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	range of values for feature 1	range of values for feature 2	excluded combinations
dsprites	0-5	0-2	(0,0),(5,2),(2,1),(3,1),(3,2)
3dshapes	0-7	0-3	(0,0),(5,2),(2,1),(3,1),(3,2),(7,3),(0,3),(7,1)
mpi3d	0-5	0-2	(0,0),(1,4),(0,5),(1,3),(1,1),(0,2)

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Table 1: Specific combinations of features excluded for the NCFF task.

## 1 MIG EXAMPLE CALCULATION

Let  $g_1$  denote shape and  $g_2$  denote colour, and let  $H$  denote entropy and  $MI$  denote mutual information. We then calculate the MIG for the model in Table 1 as follows. First, note that

$$MI(z_1, g_1) = MI(z_1, g_2) = 0, \quad (1)$$

because  $z_1$  is just noise. Then, assuming balanced classes, we have  $H(g_1) = H(g_2) = 1$ . As  $g_1$  encodes each to an accuracy of 75%, the conditional entropy is

$$-0.75 \log(0.75) - (0.25) \log 0.25 = 0.8113,$$

and so

$$MI(z_2, g_1) = MI(z_2, g_2) = 1 - 0.8113 = 0.1887.$$

The MIG, which is identical for both features, is then

$$MI(z_2, g_1) - MI(z_1, g_1) = MI(z_2, g_2) - MI(z_1, g_2) = 0.1887 - 0 = 0.1887.$$

Now, we calculate MIG for the second described model. Here,

$$MI(z_2, g_1) = MI(z_2, g_2) = 0.1887,$$

as above, and also  $MI(z_1, g_2) = 0$  as above. Now, however,

$$MI(z_1, g_1) = 1 - (-0.7 \log(0.7) - (0.3) \log 0.3) = 1 - 0.8813 = 0.1187,$$

So, the MIG for  $g_2$  is the same as for the first model, but the MIG for  $g_1$  is

$$MI(z_2, g_1) - MI(z_1, g_1) = 0.1887 - 0.1187 = 0.07.$$

## 2 NCFF RESULTS WITH STANDARD DEVIATIONS

Tabel 2 shows the central tendency, i.e. mean and standard deviations, across all the different feature combinations we exclude. For the the ‘full’ results, which just excludes a random testset rather than specific feature value combinations, we report the mean and standard deviation of 5 independent runs. Each runs included a training from scratch of the VAE-model as well as training the various classifiers on top of it. The feature values excluded for given in Table 1.

## 3 FULL RESULTS

Here we show the full results for all the experiments reported in the main paper. Each of the following tables shows all results for a particular dataset and method combination. That is, each table shows results for single-neuron classification (SNC), neuron knockout (NK1 and NK2) and recognition of novel combinations of familiar features (NCFF) under the various settings described in the main paper.

For the NCFF settings, we indicate the values of two features excluded. Recall that we always exclude a combination of size and shape. So, for example “NCFF 3-2” means that the disentanglement model and the classifier trained on top of it, used a train set that excluded exactly those data points with size 3 and shape 2 (under some arbitrary ordering of the values of shape, e.g. 0=square, 1=circle, 2=crescent).

For all settings, we report the results for all features (where measured). The feature lists for each data set are as follows:

Table 2: NCFF results as a central tendency, mean and standard dev. (in parentheses) from each combination of feature values that was excluded. For the ‘full’ results, we show the mean and standard dev. of 5 independent runs.

		dsprites size	shape	both	3dshapes size	shape	both	mpi3d size	shape	both
bVAE	normal testset	99.0 (0.1)	99.6 (0.3)	98.7 (0.2)	99.4 (1.2)	100.0 (0.0)	99.9 (0.2)	98.9 (0.1)	85.8 (1.9)	85.1 (1.9)
	NCFF	5.3 (4.0)	4.2 (9.2)	0.0 (3.7)	16.9 (23.2)	27.7 (30.3)	0.0 (19.8)	72.8 (3.1)	5.2 (9.6)	4.3 (8.3)
	NCFF linear	2.5 (8.2)	91.6 (4.8)	2.0 (0.0)	36.0 (23.8)	70.6 (37.5)	17.2 (0.0)	95.1 (17.5)	7.6 (10.4)	5.0 (10.5)
	NCFF excl 1	3.2 (3.0)	90.4 (13.9)	2.0 (2.2)	32.7 (22.7)	71.6 (31.4)	14.0 (16.3)	88.5 (5.3)	9.1 (4.8)	7.0 (4.8)
	NCFF excl 2	4.2 (5.7)	94.9 (18.1)	3.8 (3.0)	36.1 (22.1)	70.8 (27.4)	17.4 (14.1)	97.8 (12.4)	11.3 (8.6)	10.0 (8.4)
btcVAE	normal testset	88.6 (0.2)	94.3 (0.6)	85.7 (0.3)	99.6 (0.5)	100.0 (0.1)	99.6 (0.6)	97.6 (2.1)	81.2 (7.6)	79.9 (8.7)
	NCFF	0.2 (0.0)	38.0 (35.8)	0.0 (0.0)	7.1 (32.0)	61.4 (20.1)	3.9 (33.0)	83.0 (4.6)	3.6 (6.1)	3.4 (5.2)
	NCFF linear	0.0 (0.3)	99.8 (43.4)	0.0 (0.0)	41.2 (15.7)	81.1 (36.0)	28.9 (9.3)	98.0 (11.4)	11.3 (8.2)	10.6 (8.3)
	NCFF excl 1	0.0 (0.0)	92.5 (0.3)	0.0 (0.0)	28.7 (26.2)	79.8 (19.0)	19.9 (25.5)	92.1 (3.0)	13.0 (12.1)	11.6 (10.8)
	NCFF excl 2	0.0 (0.0)	82.9 (16.5)	0.0 (0.0)	32.6 (25.5)	80.6 (16.0)	20.3 (19.2)	96.8 (5.0)	6.4 (10.0)	5.3 (9.0)
factorVAE	normal testset	97.5 (0.6)	98.4 (0.6)	96.4 (1.0)	92.6 (14.3)	98.8 (1.0)	91.5 (14.1)	97.9 (0.4)	82.3 (1.7)	80.9 (1.9)
	NCFF	3.1 (13.3)	28.3 (28.4)	0.3 (13.3)	13.5 (26.8)	36.9 (28.5)	1.2 (16.5)	67.3 (2.4)	2.6 (10.8)	2.1 (9.9)
	NCFF linear	14.4 (4.6)	92.6 (24.8)	12.2 (0.7)	40.8 (27.5)	62.1 (35.8)	18.1 (3.2)	91.9 (17.4)	9.6 (4.0)	8.8 (3.5)
	NCFF excl 1	11.2 (20.3)	95.6 (8.7)	11.0 (17.2)	36.1 (20.7)	60.3 (34.1)	19.4 (21.9)	87.7 (12.2)	9.6 (9.5)	8.6 (9.1)
	NCFF excl 2	8.5 (16.1)	70.6 (3.9)	6.4 (15.9)	28.8 (15.7)	67.8 (32.2)	9.3 (22.1)	97.8 (9.0)	9.0 (8.9)	8.3 (7.9)
pVAE	normal testset	77.0 (7.6)	97.4 (2.3)	75.9 (7.8)	96.7 (3.4)	99.0 (0.1)	95.8 (3.3)	80.6 (0.9)	35.2 (1.7)	29.1 (1.8)
	NCFF	3.6 (1.3)	25.6 (39.7)	0.0 (1.0)	10.0 (32.1)	87.4 (9.1)	9.7 (31.9)	79.4 (8.3)	0.0 (0.4)	0.0 (0.3)
	NCFF linear	2.2 (6.8)	12.7 (41.9)	0.3 (0.0)	14.2 (20.5)	95.3 (9.6)	4.5 (20.1)	87.8 (15.4)	0.0 (0.0)	0.0 (0.0)
	NCFF excl 1	3.1 (2.6)	28.3 (16.0)	1.3 (0.5)	25.7 (34.2)	21.1 (7.4)	0.5 (11.1)	92.6 (10.6)	0.0 (0.0)	0.0 (0.0)
	NCFF excl 2	0.6 (2.9)	62.9 (24.5)	0.4 (2.8)	22.2 (33.7)	95.2 (39.0)	21.6 (0.7)	90.1 (3.8)	0.2 (0.0)	0.2 (0.0)
MTD	normal testset	100.0 (0.2)	99.7 (0.0)	99.7 (0.2)	100.0 (0.0)	100.0 (0.0)	100.0 (0.0)	99.9 (0.1)	95.8 (0.0)	95.8 (0.6)
	NCFF	11.3 (7.5)	33.4 (5.5)	2.9 (1.6)	12.1 (4.1)	23.3 (1.9)	1.3 (0.7)	59.9 (18.4)	16.5 (21.5)	5.0 (3.6)

- **dsprites:** x-position (x), y-position (y), object size (size), object orientation (orient), and object shape (shape)
- **3dshapes:** floor colour (floor h), wall colour (wall h), object size (size), camera azimuth (orient), object shape (shape), and object colour (object h)
- **mpi3d:** azimuth of robot arm (hor), altitude of robot arm (vert), size of object (size), colour of object (obj h), shape of object (shape), height of camera above the object (cam he), and background colour (bg h)

We also report the accuracy on both of the novel features, i.e. the fraction of the points for which the classifier correctly predicted both size and shape. This is shown in the ‘‘NCFF’’ column.

