17.8.24

DECONET(synthetic our data)-10L-4000-red4000-lr0.0001-mu100-initkaiming-datasets\_Z\_400x10\_ksparse=5%\_sig1vt\_supp=10

הרצה ראשונה על Z:

לא השתנה כלום כבר מהאפוק הראשון. אולי מספרים קטנים מידי?

mse: tensor(7.2667e-26, device='cuda:0')

normalize mse: tensor(9.6699e-15, device='cuda:0')

הרצה על X:

הוא כבר צריך אפוקים...

לומר לאיתי: כשאני משתמשת בדאטא (לדוג', התמונות של MNIST, ויקי הופכת אותן לוקטור – אבל שורה לוקטורעמודה , ואז השורה הבאה לקטור עמודה משורשר, וכך הלאה..  
בפונקציה  def measure\_x(self, x):

זה סבבה נכון? כי תאכלס בסוף הכל נכנס בתוך הכפל מטריצות לא משנה הסדר...

בנוסף: ה-Z\_HAT שיוצא בהרצה הוא בעל 2 ערכים בודדים ☹ אולי צריך להגידל את K\_SPPARSE כדי שלא יהיו ערכים כאלה קטנים ואז זה יעזור?

**להמשך**: את המדידת שגיאה: לא לשקול להוסיף את C, ולנרמל באנרגיה של X.. לא בZ כפי שעשיתי כעת

19.8.24

שגיאת שחזור Z, לאחר נרמול לפי X:

normalize mse: tensor(5.6551e-30, device='cuda:0', dtype=torch.float64)

mse: tensor(7.3068e-26, device='cuda:0')

שגיאת שחזור X:

mse: tensor(28.8954, device='cuda:0')

normalize mse: tensor(0.0023, device='cuda:0', dtype=torch.float64)

25.8.24

נריץ מחדש עם תיקון הדאטא לסיגמא הנכון ב-ZT+ תיקון ZT לk\_sparse אחדים + רעש עם הסיגמא של 0.01.

רוצה להריץ: Z,X,X\_AVG

מחדש: דאטא!

בדאטא החדש Z קטן בסדר גודל \ שניים מ-X.

שגיאות:

**Checking Z:**

tensor([[-0.0099, -0.1162, 0.0692, ..., -0.1227, -0.1122, 0.3836],

[ 0.1244, 0.1452, -0.0073, ..., 0.2773, 0.0756, -0.0105],

[-0.1327, -0.2261, 0.0739, ..., 0.0583, 0.0437, -0.2212],

...,

[-0.0667, -0.0775, -0.0890, ..., -0.0381, 0.2176, -0.0499],

[ 0.0756, 0.3291, 0.0733, ..., 0.0586, 0.0307, 0.0926],

[-0.1813, 0.1261, 0.0593, ..., 0.0277, -0.1773, 0.2438]],

device='cuda:0')

mse: tensor(0.0371, device='cuda:0')

normalize mse: tensor(**2.8649e-06**, device='cuda:0', dtype=torch.float64)

**Checking X:**

tensor([[ -5.5878, 20.8464, 19.7134, ..., 7.3324, 12.7848, 7.6807],

[ 6.7207, 7.7367, 9.9122, ..., -7.7346, 9.2630, -1.9940],

[ -5.5843, -18.9540, -6.7065, ..., -1.9787, -12.6090, 4.1030],

...,

[ -3.8949, -6.0755, -10.3604, ..., 13.6436, 6.9196, -6.8632],

[ 3.3614, 3.6713, 5.8867, ..., 5.1898, 8.5010, -0.5223],

[ 7.2559, 8.7075, -7.2732, ..., 4.5774, -4.1879, -0.8253]],

device='cuda:0')

mse: tensor(30.3121, device='cuda:0')

normalize mse: tensor(**0.0023**, device='cuda:0', dtype=torch.float64)

**Checking X-AVG:**

tensor([[ 1.0651, 6.8963, -11.2528, ..., 8.1992, -6.8748, 6.4329],

[-15.0040, 4.1642, -8.5207, ..., 6.8768, 3.8848, 0.7513],

[ 1.6362, 5.1501, -4.4835, ..., 3.5742, -5.9461, -8.3168],

...,

[-11.7274, -11.4207, -5.9959, ..., -0.1476, -3.3525, 0.8470],

[ -6.7985, 5.5769, 8.7663, ..., -16.4095, 12.9164, -4.4192],

[ -3.9339, 9.9201, 15.9312, ..., 4.1610, -3.0986, -0.3062]],

device='cuda:0')

mse: tensor(25.6252, device='cuda:0')

normalize mse: tensor(**0.0020**, device='cuda:0', dtype=torch.float64)

