of alg., env. supports and script brevity)

○

Library	# Algo.	# Env.	Image	Vector	Dict.	LoC
RLzoo	12	7	✓	✓	✓	4
Baselines	9	5	✓	✓	✓	N/A
Tianshou	8	5	✓	✓	✓	15-20
Coach	11	8	✓	✓	✗	N/A
ReAgent	4	3	✓	✓	✗	5
garage	9	6	✓	✓	✗	5-10
keras-rl	3	5	✓	✓	✓	10-15
MushroomRL	9	7	✓	✓	✗	5-10
Tensorforce	8	5	✓	✓	✓	5-15

RLzoo is rich but simple!

Additional: Distributed Training Framework

RLzoo also provides a distributed training framework[1] for training across multiple GPUs and machines, based on KungFu[2].
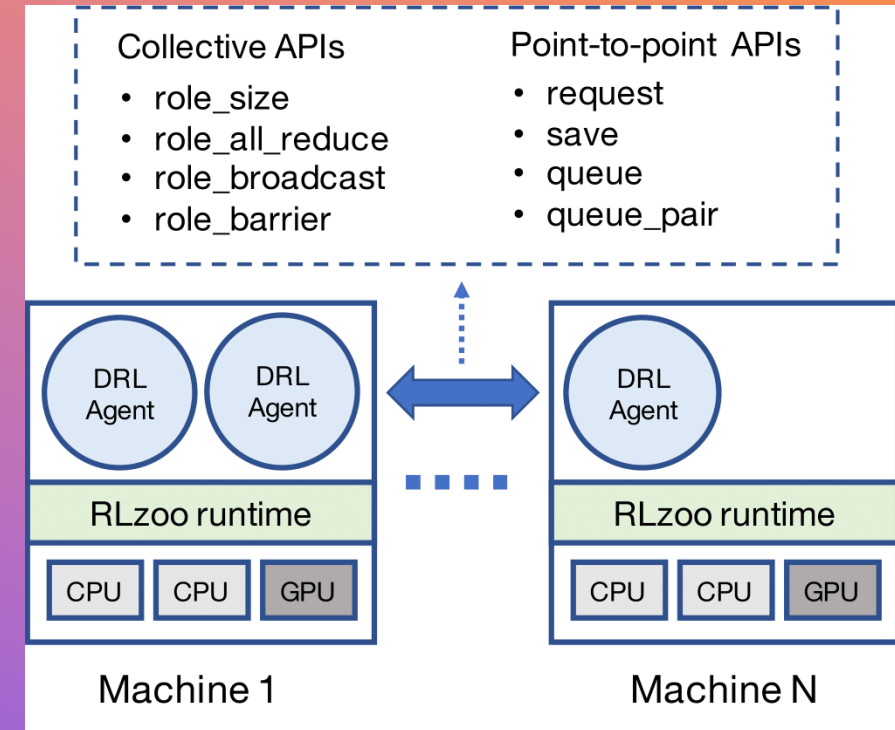
Community

RLzoo is jointly contributed by people from a variety of institutes.

Based on RLzoo community, there is a featured book *Deep Reinforcement Learning: Fundamentals, Research and Applications* published by Springer 2020 in English and Publishing House of Electronics Industry in Chinese.

THANKS

Thanks for the support of TensorLayer community.
Look forward to your contribution to RLzoo community!

Contact: zhding@mail.ustc.edu.cn