Table 3: Full results for BTCVAE on dsprites

		x	y	size	orient	shape	NCFF
normal testset 0	SNC	76.9	75.0	44.6	13.9	52.7	25.5
	linear	47.6	49.2	54.8	11.8	84.6	48.7
	NK1	-	-	99.0	-	99.0	-
	NK2	-	-	98.9	-	98.4	97.8
	NCFF excl 1	30.4	35.2	79.9	28.7	99.0	98.5
	NCFF excl 2	-	-	-	-	-	-
	MLP	80.7	79.3	98.9	43.1	98.9	98.5
normal testset 1	SNC	75.5	74.7	44.6	3.1	52.4	19.9
	SNC	75.5	74.7	44.4	12.0	52.4	22.2
	linear	59.2	60.4	46.9	14.2	73.6	33.3
	NK1	-	-	99.5	-	99.9	-
	NK2	-	-	99.1	-	99.8	80.7
	NCFF excl 1	32.8	35.6	91.4	60.8	100.0	-
	NCFF excl 2	25.7	33.7	85.6	40.4	100.0	-
normal testset 2	MLP	59.2	60.4	46.9	14.2	73.6	33.3
	SNC	58.5	65.0	44.2	10.5	49.8	20.9
	linear	73.1	55.3	44.7	10.7	65.1	31.5
	NK1	-	-	95.6	-	99.0	94.9
	NK2	-	-	93.9	-	99.1	93.1
	NCFF excl 1	43.5	43.0	83.2	37.9	97.9	-
	NCFF excl 2	40.5	35.9	74.3	23.2	96.4	-
normal testset 3	MLP	79.5	81.5	99.0	60.7	98.9	98.6
	SNC	74.1	76.2	44.6	9.3	45.5	21.0
	linear	60.0	51.7	45.2	8.4	68.8	31.0
	NK1	-	-	99.0	-	99.5	98.5
	NK2	-	-	99.2	-	99.0	98.2
	NCFF excl 1	28.9	42.5	86.5	62.6	99.3	-
	NCFF excl 2	18.3	35.4	78.9	37.2	99.1	-
normal testset 4	MLP	82.8	90.0	99.3	76.5	100.0	99.3
	SNC	76.7	51.6	44.6	12.3	49.3	20.4
	linear	81.5	87.1	99.0	72.9	100.0	99.0
	NK1	-	-	98.9	-	99.2	98.1
	NK2	-	-	98.1	-	98.8	96.9
	NCFF excl 1	29.1	45.7	87.2	42.9	100.0	-
	NCFF excl 2	19.0	42.0	81.4	25.4	98.8	-
NCFF 0-0	MLP	81.5	87.1	99.0	72.9	100.0	99.0
	linear	32.0	38.6	0.6	3.0	0.0	0.0
	NK1	-	-	-	-	-	-
	NK2	-	-	0.0	-	63.0	0.0
NCFF 5-2	mlp	91.2	96.7	0.0	6.4	19.0	0.0
	linear	23.3	22.4	0.0	21.4	0.0	0.0
	NK1	-	-	0.0	-	99.7	0.0
	NK2	-	-	0.0	-	99.6	0.0
NCFF 2-1	mlp	22.1	19.8	0.0	40.2	95.5	0.0
	linear	65.6	66.1	0.4	16.0	26.2	0.0
	NK1	-	-	0.0	-	100.0	0.0
	NK2	-	-	0.0	-	100.0	0.0
NCFF 3-1	mlp	97.7	95.5	0.0	78.8	100.0	0.0
	linear	99.5	99.4	0.0	82.2	100.0	0.0
	NK1	-	-	0.0	-	100.0	0.0
	NK2	-	-	0.0	-	100.0	0.0
NCFF 3-2	mlp	99.5	99.4	0.0	82.2	100.0	0.0
	linear	22.6	28.6	0.1	5.3	63.6	0.0
	NK1	-	-	0.0	-	99.4	0.0
	NK2	-	-	0.0	-	99.9	0.0
	mlp	38.9	51.7	0.0	94.2	100.0	0.0

Table 4: Full results for BVAE on dsprites

		x	y	size	orient	shape	NCFF
normal testset 0	SNC	8.6	8.8	25.3	2.5	37.4	9.3
	linear	70.1	72.1	48.0	7.2	44.3	17.6
	NK1	-	-	99.0	-	99.5	98.6
	NK2	-	-	98.4	-	99.0	97.6
	NCFF excl 1	19.1	20.9	52.7	55.1	99.0	-
	NCFF excl 2	15.7	15.5	44.6	40.0	98.8	-
	MLP	89.6	92.9	99.0	65.5	99.6	98.8
normal testset 1	SNC	4.0	7.8	45.8	2.3	50.0	25.4
	SNC	29.6	32.4	45.8	7.0	50.0	25.4
	linear	57.7	62.4	50.3	9.1	46.8	20.1
	NK1	-	-	99.0	-	99.3	98.4
	NK2	-	-	99.0	-	99.3	98.3
	NCFF excl 1	21.0	26.7	55.9	55.5	98.9	-
	NCFF excl 2	16.2	16.3	48.5	41.3	98.8	-
	MLP	91.2	92.5	99.2	66.8	99.5	98.9
normal testset 2	SNC	31.4	28.7	32.8	8.0	47.7	16.3
	linear	61.5	62.3	42.5	7.3	41.2	16.4
	NK1	-	-	99.1	-	99.1	98.2
	NK2	-	-	98.8	-	98.9	97.7
	NCFF excl 1	20.8	22.5	82.2	50.5	99.5	-
	NCFF excl 2	15.2	14.5	44.7	44.4	99.0	-
	MLP	90.4	91.4	98.9	65.7	99.8	98.8
normal testset 3	SNC	38.3	43.2	30.9	7.4	51.5	15.6
	linear	68.1	71.4	44.9	8.0	53.6	25.0
	NK1	-	-	99.0	-	99.1	98.1
	NK2	-	-	98.9	-	98.8	97.8
	NCFF excl 1	25.0	23.8	88.1	58.7	99.6	-
	NCFF excl 2	18.9	16.9	45.7	48.8	99.5	-
	MLP	94.1	94.2	98.9	67.5	99.9	98.8
normal testset 4	SNC	31.5	28.6	45.1	6.6	48.1	22.9
	linear	59.7	57.2	50.3	6.1	53.6	20.6
	NK1	-	-	99.0	-	98.8	98.1
	NK2	-	-	99.0	-	99.3	98.4
	NCFF excl 1	27.7	27.9	54.5	52.0	99.0	-
	NCFF excl 2	22.5	20.5	46.0	39.8	98.7	-
	MLP	89.9	89.4	99.0	61.7	99.1	98.4
NCFF 0-0	linear	30.1	19.4	7.9	2.6	0.0	0.0
	NK1	-	-	7.4	-	67.6	5.0
	NK2	-	-	13.3	-	58.0	7.2
	mlp	95.8	94.0	7.0	10.8	78.5	5.1
NCFF 5-2	linear	21.1	21.4	18.5	8.4	8.9	0.0
	NK1	-	-	0.1	-	91.6	0.1
	NK2	-	-	0.0	-	97.7	0.0
	mlp	44.4	51.2	0.0	76.8	96.9	0.0
NCFF 2-1	linear	3.1	3.1	0.0	2.5	0.0	0.0
	NK1	-	-	1.8	-	99.3	1.7
	NK2	-	-	1.2	-	96.7	1.3
	mlp	89.1	87.8	5.6	38.7	99.7	5.5
NCFF 3-1	linear	86.1	30.0	0.0	9.9	2.2	0.0
	NK1	-	-	3.3	-	99.9	3.3
	NK2	-	-	1.6	-	99.7	1.6
	mlp	98.4	97.9	8.4	73.5	99.9	8.4
NCFF 3-2	linear	22.5	20.4	0.0	9.4	9.7	0.0
	NK1	-	-	0.0	-	99.7	0.0
	NK2	-	-	0.0	-	99.6	0.0
	mlp	79.6	84.3	0.0	92.2	99.4	0.0