Run of Z:

Model Hyperparameters:

ambient\_dim=4000

measurements=1000

redundancy=40000

DECONET\_iterations=10

Step size 1 parameter=0.5

Step size 2 parameter=0.3

Type of initialization=kaiming

Beta parameter a=0.5

Beta parameter b=0.7

DECONET(

(phi): Parameter(40000, 4000)

(first\_activation): TruncationActivation()

(second\_activation): ShrinkageActivation()

)

training: 100%|█████████████████████████████████████| 55/55 [00:10<00:00, 5.06it/s, loss=0.0873]

validation: 100%|██████████████████████████████████████| 8/8 [00:03<00:00, 2.47it/s, mse=0.0821]

--------------------------------------

Average Train MSE = 0.087320

--------------------------------------

Average Test MSE = 0.082129

--------------------------------------

Epoch no. = 0

--------------------------------------

Generalization error = 0.005191

--------------------------------------

A= tensor([[-0.0077, 0.0322, -0.0068, ..., -0.0258, 0.0526, 0.0277],

[ 0.0040, -0.0067, -0.0335, ..., -0.0297, -0.0123, 0.0205],

[-0.0288, -0.0368, -0.0361, ..., 0.0320, -0.0113, 0.0255],

...,

[-0.0040, -0.0794, 0.0318, ..., 0.0178, 0.0638, -0.0073],

[-0.0208, 0.0356, 0.0116, ..., 0.0013, 0.0446, 0.0110],

[ 0.0054, -0.0430, 0.0200, ..., 0.0449, -0.0203, -0.0074]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0151, 0.0287, 0.0024, ..., 0.0270, -0.0105, -0.0105],

[-0.0028, 0.0142, -0.0211, ..., -0.0310, 0.0132, -0.0237],

[ 0.0341, -0.0593, 0.0037, ..., 0.0053, 0.0428, -0.0076],

...,

[-0.0083, -0.0061, 0.0216, ..., -0.0002, 0.0162, 0.0023],

[-0.0107, -0.0184, 0.0086, ..., -0.0079, 0.0033, -0.0020],

[-0.0158, 0.0026, -0.0398, ..., 0.0024, -0.0079, -0.0097]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Validation loss decreased (inf --> 0.005191). Saving model ...

training: 100%|█████████████████████████████████████| 55/55 [00:11<00:00, 4.96it/s, loss=0.0773]

validation: 100%|██████████████████████████████████████| 8/8 [00:03<00:00, 2.36it/s, mse=0.0745]

--------------------------------------

Average Train MSE = 0.077269

--------------------------------------

Average Test MSE = 0.074516

--------------------------------------

Epoch no. = 1

--------------------------------------

Generalization error = 0.002754

--------------------------------------

A= tensor([[-0.0077, 0.0322, -0.0068, ..., -0.0258, 0.0526, 0.0277],

[ 0.0040, -0.0067, -0.0335, ..., -0.0297, -0.0123, 0.0205],

[-0.0288, -0.0368, -0.0361, ..., 0.0320, -0.0113, 0.0255],

...,

[-0.0040, -0.0794, 0.0318, ..., 0.0178, 0.0638, -0.0073],

[-0.0208, 0.0356, 0.0116, ..., 0.0013, 0.0446, 0.0110],

[ 0.0054, -0.0430, 0.0200, ..., 0.0449, -0.0203, -0.0074]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0156, 0.0312, 0.0011, ..., 0.0269, -0.0126, -0.0124],

[-0.0043, 0.0148, -0.0219, ..., -0.0296, 0.0154, -0.0256],

[ 0.0363, -0.0612, 0.0043, ..., 0.0045, 0.0436, -0.0058],

...,

[-0.0102, -0.0075, 0.0225, ..., -0.0002, 0.0159, 0.0052],

[-0.0125, -0.0217, 0.0104, ..., -0.0086, 0.0050, -0.0021],

[-0.0172, 0.0020, -0.0390, ..., 0.0036, -0.0052, -0.0071]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Validation loss decreased (0.005191 --> 0.002754). Saving model ...

training: 100%|█████████████████████████████████████| 55/55 [00:10<00:00, 5.03it/s, loss=0.0694]

validation: 100%|██████████████████████████████████████| 8/8 [00:03<00:00, 2.54it/s, mse=0.0682]

--------------------------------------

Average Train MSE = 0.069355

--------------------------------------

Average Test MSE = 0.068150

--------------------------------------

Epoch no. = 2

--------------------------------------

Generalization error = 0.001205

--------------------------------------

A= tensor([[-0.0077, 0.0322, -0.0068, ..., -0.0258, 0.0526, 0.0277],

[ 0.0040, -0.0067, -0.0335, ..., -0.0297, -0.0123, 0.0205],

[-0.0288, -0.0368, -0.0361, ..., 0.0320, -0.0113, 0.0255],

...,

[-0.0040, -0.0794, 0.0318, ..., 0.0178, 0.0638, -0.0073],

[-0.0208, 0.0356, 0.0116, ..., 0.0013, 0.0446, 0.0110],

[ 0.0054, -0.0430, 0.0200, ..., 0.0449, -0.0203, -0.0074]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 1.6712e-02, 3.3738e-02, -3.6030e-04, ..., 2.6733e-02,

-1.4249e-02, -1.4062e-02],

[-5.0793e-03, 1.5522e-02, -2.2401e-02, ..., -2.8534e-02,

1.7384e-02, -2.7072e-02],

[ 3.8077e-02, -6.3184e-02, 4.0795e-03, ..., 3.4381e-03,

4.4577e-02, -4.7803e-03],

...,

[-1.2021e-02, -9.1479e-03, 2.3566e-02, ..., -4.7081e-05,

1.6106e-02, 7.0225e-03],

[-1.4715e-02, -2.4652e-02, 1.2678e-02, ..., -8.6622e-03,

6.4571e-03, -2.9257e-03],

[-1.8716e-02, 1.6015e-03, -3.8162e-02, ..., 4.4434e-03,

-2.5888e-03, -4.9127e-03]], device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Validation loss decreased (0.002754 --> 0.001205). Saving model ...

training: 100%|█████████████████████████████████████| 55/55 [00:10<00:00, 5.03it/s, loss=0.0628]

validation: 100%|██████████████████████████████████████| 8/8 [00:03<00:00, 2.50it/s, mse=0.0631]

--------------------------------------

Average Train MSE = 0.062784

--------------------------------------

Average Test MSE = 0.063093

--------------------------------------

Epoch no. = 3

--------------------------------------

Generalization error = 0.000310

--------------------------------------

A= tensor([[-0.0077, 0.0322, -0.0068, ..., -0.0258, 0.0526, 0.0277],

[ 0.0040, -0.0067, -0.0335, ..., -0.0297, -0.0123, 0.0205],

[-0.0288, -0.0368, -0.0361, ..., 0.0320, -0.0113, 0.0255],

...,

[-0.0040, -0.0794, 0.0318, ..., 0.0178, 0.0638, -0.0073],

[-0.0208, 0.0356, 0.0116, ..., 0.0013, 0.0446, 0.0110],

[ 0.0054, -0.0430, 0.0200, ..., 0.0449, -0.0203, -0.0074]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0174, 0.0356, -0.0017, ..., 0.0263, -0.0162, -0.0158],

[-0.0056, 0.0162, -0.0229, ..., -0.0279, 0.0193, -0.0284],

[ 0.0396, -0.0643, 0.0044, ..., 0.0024, 0.0452, -0.0037],

...,

[-0.0141, -0.0110, 0.0241, ..., -0.0001, 0.0165, 0.0088],

[-0.0169, -0.0276, 0.0142, ..., -0.0086, 0.0079, -0.0030],

[-0.0200, 0.0011, -0.0375, ..., 0.0052, -0.0005, -0.0029]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Validation loss decreased (0.001205 --> 0.000310). Saving model ...

training: 100%|█████████████████████████████████████| 55/55 [00:10<00:00, 5.01it/s, loss=0.0575]

validation: 100%|███████████████████████████████████████| 8/8 [00:03<00:00, 2.43it/s, mse=0.059]