Table 5: Full results for FACTOR on dsprites

		x	y	size	orient	shape	NCFF
normal testset 0	SNC	10.9	17.0	45.1	4.6	43.7	18.9
	linear	31.4	29.8	49.1	4.7	46.3	20.5
	NK1	-	-	96.9	-	95.8	93.1
	NK2	-	-	96.5	-	95.6	92.3
	NCFF excl 1	46.6	26.2	36.5	22.7	96.8	-
	NCFF excl 2	23.0	17.2	31.6	17.5	94.7	-
	MLP	76.3	77.7	97.4	34.0	98.6	96.3
normal testset 1	SNC	3.6	6.6	46.3	2.6	46.7	24.4
	SNC	10.7	7.8	46.4	4.0	46.7	22.2
	linear	20.3	21.7	49.8	3.9	43.9	22.9
	NK1	-	-	95.4	-	95.9	-
	NK2	-	-	95.3	-	95.0	91.0
	NCFF excl 1	26.3	45.8	37.6	22.1	96.6	-
	NCFF excl 2	19.6	33.3	31.2	15.9	94.6	-
normal testset 2	MLP	75.0	74.9	97.0	32.4	97.5	95.2
	SNC	10.3	5.9	33.1	8.0	54.0	16.7
	linear	5.5	27.5	49.8	6.3	53.4	27.5
	NK1	-	-	96.5	-	98.8	95.5
	NK2	-	-	95.5	-	98.5	94.2
	NCFF excl 1	48.7	46.9	43.1	27.6	97.5	-
	NCFF excl 2	26.7	20.8	37.3	18.9	96.3	-
normal testset 3	MLP	78.2	78.7	98.4	42.2	99.0	97.7
	SNC	13.4	48.4	43.5	4.6	38.6	17.4
	linear	31.4	32.3	52.7	4.0	46.5	24.2
	NK1	-	-	97.5	-	97.7	95.6
	NK2	-	-	96.7	-	97.0	93.6
	NCFF excl 1	29.4	23.4	37.1	22.7	98.0	-
	NCFF excl 2	20.1	16.2	33.6	14.2	94.8	-
normal testset 4	MLP	76.1	77.8	97.9	36.4	98.6	96.8
	SNC	42.8	15.9	31.9	8.2	46.8	15.4
	linear	29.7	26.0	51.4	4.3	48.4	27.4
	NK1	-	-	94.8	-	97.5	92.6
	NK2	-	-	94.9	-	96.6	-
	NCFF excl 1	49.3	51.1	41.5	27.9	95.1	-
	NCFF excl 2	33.9	24.0	32.5	21.5	94.6	-
NCFF 0-0	MLP	74.0	75.4	97.0	37.7	98.6	96.0
	linear	37.3	29.6	2.1	2.9	0.0	0.0
	NK1	-	-	-	-	-	-
	NK2	-	-	0.0	-	92.5	0.0
NCFF 5-2	mlp	96.6	95.5	0.4	7.5	31.5	0.0
	linear	33.8	35.8	0.0	7.2	6.3	0.0
	NK1	-	-	-	-	-	-
	NK2	-	-	0.0	-	97.0	0.0
NCFF 2-1	mlp	34.7	20.9	0.2	46.8	67.8	0.2
	linear	27.0	27.8	11.2	7.2	57.4	1.6
	NK1	-	-	-	-	-	-
	NK2	-	-	34.8	-	99.7	34.7
NCFF 3-1	mlp	27.0	27.8	11.2	7.2	57.4	1.6
	linear	24.7	17.1	2.3	4.8	31.8	0.0
	NK1	-	-	28.8	-	86.5	24.4
	NK2	-	-	21.3	-	90.6	20.3
NCFF 3-2	mlp	89.3	85.2	30.6	28.8	98.8	30.1
	linear	23.1	17.1	0.0	6.2	46.2	0.0
	NK1	-	-	0.0	-	98.7	0.0
	NK2	-	-	0.0	-	98.1	0.0
	mlp	41.8	39.6	0.0	64.7	97.5	0.0

Table 6: Full results for MTD on dsprites

		x	y	size	orient	shape	zs
normal testset 0	SNC	-	-	-	-	-	-
	linear	-	-	-	-	-	-
	NK1	-	-	-	-	-	-
	NK2	-	-	-	-	-	-
	NCFF excl 1	-	-	-	-	-	-
	NCFF excl 2	-	-	-	-	-	-
	MLP	99.0	99.4	100.0	83.3	100.0	100.0
normal testset 1	SNC	-	-	-	-	-	-
	SNC	-	-	-	-	-	-
	linear	-	-	-	-	-	-
	NK1	-	-	-	-	-	-
	NK2	-	-	-	-	-	-
	NCFF excl 1	-	-	-	-	-	-
	NCFF excl 2	-	-	-	-	-	-
normal testset 2	MLP	99.0	98.6	99.8	75.0	100.0	99.8
	SNC	-	-	-	-	-	-
	linear	-	-	-	-	-	-
	NK1	-	-	-	-	-	-
	NK2	-	-	-	-	-	-
	NCFF excl 1	-	-	-	-	-	-
	NCFF excl 2	-	-	-	-	-	-
normal testset 3	MLP	98.3	98.6	99.8	75.4	100.0	99.8
	SNC	-	-	-	-	-	-
	linear	-	-	-	-	-	-
	NK1	-	-	-	-	-	-
	NK2	-	-	-	-	-	-
	NCFF excl 1	-	-	-	-	-	-
	NCFF excl 2	-	-	-	-	-	-
normal testset 4	MLP	97.2	98.8	99.4	74.1	100.0	99.4
	SNC	-	-	-	-	-	-
	linear	-	-	-	-	-	-
	NK1	-	-	-	-	-	-
	NK2	-	-	-	-	-	-
	NCFF excl 1	-	-	-	-	-	-
	NCFF excl 2	-	-	-	-	-	-
NCFF 0-0	MLP	98.7	97.4	99.6	73.0	100.0	99.6
	linear	-	-	-	-	-	-
	NK1	-	-	-	-	-	-
	NK2	99.1	96.2	4.2	2.9	21.4	0.8
NCFF 5-2	mlp	-	-	-	-	-	-
	linear	-	-	-	-	-	-
	NK1	-	-	-	-	-	-
	NK2	-	-	-	-	-	-
NCFF 2-1	mlp	77.9	77.6	6.1	3.3	33.9	2.5
	linear	-	-	-	-	-	-
	NK1	-	-	-	-	-	-
	NK2	-	-	-	-	-	-
NCFF 3-1	mlp	94.1	95.8	17.8	3.1	25.6	3.8
	linear	-	-	-	-	-	-
	NK1	-	-	-	-	-	-
	NK2	-	-	-	-	-	-
NCFF 3-2	mlp	93.9	95.8	17.8	3.6	35.6	4.5
	linear	-	-	-	-	-	-
	NK1	-	-	-	-	-	-
	NK2	-	-	-	-	-	-
NCFF 3-2	mlp	88.2	88.8	3.6	3.1	38.3	0.9
	linear	-	-	-	-	-	-

Table 7: Full results for PVAE on dsprites

		x	y	size	orient	shape	NCFF
normal testset 0	SNC	47.1	12.4	27.6	9.1	43.6	14.0
	linear	42.2	48.9	42.9	8.6	52.1	22.9
	NK1	74.5	38.0	73.2	36.5	46.2	33.8
	NK2	37.3	74.1	71.0	32.3	45.0	31.4
	NCFF excl 1	9.5	64.1	55.3	10.8	86.3	-
	NCFF excl 2	8.0	52.9	51.4	7.5	-	-
	MLP	72.1	68.9	75.6	32.0	95.9	74.0
normal testset 1	SNC	6.3	3.8	17.1	3.0	44.3	7.2
	SNC	7.5	6.5	30.7	8.2	44.4	13.5
	linear	36.2	36.7	33.7	11.7	44.3	15.5
	NK1	30.5	30.5	62.9	52.9	44.3	25.5
	NK2	30.8	30.7	61.8	53.1	44.4	24.5
	NCFF excl 1	15.7	27.3	71.1	15.5	90.2	-
	NCFF excl 2	12.8	22.2	62.0	6.8	-	-
normal testset 2	MLP	72.3	73.5	67.2	46.1	99.0	66.8
	SNC	10.3	5.9	33.1	8.0	54.0	16.7
	linear	30.8	31.6	39.8	11.1	60.0	24.0
	NK1	42.0	38.3	63.5	57.7	50.4	31.8
	NK2	39.3	68.9	82.7	18.9	46.6	39.2
	NCFF excl 1	10.1	71.4	72.3	21.2	93.4	-
	NCFF excl 2	8.8	53.3	72.9	6.1	-	-
normal testset 3	MLP	70.3	74.2	78.9	55.0	99.0	78.5
	SNC	13.4	48.4	43.5	4.6	38.6	17.4
	linear	52.7	41.8	42.5	4.3	46.0	17.4
	NK1	39.1	68.9	82.9	18.9	48.1	41.2
	NK2	42.1	38.7	63.8	57.8	50.6	31.3
	NCFF excl 1	65.5	7.6	50.5	11.3	83.1	-
	NCFF excl 2	59.1	5.9	44.6	7.9	-	-
normal testset 4	MLP	66.6	75.1	74.9	20.9	94.1	72.8
	SNC	42.8	15.9	31.9	8.2	46.8	15.4
	linear	37.5	46.1	46.3	11.7	45.5	20.3
	NK1	62.1	49.8	55.8	52.1	51.9	28.7
	NK2	37.3	74.1	71.0	32.3	45.0	31.4
	NCFF excl 1	11.2	38.3	72.7	15.2	92.5	-
	NCFF excl 2	7.4	32.2	57.7	4.9	-	-
NCFF 0-0	MLP	70.3	73.5	88.2	50.1	99.0	87.7
	linear	8.8	25.8	15.8	2.5	2.5	0.0
	NK1	94.3	91.9	1.6	2.5	0.6	0.0
	NK2	87.0	59.7	2.7	0.3	32.4	0.0
NCFF 5-2	mlp	99.4	99.1	0.0	2.5	0.0	0.0
	linear	19.8	21.5	0.2	16.1	1.3	0.0
	NK1	17.4	9.5	6.1	28.9	14.4	1.1
	NK2	17.3	8.9	7.7	27.9	68.7	6.4
NCFF 2-1	mlp	16.8	20.5	0.2	36.6	60.7	0.0
	linear	50.6	49.6	0.0	26.7	98.7	0.0
	NK1	89.7	89.6	0.0	81.8	0.1	0.0
	NK2	57.6	62.7	1.5	35.1	7.5	0.0
NCFF 3-1	mlp	93.1	90.4	0.0	74.2	95.7	0.0
	linear	31.3	39.6	2.2	5.9	23.2	0.0
	NK1	37.0	30.9	3.1	26.2	9.3	0.2
	NK2	37.9	31.5	3.7	26.1	12.5	0.2
NCFF 3-2	mlp	86.6	86.2	2.9	33.0	98.2	2.2
	linear	25.1	25.6	0.0	10.8	2.4	0.0
	NK1	24.6	23.2	0.0	11.5	39.3	0.0
	NK2	25.3	23.3	0.0	12.2	20.3	0.0
	mlp	27.6	22.7	0.0	13.2	60.1	0.0