--------------------------------------

Average Train MSE = 0.057544

--------------------------------------

Average Test MSE = 0.059039

--------------------------------------

Epoch no. = 4

--------------------------------------

Generalization error = 0.001495

--------------------------------------

A= tensor([[-0.0077, 0.0322, -0.0068, ..., -0.0258, 0.0526, 0.0277],

[ 0.0040, -0.0067, -0.0335, ..., -0.0297, -0.0123, 0.0205],

[-0.0288, -0.0368, -0.0361, ..., 0.0320, -0.0113, 0.0255],

...,

[-0.0040, -0.0794, 0.0318, ..., 0.0178, 0.0638, -0.0073],

[-0.0208, 0.0356, 0.0116, ..., 0.0013, 0.0446, 0.0110],

[ 0.0054, -0.0430, 0.0200, ..., 0.0449, -0.0203, -0.0074]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0181, 0.0374, -0.0028, ..., 0.0257, -0.0180, -0.0172],

[-0.0064, 0.0166, -0.0233, ..., -0.0270, 0.0211, -0.0293],

[ 0.0415, -0.0657, 0.0045, ..., 0.0010, 0.0461, -0.0030],

...,

[-0.0159, -0.0129, 0.0244, ..., 0.0002, 0.0164, 0.0100],

[-0.0190, -0.0302, 0.0160, ..., -0.0086, 0.0093, -0.0036],

[-0.0208, 0.0011, -0.0367, ..., 0.0059, 0.0019, -0.0011]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Patience used: 1 out of 5

training: 100%|█████████████████████████████████████| 55/55 [00:10<00:00, 5.01it/s, loss=0.0532]

validation: 100%|██████████████████████████████████████| 8/8 [00:03<00:00, 2.37it/s, mse=0.0557]

--------------------------------------

Average Train MSE = 0.053227

--------------------------------------

Average Test MSE = 0.055675

--------------------------------------

Epoch no. = 5

--------------------------------------

Generalization error = 0.002448

--------------------------------------

A= tensor([[-0.0077, 0.0322, -0.0068, ..., -0.0258, 0.0526, 0.0277],

[ 0.0040, -0.0067, -0.0335, ..., -0.0297, -0.0123, 0.0205],

[-0.0288, -0.0368, -0.0361, ..., 0.0320, -0.0113, 0.0255],

...,

[-0.0040, -0.0794, 0.0318, ..., 0.0178, 0.0638, -0.0073],

[-0.0208, 0.0356, 0.0116, ..., 0.0013, 0.0446, 0.0110],

[ 0.0054, -0.0430, 0.0200, ..., 0.0449, -0.0203, -0.0074]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 1.8789e-02, 3.9408e-02, -3.6698e-03, ..., 2.5016e-02,

-1.9661e-02, -1.8441e-02],

[-7.0835e-03, 1.7077e-02, -2.3445e-02, ..., -2.6318e-02,

2.2636e-02, -3.0268e-02],

[ 4.2756e-02, -6.6637e-02, 4.1180e-03, ..., -4.1408e-04,

4.7122e-02, -2.3310e-03],

...,

[-1.7695e-02, -1.4402e-02, 2.5017e-02, ..., 2.2158e-04,

1.6767e-02, 1.1362e-02],

[-2.0960e-02, -3.3004e-02, 1.7712e-02, ..., -9.1316e-03,

1.0209e-02, -4.0096e-03],

[-2.1743e-02, 9.4004e-04, -3.5740e-02, ..., 6.5762e-03,

3.9024e-03, 8.7454e-05]], device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Patience used: 2 out of 5

training: 100%|█████████████████████████████████████| 55/55 [00:10<00:00, 5.02it/s, loss=0.0497]

validation: 100%|██████████████████████████████████████| 8/8 [00:03<00:00, 2.56it/s, mse=0.0529]

--------------------------------------

Average Train MSE = 0.049700

--------------------------------------

Average Test MSE = 0.052892

--------------------------------------

Epoch no. = 6

--------------------------------------

Generalization error = 0.003192

--------------------------------------

A= tensor([[-0.0077, 0.0322, -0.0068, ..., -0.0258, 0.0526, 0.0277],

[ 0.0040, -0.0067, -0.0335, ..., -0.0297, -0.0123, 0.0205],

[-0.0288, -0.0368, -0.0361, ..., 0.0320, -0.0113, 0.0255],

...,

[-0.0040, -0.0794, 0.0318, ..., 0.0178, 0.0638, -0.0073],

[-0.0208, 0.0356, 0.0116, ..., 0.0013, 0.0446, 0.0110],

[ 0.0054, -0.0430, 0.0200, ..., 0.0449, -0.0203, -0.0074]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0192, 0.0409, -0.0046, ..., 0.0244, -0.0212, -0.0195],