Table 8: Full results for BTCVAE on 3dshapes

		floor h	wall h	size	orient	shape	obj h	NCFF
normal testset 0	SNC	31.4	20.09	36.03	20.68	39.68	21.13	14.58
	linear	99.13	99.08	59.18	82.33	29.42	99.03	17.38
	NK1	-	-	99.09	-	99.62	-	98.97
	NK2	-	-	98.88	-	99.02	-	97.98
	NCFF excl 1	95.32	98.67	98.95	84.35	99.38	99.02	-
	NCFF excl 2	81.34	82.8	86.69	47.37	98.97	98.97	-
	MLP	100	100	98.76	99.98	99.81	100	98.51
normal testset 1	SNC	27.81	19.68	21.44	25.79	39.33	25.51	9.74
	linear	98.83	98.75	31.02	83.3	37.69	98.96	10.72
	NK1	-	-	98.93	-	98.99	-	97.92
	NK2	-	-	96.43	-	98.92	-	95.41
	NCFF excl 1	95.72	99.03	95.06	94.34	98.94	99.23	-
	NCFF excl 2	87.47	93.61	85.91	42.49	99.02	99.02	-
	MLP	100	100	99.72	99.98	100	100	99.72
normal testset 2	SNC	27.81	19.68	21.44	25.79	39.33	25.51	9.74
	linear	98.87	99.1	31.58	73.53	35.15	99	9.22
	NK1	-	-	98.92	-	98.82	-	98.74
	NK2	-	-	96.9	-	98.93	-	95.86
	NCFF excl 1	99.05	99.07	99.05	87.41	99.02	99.03	-
	NCFF excl 2	95.75	95.95	89.21	49.75	98.99	98.94	-
	MLP	100	100	100	99.03	100	100	100
normal testset 3	SNC	20.73	19.97	17.53	19.13	35.65	28.5	6.03
	linear	98.94	98.77	17.01	83.2	67.16	98.97	10.27
	NK1	-	-	98.95	-	99.36	-	98.31
	NK2	-	-	98.95	-	99.07	-	98.02
	NCFF excl 1	98.92	98.91	98.93	96.57	99.38	98.81	-
	NCFF excl 2	96.42	97.28	91.59	57.44	98.81	99	-
	MLP	100	100	99.71	99.99	100	100	99.71
normal testset 4	SNC	23.88	18.2	22.18	19.96	42.96	20.8	10.38
	linear	98.96	99.06	18.62	83.3	70.9	99.03	12.27
	NK1	-	-	98.98	-	100	-	98.98
	NK2	-	-	94.42	-	99	-	93.58
	NCFF excl 1	97.49	98.93	98.99	64.41	99.85	98.95	-
	NCFF excl 2	86.04	90.1	98.8	33.5	98.99	94.69	-
	MLP	100	100	99.99	99.85	100	100	99.99
NCFF 0-0	linear	93.59	95.03	45.3	90.57	76.21	76.68	26.85
	NK1	-	-	45.42	-	48.15	-	2.16
	NK2	-	-	45.25	-	51.79	-	2.49
	mlp	99.11	100	45.35	99.96	49.21	80.89	0.03
NCFF 5-2	linear	99.12	98.65	1.41	97.91	95.38	90.47	1.41
	NK1	-	-	32	-	100	-	32
	NK2	-	-	3.75	-	100	-	3.75
	mlp	100	100	0	100	100	93.93	0
NCFF 2-1	linear	100	100	0	88.6	74.31	99.99	0
	NK1	-	-	18.69	-	73.73	-	14.02
	NK2	-	-	50.34	-	73.89	-	38.66
	mlp	100	100	43.31	99.95	73.91	100	36.43
NCFF 3-1	linear	99.85	99.88	0	83.13	84.91	100	0
	NK1	-	-	78.05	-	84.9	-	64
	NK2	-	-	41.27	-	81.95	-	27.46
	mlp	100	100	12.79	100	84.64	100	0
NCFF 3-2	linear	99.04	99.73	0	85.46	99.99	99.87	0
	NK1	-	-	5.95	-	100	-	5.95
	NK2	-	-	0.12	-	100	-	0.12
	mlp	100	100	0	99.69	100	99.93	0
NCFF 7-3	linear	99.99	99.21	8.26	83.51	25.83	100	2.92
	NK1	-	-	25.55	-	92.79	-	22.2
	NK2	-	-	13.59	-	84.25	-	13.09
	mlp	100	99.99	39.67	97.91	90.04	100	30.63
NCFF 0-3	linear	99.94	100	0.04	87.69	4.49	69.07	0
	NK1	-	-	46.62	-	59.9	-	20.53



Table 9: Full results for BVAE on 3dshapes

		floor h	wall h	size	orient	shape	obj h	NCFF
normal testset 0	SNC	20.17	23.3	35.49	24.59	36.73	20.51	12.85
	linear	99.06	99.25	55.55	87.31	35.56	99.03	13.93
	NK1	-	-	99.1	-	99.26	-	-
	NK2	-	-	98.95	-	98.89	-	97.82
	NCFF excl 1	99	98.97	96.92	57.59	99.77	99.13	-
	NCFF excl 2	93.12	91.86	84.05	34.11	99.86	98.58	-
	MLP	100	100	100	99.92	100	100	100
normal testset 1	SNC	22.05	17.04	16.64	15.78	41.45	17.33	7.38
	linear	99	99.12	15.72	96.39	64.16	99.05	8.39
	NK1	-	-	98.86	-	99.26	-	98.12
	NK2	-	-	96.41	-	98.99	-	95.43
	NCFF excl 1	98.95	99.06	99.04	93.06	98.87	98.83	-
	NCFF excl 2	92.94	90.57	93.66	57.28	99	99.01	-
	MLP	100	100	97.34	100	100	100	99.74
normal testset 2	SNC	29.08	18.85	28.5	13.11	36.68	18.89	10.97
	linear	99.28	98.94	66.14	31.35	79.27	99.1	55.6
	NK1	-	-	99.03	-	99.08	-	98.12
	NK2	-	-	97.97	-	98.9	-	96.88
	NCFF excl 1	98.66	98.97	98.89	96.66	99.21	99.06	-
	NCFF excl 2	88.08	85.79	87.96	63.75	98.96	95.55	-
	MLP	100	100	99.63	99.68	100	100	99.63
normal testset 3	SNC	25.47	18	36.35	19.76	35.68	22.22	14.7
	linear	99.19	99.34	44.92	88.59	53.89	99	26.22
	NK1	-	-	99.38	-	99	-	98.38
	NK2	-	-	98.01	-	99	-	97.04
	NCFF excl 1	98.91	98.92	94.31	93.18	99.99	99.39	-
	NCFF excl 2	98.11	92.35	76.62	52.11	99.02	99.08	-
	MLP	100	100	99.98	99.97	99.99	99.99	99.97
normal testset 4	SNC	22.48	20.08	25.16	65.74	35.74	21.26	9.35
	linear	99.3	98.8	46.12	83.24	36.65	99.01	13.09
	NK1	-	-	99.55	-	99.29	-	98.84
	NK2	-	-	98.17	-	98.92	-	97.1
	NCFF excl 1	98.88	99	99.01	73.41	99.04	99.13	-
	NCFF excl 2	92.6	96.95	94.27	38.71	98.92	98.94	-
	MLP	100	100	100	98.87	100	100	100
NCFF 0-0	linear	99.25	99.03	48.31	86.55	0	96.83	0
	NK1	-	-	46.34	-	46.55	-	3.88
	NK2	-	-	36.9	-	52.23	-	3.43
	mlp	100	100	46.61	100	52.34	99.89	4.97
NCFF 5-2	linear	100	100	0	92.12	100	100	0
	NK1	-	-	0	-	100	-	0
	NK2	-	-	0	-	99.87	-	0
	mlp	100	100	0	100	100	100	0
NCFF 2-1	linear	100	99.87	0	64.17	16.77	100	0
	NK1	-	-	31.59	-	81.72	-	28.44
	NK2	-	-	7.67	-	76.67	-	5.77
	mlp	100	100	38.27	99.66	79.52	100	32.94
NCFF 3-1	linear	99.41	99.7	0	90.09	41.61	100	0
	NK1	-	-	50.93	-	15.1	-	1.8
	NK2	-	-	68.52	-	18.6	-	6.14
	mlp	100	100	47.07	100	15.8	100	0
NCFF 3-2	linear	99.95	99.93	15.86	90.67	0	99.33	0
	NK1	-	-	5.95	-	100	-	5.95
	NK2	-	-	40.35	-	99.01	-	40.05
	mlp	100	100	0	99.77	100	100	0
NCFF 7-3	linear	97.3	96.9	59.35	78.43	0	100	0
	NK1	-	-	35.61	-	96.09	-	35.09
	NK2	-	-	35.03	-	88.95	-	29.86
	mlp	100	99.88	43.79	83.65	93.99	100	37.78
NCFF 0-3	linear	99.59	99.81	0	89.38	63.08	68.14	0
	NK1	-	-	62.97	-	45.37	-	21.31

Table 10: Full results for FACTOR on 3dshapes

		floor h	wall h	size	orient	shape	obj h	NCFF
normal testset 0	SNC	30.77	23.69	31.55	16	31.86	12.84	10.41
	linear	98.94	98.97	38.43	38.27	31.99	74.98	11.52
	NK1	-	-	64.7	-	88.42	-	54.93
	NK2	-	-	68.93	-	68.19	-	44.36
	NCFF excl 1	98.81	91.42	58.91	39.2	92.27	91.34	-
	NCFF excl 2	68.03	74.44	61.11	23.47	71.67	63.94	-
	MLP	100	99.54	67.03	98.46	98.9	98.99	66.2
normal testset 1	SNC	-	-	-	-	-	-	-
	linear	96.79	99.02	18.76	57.48	54.74	86.12	9.14
	NK1	-	-	98.95	-	99.07	-	98.02
	NK2	-	-	89.64	-	98.56	-	88.33
	NCFF excl 1	71.14	99	92.94	93.44	98.11	96.26	-
	NCFF excl 2	43.72	64.14	68.53	38.44	90.27	77.41	-
	MLP	100	100	98.95	99.25	98.86	99.19	97.82
normal testset 2	SNC	21.96	20.48	23.11	15.92	26.72	18.29	6.63
	linear	99.03	99.04	37.24	49.19	36.76	90.54	10.63
	NK1	-	-	85.97	-	98.97	-	85.2
	NK2	-	-	66.17	-	96.04	-	64.21
	NCFF excl 1	90.7	95.84	90.88	83.87	99.08	98.98	-
	NCFF excl 2	76.32	70.68	66.23	53.14	95.09	83.91	-
	MLP	100	100	99.02	99.3	99.91	99.99	98.93
normal testset 3	SNC	24.19	41.23	17.67	18.79	41.61	23.71	7.63
	linear	99.08	99.09	17.62	52.32	50.72	76.24	8.7
	NK1	-	-	96.52	-	99.09	-	95.61
	NK2	-	-	81.57	-	93.16	-	76.05
	NCFF excl 1	79.03	81.78	86.41	57.75	98.78	99.01	-
	NCFF excl 2	54.14	46.17	62.67	32.97	87.83	77.92	-
	MLP	100	99.99	99.04	94.05	97.18	99.27	96.33
normal testset 4	SNC	21.77	20.19	21.08	15.01	31.19	23.71	6.46
	linear	95.49	93.47	18.97	31.85	38.35	75.64	5.68
	NK1	-	-	98.96	-	99	-	98
	NK2	-	-	78.93	-	84.64	-	66.78
	NCFF excl 1	57.42	72.05	99.03	60.61	94.3	87.4	-
	NCFF excl 2	39.54	51.49	57.98	32.79	72.5	64.89	-
	MLP	100	99.49	98.94	99.21	99.03	99.06	97.99
NCFF 0-0	linear	100	99.8	0	65.11	47.82	48.82	0
	NK1	-	-	43.19	-	33.47	-	0.77
	NK2	-	-	42.47	-	32.86	-	5.69
	mlp	100	100	38.69	100	40.93	99.16	0.73
NCFF 5-2	linear	93.81	95.39	0	59.65	56	77.95	0
	NK1	-	-	32	-	100	-	32
	NK2	-	-	26.28	-	96.82	-	26.51
	mlp	100	100	0	99.97	100	100	0
NCFF 2-1	linear	88.57	90.95	0	33.27	2.14	61.83	0
	NK1	-	-	12.96	-	49.47	-	9.41
	NK2	-	-	6.58	-	39.47	-	2.75
	mlp	-	-	1.92	99.32	51.35	100	0.91
NCFF 3-1	linear	93.55	88.59	0	56.3	0	65.76	0
	NK1	-	-	67.06	-	95.35	-	61.92
	NK2	-	-	47.03	-	86.03	-	59.64
	mlp	100	100	49.81	100	98.73	100	48.74
NCFF 3-2	linear	100	100	0	83.4	99.06	100	0
	NK1	-	-	31.6	-	99.02	-	31.34
	NK2	-	-	44.69	-	99.37	-	44.67
	mlp	100	100	11.51	99.8	99.9	100	11.51
NCFF 7-3	linear	91.25	89.19	13.79	51.55	0	97.49	0
	NK1	-	-	31.27	-	69.24	-	7.17
	NK2	-	-	29.41	-	74.3	-	10.93
	mlp	100	95.83	26.48	94.97	67.05	100	2.47
NCFF 0-3	linear	98.27	99.94	14.73	58.26	61.55	90.27	0.32
	NK1	-	-	32.35	-	40.42	-	0.14

Table 11: Full results for LEI on 3dshapes

		floor h	wall h	size	orient	shape	obj h	NCFF
normal testset 0	SNC	-	-	-	-	-	-	-
	linear	-	-	-	-	-	-	-
	NK1	-	-	-	-	-	-	-
	NK2	-	-	-	-	-	-	-
	NCFF excl 1	-	-	-	-	-	-	-
	NCFF excl 2	-	-	-	-	-	-	-
	MLP	100	100	100	100	100	100	100
normal testset 1	SNC	-	-	-	-	-	-	-
	linear	-	-	-	-	-	-	-
	NK1	-	-	-	-	-	-	-
	NK2	-	-	-	-	-	-	-
	NCFF excl 1	-	-	-	-	-	-	-
	NCFF excl 2	-	-	-	-	-	-	-
	MLP	100	100	100	100	100	100	100
normal testset 2	SNC	-	-	-	-	-	-	-
	linear	-	-	-	-	-	-	-
	NK1	-	-	-	-	-	-	-
	NK2	-	-	-	-	-	-	-
	NCFF excl 1	-	-	-	-	-	-	-
	NCFF excl 2	-	-	-	-	-	-	-
	MLP	9.2	100	100	100	100	100	100
normal testset 3	SNC	-	-	-	-	-	-	-
	linear	-	-	-	-	-	-	-
	NK1	-	-	-	-	-	-	-
	NK2	-	-	-	-	-	-	-
	NCFF excl 1	-	-	-	-	-	-	-
	NCFF excl 2	-	-	-	-	-	-	-
	MLP	7.3	100	100	100	100	100	100
normal testset 4	SNC	-	-	-	-	-	-	-
	linear	-	-	-	-	-	-	-
	NK1	-	-	-	-	-	-	-
	NK2	-	-	-	-	-	-	-
	NCFF excl 1	-	-	-	-	-	-	-
	NCFF excl 2	-	-	-	-	-	-	-
	MLP	20	100	100	100	100	100	100
NCFF 0-0	linear	-	-	-	-	-	-	-
	NK1	-	-	-	-	-	-	-
	NK2	11.1	90.9	18.8	100	29.8	93	1.29
	mlp	-	-	-	-	-	-	-
NCFF 5-2	linear	-	-	-	-	-	-	-
	NK1	-	-	-	-	-	-	-
	NK2	8.5	92.4	4.2	100	26.9	94.8	0.57
	mlp	-	-	-	-	-	-	-
NCFF 2-1	linear	-	-	-	-	-	-	-
	NK1	-	-	-	-	-	-	-
	NK2	8.2	90.5	12.2	100	27.8	93.9	4.25
	mlp	-	-	-	-	-	-	-
NCFF 3-1	linear	-	-	-	-	-	-	-
	NK1	-	-	-	-	-	-	-
	NK2	13.9	90.2	9.4	100	24.7	91.3	3.22
	mlp	-	-	-	-	-	-	-
NCFF 3-2	linear	-	-	-	-	-	-	-
	NK1	-	-	-	-	-	-	-
	NK2	10.1	96.3	10.2	100	24.1	94.7	2.17
	mlp	-	-	-	-	-	-	-
NCFF 7-3	linear	-	-	-	-	-	-	-
	NK1	-	-	-	-	-	-	-
	NK2	-	-	-	-	-	-	-
	mlp	10.087	96.02	12.793	99.94	25.027	96.347	2
NCFF 0-3	linear	-	-	-	-	-	-	-
	NK1	-	-	-	-	-	-	-