[-0.0071, 0.0174, -0.0237, ..., -0.0263, 0.0241, -0.0312],

[ 0.0444, -0.0676, 0.0035, ..., -0.0014, 0.0481, -0.0014],

...,

[-0.0195, -0.0157, 0.0251, ..., 0.0003, 0.0173, 0.0126],

[-0.0229, -0.0350, 0.0193, ..., -0.0095, 0.0114, -0.0042],

[-0.0230, 0.0007, -0.0348, ..., 0.0073, 0.0055, 0.0014]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Patience used: 3 out of 5

training: 100%|█████████████████████████████████████| 55/55 [00:11<00:00, 4.91it/s, loss=0.0467]

validation: 100%|██████████████████████████████████████| 8/8 [00:03<00:00, 2.32it/s, mse=0.0506]

--------------------------------------

Average Train MSE = 0.046734

--------------------------------------

Average Test MSE = 0.050594

--------------------------------------

Epoch no. = 7

--------------------------------------

Generalization error = 0.003860

--------------------------------------

A= tensor([[-0.0077, 0.0322, -0.0068, ..., -0.0258, 0.0526, 0.0277],

[ 0.0040, -0.0067, -0.0335, ..., -0.0297, -0.0123, 0.0205],

[-0.0288, -0.0368, -0.0361, ..., 0.0320, -0.0113, 0.0255],

...,

[-0.0040, -0.0794, 0.0318, ..., 0.0178, 0.0638, -0.0073],

[-0.0208, 0.0356, 0.0116, ..., 0.0013, 0.0446, 0.0110],

[ 0.0054, -0.0430, 0.0200, ..., 0.0449, -0.0203, -0.0074]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0196, 0.0422, -0.0050, ..., 0.0233, -0.0228, -0.0205],

[-0.0074, 0.0177, -0.0235, ..., -0.0260, 0.0255, -0.0317],

[ 0.0458, -0.0680, 0.0033, ..., -0.0028, 0.0488, -0.0005],

...,

[-0.0213, -0.0172, 0.0251, ..., 0.0002, 0.0174, 0.0137],

[-0.0243, -0.0372, 0.0206, ..., -0.0099, 0.0121, -0.0041],

[-0.0238, 0.0007, -0.0339, ..., 0.0075, 0.0071, 0.0022]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Patience used: 4 out of 5

training: 100%|█████████████████████████████████████| 55/55 [00:10<00:00, 5.00it/s, loss=0.0443]

validation: 100%|██████████████████████████████████████| 8/8 [00:03<00:00, 2.46it/s, mse=0.0486]

--------------------------------------

Average Train MSE = 0.044250

--------------------------------------

Average Test MSE = 0.048636

--------------------------------------

Epoch no. = 8

--------------------------------------

Generalization error = 0.004386

--------------------------------------

A= tensor([[-0.0077, 0.0322, -0.0068, ..., -0.0258, 0.0526, 0.0277],

[ 0.0040, -0.0067, -0.0335, ..., -0.0297, -0.0123, 0.0205],

[-0.0288, -0.0368, -0.0361, ..., 0.0320, -0.0113, 0.0255],

...,

[-0.0040, -0.0794, 0.0318, ..., 0.0178, 0.0638, -0.0073],

[-0.0208, 0.0356, 0.0116, ..., 0.0013, 0.0446, 0.0110],

[ 0.0054, -0.0430, 0.0200, ..., 0.0449, -0.0203, -0.0074]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 1.9758e-02, 4.3778e-02, -5.5456e-03, ..., 2.2485e-02,

-2.4151e-02, -2.1695e-02],

[-7.7758e-03, 1.8015e-02, -2.3554e-02, ..., -2.5710e-02,

2.6305e-02, -3.2083e-02],

[ 4.6814e-02, -6.8846e-02, 2.8851e-03, ..., -3.8078e-03,

4.9971e-02, -7.7873e-05],

...,

[-2.3109e-02, -1.8136e-02, 2.5409e-02, ..., 5.3936e-04,

1.7779e-02, 1.4774e-02],

[-2.6130e-02, -3.9139e-02, 2.1677e-02, ..., -1.0589e-02,

1.3224e-02, -4.0544e-03],

[-2.4624e-02, 6.3152e-04, -3.2842e-02, ..., 7.7898e-03,

8.5285e-03, 3.2797e-03]], device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Patience used: 5 out of 5