Table 12: Full results for PVAE on 3dshapes

		floor h	wall h	size	orient	shape	obj h	NCFF
normal testset 0	SNC	99.86	37.53	38.02	99.53	93.45	82.14	31.89
	linear	89.72	96.97	17.46	78.2	82.05	82.2	13.72
	NK1	100	53.64	93.92	99.16	99.11	34.71	32.84
	NK2	95.96	87.24	90.72	21.31	97.36	29.51	26.67
	NCFF excl 1	22.94	93.37	28.48	13.78	27.66	98.45	-
	NCFF excl 2	15.59	80.7	24.52	13.25	22.97	-	-
	MLP	99.07	98.86	90.97	99.07	99.03	98.94	90.13
normal testset 1	SNC	99.81	39.3	72.16	86.71	95.74	99.96	72.15
	linear	99.04	90.69	33.07	15.41	89.03	98.97	30.04
	NK1	37.65	100	99.65	98.84	100	33.53	33.47
	NK2	100	18.41	99.87	87.87	31.04	-	30.99
	NCFF excl 1	87.08	31.35	38.22	24.47	25.82	100	-
	NCFF excl 2	71.66	17.97	30.66	19.61	16.15	-	-
	MLP	98.86	99.37	98.94	95.95	99.12	99.7	98.07
normal testset 2	SNC	99.88	34.63	20.25	99.78	93.1	69.49	12.11
	linear	91.98	90.53	50.64	9.16	79.54	42.59	40.33
	NK1	99.89	96.71	66.62	37.42	97.94	39.91	26
	NK2	42.06	28.18	98.76	100	92.44	26.78	26.39
	NCFF excl 1	31.3	70.71	93.07	27.94	50.03	97.51	-
	NCFF excl 2	23.31	55.38	75.43	23.83	45.65	-	-
	MLP	98.87	99.04	96.26	30.39	98.95	98.84	95.29
normal testset 3	SNC	30.84	31.22	29.36	99.52	66.94	34.49	8.79
	linear	97.81	94.28	28.81	76.05	87.9	57.23	25.61
	NK1	100	45.95	98.37	99.99	98.97	32.87	32.35
	NK2	100	76.21	69.73	100	98.51	46.92	34.93
	NCFF excl 1	37.27	98.93	34.16	18.55	35.64	98.75	-
	NCFF excl 2	16.44	72.2	27.05	9.21	19.44	-	-
	MLP	98.98	98.34	98.12	99.29	99.11	99.05	97.32
normal testset 4	SNC	99.88	47.2	55.89	99.34	97.51	67.04	39.71
	linear	96.44	95.66	22.61	77.58	92.48	58.63	20.56
	NK1	100	46.94	98.87	99.99	98.46	33.87	33.49
	NK2	100	16.64	99.89	100	100	33.44	33.41
	NCFF excl 1	44.16	95.6	44.48	20.59	39.88	98.96	-
	NCFF excl 2	14.69	74.5	34.57	11.31	25.42	-	-
	MLP	98.93	99.1	98.98	99.05	99.01	99.07	97.99
NCFF 0-0	linear	92.95	91.58	0.75	76.03	80.19	0	0.43
	NK1	100	45.12	5.38	99.94	94.03	37.38	3.33
	NK2	100	26.95	21.23	100	1.5	79.9	0.38
	mlp	99.07	99.04	31.42	99.35	92.53	67.45	27.71
NCFF 5-2	linear	98.63	91.13	0	89.03	94.97	13.33	0
	NK1	32.29	100	0.03	99.69	100	17.73	0.01
	NK2	100	10.72	0	43.59	18.02	92.52	0
	mlp	0	99.34	2.49	99.71	99.87	99.93	2.49
NCFF 2-1	linear	91.69	93.41	57.2	85.97	97.07	0	55.72
	NK1	98.39	97.13	0	100	100	0.01	0
	NK2	11.71	100	12.59	1	4.68	99.99	0.51
	mlp	99.87	99.12	94.9	99.71	99.57	64.74	94.53
NCFF 3-1	linear	96.72	91.91	0	83.17	86.87	99.97	0
	NK1	30.27	100	0	100	100	2.39	0
	NK2	92.65	9.85	0	100	2.49	11.3	0
	mlp	99.91	97.51	0	99.07	99.82	99.94	0
NCFF 3-2	linear	93.36	98.02	0	86.93	89.82	92.88	0
	NK1	93.36	98.02	0	86.93	89.82	92.88	0
	NK2	100	100	90.05	11.62	0.17	-	0.13
	mlp	99.55	99.75	1.97	99.49	99.69	99.95	1.97
NCFF 7-3	linear	94.49	89.35	0	67.2	71.25	0.64	0
	NK1	7.91	100	6.38	64.47	99.88	6.17	0.27
	NK2	100	92.95	30.13	64.41	99.69	12.35	1.85
	mlp	98.38	96.93	18.09	67.31	96.62	98.57	17.62
NCFF 0-3	linear	98.17	97.79	0	80.65	80.35	28.11	0
	NK1	100	15.14	3.29	100	79.53	15.04	0.48

Table 13: Full results for BTCVAE on mpi3d

		hor	vert	size	obj h	shape	cam he	bg h	NCFF
normal testset 0	SNC	5.04	4.36	65.64	70.84	23.31	67.86	55.5	14.34
	linear	13.54	10.34	75.53	70.25	32.45	99.84	40.92	23.82
	NK1	-	-	95.74	-	75.89	-	-	73.37
	NK2	-	-	89.69	-	69.84	-	-	63.52
	NCFF excl 1	63.33	46.12	95.09	85.05	71.45	93.98	48.8	-
	NCFF excl 2	49.69	31.77	90.37	50.51	58.22	66	45.55	-
	MLP	85.59	66.92	98.79	99.44	86.87	0	100	86.06
normal testset 1	SNC	5.81	5.58	69.62	71.87	28.22	67.77	55.6	19.24
	linear	17.2	12.7	76.87	75.5	35.48	100	46.89	26.01
	NK1	-	-	96.83	-	78.42	-	-	76.24
	NK2	-	-	92.4	-	67.72	-	-	63.03
	NCFF excl 1	66.92	45.35	93.14	77.16	75.92	88.31	38.18	-
	NCFF excl 2	46.46	29.96	86.08	54.16	60.45	67.9	37.97	-
	MLP	86.95	67.02	98.92	99.73	86.77	0	100	86.1
normal testset 2	SNC	6.75	4.49	57.17	39.4	24.34	77.33	99.99	13.3
	linear	15.48	9.25	65.72	43.77	31.83	99.54	100	20.39
	NK1	-	-	95.76	-	71.56	-	-	68.87
	NK2	-	-	88.66	-	66.61	-	-	59.63
	NCFF excl 1	65.71	45.85	96.39	79.77	69.16	89.75	35.46	-
	NCFF excl 2	43.05	26.78	90.32	57.04	60.32	63.81	34.78	-
	MLP	86.18	65.38	97.93	99.38	81.62	0	0	80.38
normal testset 3	SNC	6.41	5.38	59.49	75.47	26.9	76.81	99.99	16.25
	linear	13.13	7.52	66.07	74.07	34.6	99.9	99.99	22.44
	NK1	-	-	95.29	-	74.1	-	-	70.9
	NK2	-	-	90.92	-	63.42	-	-	58.13
	NCFF excl 1	72.43	45.52	94.8	78.01	71.3	88.29	37.66	-
	NCFF excl 2	51.77	27.64	88.49	53.09	60.94	66.1	36.48	-
	MLP	87.72	69.01	98.36	99.92	82.72	0	0	81.69
normal testset 4	SNC	6.02	4.5	64.64	77.51	23.02	68.2	55.64	14.48
	linear	15.39	9.03	70.9	76.98	34.63	99.55	48.02	23.89
	NK1	-	-	88.74	-	57.13	-	-	51.63
	NK2	-	-	84.95	-	51.2	-	-	44.26
	NCFF excl 1	50.37	32.87	90.09	77.02	59.48	92.24	47.27	-
	NCFF excl 2	34.46	22.59	82.22	64.6	49.32	81.32	45.64	-
	MLP	67.18	48.54	93.79	98.46	68.25	0	99.9	65.03
NCFF 0-0	linear	15.62	9.01	97.71	40.08	0.03	100	53.47	0.01
	NK1	-	-	99.9	-	13.21	-	-	13.16
	NK2	-	-	98.67	-	25.11	-	-	24.7
	mlp	69.87	53.41	99.87	96.95	2.3	0	100	2.3
NCFF 1-4	linear	18.32	12.63	68.95	72.15	1.31	99.99	45.06	0
	NK1	-	-	92.13	-	34.81	-	-	31.18
	NK2	-	-	86.06	-	19.68	-	-	15.22
	mlp	54.29	40.48	93.83	99.66	13.79	0	100	11.74
NCFF 0-5	linear	6.51	10.99	93.31	38.7	20.3	100	44.35	20.3
	NK1	-	-	99.91	-	7.76	-	-	7.54
	NK2	-	-	87.87	-	20.56	-	-	17.48
	mlp	51.64	41.37	88.87	95.26	10.13	0	99.98	5.8
NCFF 1-3	linear	15.55	8.44	86.18	60.64	0	99.98	45.47	0
	NK1	-	-	99.45	-	2.32	-	-	2.31
	NK2	-	-	96.83	-	2.03	-	-	2
	mlp	85.38	64.75	99.97	99.69	0.53	0	98.46	0.53
NCFF 1-1	linear	12.76	8.45	78.44	74	0	99.18	44.43	0
	NK1	-	-	99.08	-	6.52	-	-	6.26
	NK2	-	-	92.84	-	7.63	-	-	7.18
	mlp	67.06	51.68	99.9	99.53	11.52	0	100	11.47
NCFF 0-2	linear	18.69	9.13	73.26	78.03	0	100	44.74	0
	NK1	-	-	97.34	-	3.4	-	-	3.17
	NK2	-	-	90.5	-	3.13	-	-	2.75
	mlp	89.86	70.4	98.49	99.76	0.24	0	99.99	0.2

Table 14: Full results for BVAE on mpi3d

		hor	vert	size	obj h	shape	cam he	bg h	NCFF
normal testset 0	SNC	5.5	5.4	66.06	73.8	25.93	94.84	54.61	17.56
	linear	17.63	11.68	77.79	76.17	36.94	99.71	48.3	28.21
	NK1	-	-	97.63	-	76.75	-	-	75.29
	NK2	-	-	93.09	-	61.52	-	-	57.66
	NCFF excl 1	72.83	44.89	94.73	72.82	79.24	91.12	52.08	-
	NCFF excl 2	48.69	28.54	87.99	53.5	59.74	89.22	51.57	-
	MLP	86.51	70.23	98.92	99.82	88.28	0	99.99	87.61
normal testset 1	SNC	5.93	4.41	66.69	78.82	27.22	74.31	52.44	17.38
	linear	16.87	9.24	76.29	88.91	34.92	100	45.3	25.93
	NK1	-	-	96.29	-	77.56	-	-	75.02
	NK2	-	-	91.29	-	69.5	-	-	64.16
	NCFF excl 1	66.69	46.28	94.35	72.25	76.04	93.58	72.27	-
	NCFF excl 2	45.33	31.59	89.01	62.91	63.88	74.5	70.98	-
	MLP	86.01	66.49	98.96	99.9	87.26	0	99.83	86.56
normal testset 2	SNC	5.85	5.49	59.77	57.65	22.92	87.11	36.2	13.82
	linear	15.54	14.62	71.78	73.45	34.85	99.89	36.64	24.08
	NK1	-	-	94.7	-	75.19	-	-	71.87
	NK2	-	-	89.73	-	66.43	-	-	60.42
	NCFF excl 1	67.6	41.56	95.67	89.18	74.21	88.93	80.82	-
	NCFF excl 2	47.32	32.03	90.58	81.41	64.72	71.63	76.35	-
	MLP	85.17	68.24	98.68	99.58	84.47	0	99.99	83.71
normal testset 3	SNC	5.73	5.02	62.93	72.61	27.47	73.22	55.5	17.16
	linear	15.54	14.62	71.78	73.45	34.85	99.89	36.64	24.08
	NK1	-	-	94.75	-	75.34	-	-	71.85
	NK2	-	-	89.73	-	66.43	-	-	60.42
	NCFF excl 1	67.6	41.56	95.67	89.18	74.21	88.93	80.82	-
	NCFF excl 2	47.32	32.03	90.58	81.41	64.72	71.63	76.35	-
	MLP	87.32	67.92	98.9	99.74	84.63	0	100	83.94
normal testset 4	SNC	6.35	4.65	56.47	62.55	27.04	58.91	40.52	15.17
	linear	14.15	8.5	64.75	97.15	33.86	99.08	44.15	21.45
	NK1	-	-	95.33	-	77.6	-	-	74.43
	NK2	-	-	91.22	-	65.77	-	-	60.22
	NCFF excl 1	70.52	47.31	96.17	84.19	73.69	98.45	76.71	-
	NCFF excl 2	54.99	34.46	92.72	60.88	59.78	85.66	65.59	-
	MLP	86.68	68.55	98.88	99.86	84.24	0	99.99	83.54
NCFF 0-0	linear	9.68	7.66	80.89	95.2	0.13	99.37	38.2	0
	NK1	-	-	99.27	-	13.01	-	-	12.83
	NK2	-	-	96.08	-	21.98	-	-	20.96
	mlp	75.16	55.28	99.86	98.63	20.23	0	100	20.12
NCFF 1-4	linear	16.5	6.34	42.34	91.57	5.06	99	99.85	0
	NK1	-	-	91.06	-	3.91	-	-	2.53
	NK2	-	-	83.4	-	11.88	-	-	8.49
	mlp	51.51	37.19	94.21	99.93	17.16	0	0	15.56
NCFF 0-5	linear	12.55	12.39	83.41	90.54	26.06	99.98	50.46	25.62
	NK1	-	-	87.32	-	7.82	-	-	6.06
	NK2	-	-	67.55	-	9.47	-	-	3.46
	mlp	56.62	47.98	93.39	99.97	21.4	0	100	15.56
NCFF 1-3	linear	16.35	10.47	67.32	81.67	0	99.36	57.25	0
	NK1	-	-	99.48	-	2.52	-	-	2.52
	NK2	-	-	99.08	-	1.49	-	-	1.46
	mlp	87.19	65.85	99.96	99.98	0.62	0	100	0.62
NCFF 1-1	linear	15.79	10.85	92.48	74.8	0	97.95	55.88	0
	NK1	-	-	99.54	-	17.17	-	-	-
	NK2	-	-	98.57	-	8.64	-	-	-
	mlp	73.84	56.43	99.98	99.77	7.93	0	99.7	7.91
NCFF 0-2	linear	16.22	10.56	70.52	80.97	0	99.94	46.48	0
	NK1	-	14	94.22	-	1.05	-	-	0.85
	NK2	-	-	86.32	-	0.9	-	-	0.59
	mlp	86.08	67.12	99.24	99.98	0.55	0	100	0.52

Table 15: Full results for FACTOR on mpi3d

		hor	vert	size	obj h	shape	cam he	bg h	NCFF
normal testset 0	SNC	6.09	5.05	64.12	40.64	24.57	68.75	47.16	15.79
	linear	12.66	8.85	63.69	52.95	36.11	99.1	36.79	23.72
	NK1	-	-	91.88	-	69.83	-	-	64.56
	NK2	-	-	91.43	-	67.03	-	-	61.58
	NCFF excl 1	55.3	34.02	90.71	78.27	66.5	83.96	60.66	-
	NCFF excl 2	37.06	21.26	90.09	62.37	65	61.36	59.61	-
	MLP	77.95	59.73	97.43	98.88	80.46	0	99.83	78.84
normal testset 1	SNC	5.27	4.45	56.76	69.91	27.07	75.57	52.86	15.24]
	linear	6.3	9.78	61.18	76.65	35.1	99.33	35.35	21.39
	NK1	-	-	93.82	-	71.77	-	-	67.55
	NK2	-	-	88.2	-	61.37	-	-	54.56
	NCFF excl 1	62.39	36.9	93.18	69.21	70.71	84.49	63.26	-
	NCFF excl 2	41.9	25.47	85.95	51.64	57.1	67.02	62.91	-
	MLP	80.17	62.57	98.12	99.51	83.14	0	99.88	82
normal testset 2	SNC	5.2	4.55	64.89	34.89	26	70.51	50.2	16.53
	linear	15.99	10.08	75.54	46.83	41.87	99.68	45.27	31.97
	NK1	-	-	95.09	-	77.2	-	-	73.99
	NK2	-	-	89.24	-	67.87	-	-	61.28
	NCFF excl 1	57.28	38.14	91.45	79.42	73.66	84.97	59.38	-
	NCFF excl 2	38.11	26.57	84.82	68.07	59.59	65.28	59.16	-
	MLP	79.81	60.92	98.25	98.73	84.47	0	99.79	83.31
normal testset 3	SNC	6.13	4.51	61.02	35.7	24.58	74.69	38.31	15.23
	linear	11.41	9.66	69.75	77.15	39.51	98.97	38.68	27.03
	NK1	-	-	93.52	-	73.47	-	-	69.42
	NK2	-	-	86.09	-	61.29	-	-	53.19
	NCFF excl 1	59.1	39.34	92.18	80.05	70.78	88.1	81.77	-
	NCFF excl 2	41.65	23.89	85.04	68.65	60.37	74.16	80.32	-
	MLP	81.2	62.05	97.99	99.09	82.61	0	99.13	81.28
normal testset 4	SNC	5.9	4.23	61.39	47.24	27.31	67.78	55.04	17.4
	linear	13.21	8.51	65.71	57.53	36.77	99.11	46.84	24.16
	NK1	-	-	93.74	-	72.98	-	-	68.61
	NK2	-	-	93.23	-	70.12	-	-	65.65
	NCFF excl 1	60.72	37.5	92.53	74	67.24	88.57	56.45	-
	NCFF excl 2	43.17	25.46	92.28	60.93	63.67	61.44	56.2	-
	MLP	80.62	61.44	97.49	98.91	80.69	0	99.98	79.16
NCFF 0-0	linear	16.06	8.9	71.63	30.92	6.94	97.43	51.25	4.3
	NK1	-	-	97.34	-	12.21	-	-	11.38
	NK2	-	-	97.48	-	15.76	-	-	15.18
	mlp	65	50.01	99.57	93.45	9.92	99.95	99.92	9.71
NCFF 1-4	linear	14.03	11.09	40.42	57.51	0.05	99.86	42.14	0
	NK1	-	-	99.61	-	25.21	-	-	23.16
	NK2	-	-	73.13	-	19.49	-	-	15.08
	mlp	46.42	34.33	93.18	98.03	29.25	0	99.99	26.63
NCFF 0-5	linear	11.64	7.73	92.4	64.68	8.43	99.85	52.75	8.43
	NK1	-	-	67.26	-	3.11	-	-	1.66
	NK2	-	-	83.91	-	2.95	-	-	2.7
	mlp	58.01	39.48	97.24	98.22	3.66	0	99.97	2.7
NCFF 1-3	linear	15.18	9.77	57.91	83.34	0	99.33	46.93	0
	NK1	-	-	97.52	-	0.92	-	-	0.91
	NK2	-	-	96.37	-	1.4	-	-	1.31
	mlp	79.48	60.41	99.89	99.94	0.55	0	99.99	0.55
NCFF 1-1	linear	17.13	11.69	74.08	76.06	0	98.12	46.27	0
	NK1	-	-	95.63	-	14.61	-	-	14.47
	NK2	-	-	85.16	-	17.84	-	-	16.97
	mlp	58.1	47.78	98.25	98.8	10.18	0	99.32	9.44
NCFF 0-2	linear	16.27	11.76	67.23	80.28	0.25	99.08	48.57	0
	NK1	-	15	93.75	-	1.76	-	-	1.51
	NK2	-	-	89.98	-	0.45	-	-	0.33
	mlp	78.8	59.93	98.58	99.75	0.62	0	99.98	0.55