Part of X:

--------------------------------------

A= tensor([[-0.0337, -0.0565, -0.0594, ..., 0.0128, 0.0096, -0.0342],

[ 0.0192, 0.0262, -0.0068, ..., -0.0084, -0.0703, -0.0247],

[ 0.0076, 0.0126, 0.0174, ..., -0.0166, -0.0177, -0.0823],

...,

[-0.0470, 0.0542, 0.0055, ..., 0.0460, -0.0113, -0.0051],

[ 0.0052, 0.0569, -0.0114, ..., 0.0470, 0.0398, 0.0392],

[-0.0278, 0.0094, 0.0081, ..., -0.0008, 0.0239, -0.0150]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0153, -0.0535, -0.0493, ..., 0.0936, -0.0481, 0.0529],

[ 0.0262, -0.1161, -0.0397, ..., -0.0075, 0.0614, 0.0244],

[ 0.0636, -0.0673, 0.0246, ..., 0.0113, 0.0804, 0.0405],

...,

[-0.0626, -0.0950, 0.0299, ..., 0.0591, -0.0820, -0.0044],

[ 0.0753, -0.0803, -0.0718, ..., 0.0788, -0.0708, 0.0839],

[-0.0758, -0.0939, 0.0883, ..., -0.0634, -0.0076, -0.0843]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Patience used: 2 out of 5

training: 100%|██████████████████████████████████████████████| 55/55 [00:10<00:00, 5.01it/s, loss=50.4]

validation: 100%|███████████████████████████████████████████████| 8/8 [00:03<00:00, 2.57it/s, mse=50.7]

--------------------------------------

Average Train MSE = 50.445726

--------------------------------------

Average Test MSE = 50.701930

--------------------------------------

Epoch no. = 17

--------------------------------------

Generalization error = 0.256204

--------------------------------------

A= tensor([[-0.0337, -0.0565, -0.0594, ..., 0.0128, 0.0096, -0.0342],

[ 0.0192, 0.0262, -0.0068, ..., -0.0084, -0.0703, -0.0247],

[ 0.0076, 0.0126, 0.0174, ..., -0.0166, -0.0177, -0.0823],

...,

[-0.0470, 0.0542, 0.0055, ..., 0.0460, -0.0113, -0.0051],

[ 0.0052, 0.0569, -0.0114, ..., 0.0470, 0.0398, 0.0392],

[-0.0278, 0.0094, 0.0081, ..., -0.0008, 0.0239, -0.0150]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0155, -0.0552, -0.0527, ..., 0.0975, -0.0510, 0.0566],

[ 0.0288, -0.1204, -0.0443, ..., -0.0067, 0.0633, 0.0248],

[ 0.0676, -0.0715, 0.0249, ..., 0.0131, 0.0832, 0.0402],

...,

[-0.0661, -0.0996, 0.0337, ..., 0.0622, -0.0848, -0.0059],

[ 0.0786, -0.0829, -0.0758, ..., 0.0831, -0.0740, 0.0882],

[-0.0800, -0.0989, 0.0923, ..., -0.0657, -0.0073, -0.0882]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Patience used: 3 out of 5

training: 100%|██████████████████████████████████████████████| 55/55 [00:11<00:00, 4.97it/s, loss=48.8]

validation: 100%|███████████████████████████████████████████████| 8/8 [00:03<00:00, 2.47it/s, mse=49.1]

--------------------------------------

Average Train MSE = 48.802912

--------------------------------------

Average Test MSE = 49.075002

--------------------------------------

Epoch no. = 18

--------------------------------------

Generalization error = 0.272090

--------------------------------------

A= tensor([[-0.0337, -0.0565, -0.0594, ..., 0.0128, 0.0096, -0.0342],

[ 0.0192, 0.0262, -0.0068, ..., -0.0084, -0.0703, -0.0247],

[ 0.0076, 0.0126, 0.0174, ..., -0.0166, -0.0177, -0.0823],

...,

[-0.0470, 0.0542, 0.0055, ..., 0.0460, -0.0113, -0.0051],

[ 0.0052, 0.0569, -0.0114, ..., 0.0470, 0.0398, 0.0392],

[-0.0278, 0.0094, 0.0081, ..., -0.0008, 0.0239, -0.0150]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0157, -0.0571, -0.0562, ..., 0.1011, -0.0539, 0.0601],