Table 16: Full results for LEI on mpi3d

		hor	vert	size	obj h	cam height	bg h	shape	NCFF
normal testset 0	SNC	-	-	-	-	-	-	-	-
	linear	-	-	-	-	-	-	-	-
	NK1	-	-	-	-	-	-	-	-
	NK2	-	-	-	-	-	-	-	-
	NCFF excl 1	-	-	-	-	-	-	-	-
	NCFF excl 2	-	-	-	-	-	-	-	-
	MLP	2.5	2.5	99.9	100	96.2	100	100	96.1
normal testset 1	SNC	-	-	-	-	-	-	-	-
	linear	-	-	-	-	-	-	-	-
	NK1	-	-	-	-	-	-	-	-
	NK2	-	-	-	-	-	-	-	-
	NCFF excl 1	-	-	-	-	-	-	-	-
	NCFF excl 2	-	-	-	-	-	-	-	-
	MLP	3.426	2.746	99.918	99.988	95.945	100	100	95.88
normal testset 2	SNC	-	-	-	-	-	-	-	-
	linear	-	-	-	-	-	-	-	-
	NK1	-	-	-	-	-	-	-	-
	NK2	-	-	-	-	-	-	-	-
	NCFF excl 1	-	-	-	-	-	-	-	-
	NCFF excl 2	-	-	-	-	-	-	-	-
	MLP	2.477	3.001	99.918	99.994	96.434	100	100	96.37
normal testset 3	SNC	-	-	-	-	-	-	-	-
	linear	-	-	-	-	-	-	-	-
	NK1	-	-	-	-	-	-	-	-
	NK2	-	-	-	-	-	-	-	-
	NCFF excl 1	-	-	-	-	-	-	-	-
	NCFF excl 2	-	-	-	-	-	-	-	-
	MLP	2.702	2.336	99.935	99.988	95.555	100	100	95.51
normal testset 4	SNC	-	-	-	-	-	-	-	-
	linear	-	-	-	-	-	-	-	-
	NK1	-	-	-	-	-	-	-	-
	NK2	-	-	-	-	-	-	-	-
	NCFF excl 1	-	-	-	-	-	-	-	-
	NCFF excl 2	-	-	-	-	-	-	-	-
	MLP	2.65	2.457	99.748	99.988	95.09	100	100	94.87
NCFF 0-0	linear	-	-	-	-	-	-	-	-
	NK1	-	-	-	-	-	-	-	-
	NK2	-	-	-	-	-	-	-	-
	mlp	2.2	2.3	50.5	21.7	8.5	43.9	58.6	2.67
NCFF 1-4	linear	-	-	-	-	-	-	-	-
	NK1	-	-	-	-	-	-	-	-
	NK2	-	-	-	-	-	-	-	-
	mlp	2.5	0	96.6	53.9	11.6	99.6	100	11.4
NCFF 0-5	linear	-	-	-	-	-	-	-	-
	NK1	-	-	-	-	-	-	-	-
	NK2	-	-	-	-	-	-	-	-
	mlp	1.786	2.444	49.549	20.931	7.951	42.794	58.668	7.36
NCFF 1-3	linear	-	-	-	-	-	-	-	-
	NK1	-	-	-	-	-	-	-	-
	NK2	-	-	-	-	-	-	-	-
	mlp	2.316	2.516	51.524	19.622	9.767	42.052	57.677	3.06
NCFF 1-1	linear	-	-	-	-	-	-	-	-
	NK1	-	-	-	-	-	-	-	-
	NK2	-	-	-	-	-	-	-	-
	mlp	2.9	3.75	51.196	31.381	54.807	100	100	2.9
NCFF 0-2	linear	-	-	-	-	-	-	-	-
	NK1	-	16	-	-	-	-	-	-
	NK2	-	-	-	-	-	-	-	-
	mlp	2.389	2.519	59.978	21.817	6.456	45.272	58.735	2.68



Table 17: Full results for PVAE on mpi3d								
		hor	vert	size	obj h	cam height	bg h	shape
normal testset 0	SNC	10.31	6.69	59.61	20.7	85.2	79.62	21.03
	linear	13.61	5.03	74.11	30.09	100	99.84	28.68
	NK1	35.76	26.67	81.59	81.86	96.79	0	25.76
	NK2	21.55	16.02	72.49	79.75	91.13	46.91	23.22
	NCFF excl 1	25.58	13.43	77.83	88.29	100	97.47	40.07
	NCFF excl 2	24.24	11.76	75.65	83.22	98.03	79.15	-
	MLP	38.36	26.28	81.37	93.46	100	99.97	37.5
normal testset 1	SNC	9.2	6.89	59.86	23.5	99.46	89.06	20.94
	linear	13.81	4.39	72.6	30.92	100	98.54	28.38
	NK1	35.22	25.92	83.1	84.98	98.33	0	25.41
	NK2	-	-	-	-	-	-	-
	NCFF excl 1	22.6	10.79	79.67	85.59	100	97.58	39.44
	NCFF excl 2	21.1	8.91	78.62	79.52	98.33	82.01	-
	MLP	35.75	23.08	81.95	88.11	100	99.87	35.97
normal testset 2	SNC	7.47	4.07	69.29	20.73	95.12	89.54	21.84
	linear	12.42	4.52	75.2	32.37	100	98.98	28.73
	NK1	30.6	22.44	80.46	78.33	94.38	99.98	24.45
	NK2	-	-	-	-	-	-	-
	NCFF excl 1	21.08	13.06	76.98	81.63	100	91.97	37.33
	NCFF excl 2	18.89	11.11	75.78	80.24	99.02	79.49	-
	MLP	32.55	21.78	79.78	84.59	100	99.8	34.82
normal testset 3	SNC	8.26	5.38	66.09	23.87	99.91	99.97	21.07
	linear	11.58	5.26	73.16	34.27	100	99.4	27.87
	NK1	32.36	23.57	81.11	81.84	97.11	100	24.55
	NK2	-	-	-	-	-	-	-
	NCFF excl 1	23.88	11.58	78.3	82.85	100	85.69	37.52
	NCFF excl 2	18.98	10.62	77.25	81.59	99.17	61.82	-
	MLP	29.91	21	80.05	86	100	99.99	33.08
normal testset 4	SNC	7.21	4.49	72.89	21.37	99.93	66.75	24.29
	linear	12.72	5.04	74.3	32.78	100	70.82	29.77
	NK1	33.66	25	81.62	86.48	97.44	84.37	26.23
	NK2	-	-	-	-	-	-	-
	NCFF excl 1	19.12	11.63	80.55	90.2	100	77.85	36.97
	NCFF excl 2	18.01	9.97	77.48	90.18	98.97	75.15	-
	MLP	32.78	24.02	80.31	91.45	100	84.24	34.44
NCFF 0-0	linear	9.29	2.77	93.64	23.7	100	92.7	0
	NK1	22.4	18.86	94.57	59.36	98.51	98.15	0
	NK2	20.5	17.94	89.99	41.76	75.88	0	0
	mlp	21.86	18.07	98.32	70.95	100	99.57	0.06
NCFF 1-4	linear	12.39	5.12	60.38	38.19	100	97.27	0
	NK1	27.4	20.65	74.17	85.05	98.18	99.58	0
	NK2	-	-	-	-	-	-	-
	mlp	27.8	18.19	80.16	85.51	100	99.52	0.08
	-	-	-	-	-	-	-	-
NCFF 0-5	linear	10.58	4.2	88.16	31.08	100	99.21	0
	NK1	29.66	26.42	92.56	87.57	96.71	0	0
	NK2	20.04	16.86	89.64	53.77	94.58	76.37	0
	mlp	28.58	24.29	92.93	90.35	100	99.99	0.05
NCFF 1-3	linear	10.65	4.67	90.47	31.14	100	96.15	0
	NK1	25.45	17.84	95.56	81.02	94.3	98.87	0
	NK2	23.91	15.93	93	72.66	86.86	94.24	0
	mlp	28.4	17.32	97.09	86.12	100	98.58	0.95
NCFF 1-1	linear	11.27	4.79	84.14	31.4	100	98.36	0
	NK1	30.6	19.26	95.66	82.08	96.33	0	0
	NK2	19.99	11.86	97.83	56.9	82.33	98.11	0
	mlp	31.14	18.25	92.75	88.23	100	99.66	0.02
NCFF 0-2	linear	12.43	4.9	59.53	37.04	100	97.06	0
	NK1	28	20.49	74.03	84.77	98.28	99.58	0
	NK2	-	-	-	-	-	-	-
	mlp	29.03	18.11	79.58	86.12	100	99.48	0.05