[ 0.0311, -0.1245, -0.0489, ..., -0.0057, 0.0651, 0.0252],

[ 0.0715, -0.0755, 0.0250, ..., 0.0146, 0.0857, 0.0401],

...,

[-0.0693, -0.1041, 0.0373, ..., 0.0649, -0.0879, -0.0076],

[ 0.0816, -0.0851, -0.0796, ..., 0.0870, -0.0771, 0.0922],

[-0.0839, -0.1037, 0.0963, ..., -0.0679, -0.0072, -0.0920]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Patience used: 4 out of 5

training: 100%|██████████████████████████████████████████████| 55/55 [00:10<00:00, 5.03it/s, loss=47.4]

validation: 100%|███████████████████████████████████████████████| 8/8 [00:03<00:00, 2.43it/s, mse=47.7]

--------------------------------------

Average Train MSE = 47.375564

--------------------------------------

Average Test MSE = 47.749811

--------------------------------------

Epoch no. = 19

--------------------------------------

Generalization error = 0.374247

--------------------------------------

A= tensor([[-0.0337, -0.0565, -0.0594, ..., 0.0128, 0.0096, -0.0342],

[ 0.0192, 0.0262, -0.0068, ..., -0.0084, -0.0703, -0.0247],

[ 0.0076, 0.0126, 0.0174, ..., -0.0166, -0.0177, -0.0823],

...,

[-0.0470, 0.0542, 0.0055, ..., 0.0460, -0.0113, -0.0051],

[ 0.0052, 0.0569, -0.0114, ..., 0.0470, 0.0398, 0.0392],

[-0.0278, 0.0094, 0.0081, ..., -0.0008, 0.0239, -0.0150]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0160, -0.0584, -0.0595, ..., 0.1048, -0.0567, 0.0638],

[ 0.0341, -0.1284, -0.0535, ..., -0.0055, 0.0671, 0.0252],

[ 0.0756, -0.0794, 0.0248, ..., 0.0157, 0.0882, 0.0399],

...,

[-0.0723, -0.1083, 0.0408, ..., 0.0678, -0.0905, -0.0087],

[ 0.0848, -0.0873, -0.0833, ..., 0.0910, -0.0800, 0.0963],

[-0.0879, -0.1084, 0.1001, ..., -0.0700, -0.0071, -0.0957]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Patience used: 5 out of 5

X-AVG

Model Hyperparameters:

ambient\_dim=4000

measurements=1000

redundancy=40000

DECONET\_iterations=10

Step size 1 parameter=0.5

Step size 2 parameter=0.3

Type of initialization=kaiming

Beta parameter a=0.5

Beta parameter b=0.7

DECONET(

(phi): Parameter(40000, 4000)

(first\_activation): TruncationActivation()

(second\_activation): ShrinkageActivation()

)

training: 100%|██████████████████████████████████████████| 55/55 [00:11<00:00, 4.92it/s, loss=1.12e+02]

validation: 100%|████████████████████████████████████████████| 8/8 [00:03<00:00, 2.55it/s, mse=1.1e+02]

--------------------------------------

Average Train MSE = 111.520253

--------------------------------------

Average Test MSE = 110.121840

--------------------------------------

Epoch no. = 0

--------------------------------------

Generalization error = 1.398414

--------------------------------------

A= tensor([[-0.0245, -0.0132, 0.0184, ..., 0.0080, -0.0241, 0.0338],

[ 0.0341, -0.0482, -0.0084, ..., 0.0069, 0.0040, 0.0609],

[-0.0245, 0.0399, 0.0705, ..., 0.0024, 0.0134, -0.0222],

...,

[-0.0047, 0.0285, -0.0451, ..., 0.0493, 0.0584, -0.0404],

[ 0.0256, -0.0036, 0.0230, ..., 0.0007, -0.0268, -0.0407],

[-0.0181, -0.0022, -0.0705, ..., 0.0588, -0.0144, 0.0185]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[-6.2711e-03, 4.1424e-05, 1.7847e-02, ..., 1.9021e-02,

2.3262e-02, -8.2587e-03],

[ 1.1852e-02, 2.0183e-02, -1.4214e-03, ..., 6.1916e-04,

-1.0655e-02, -1.5962e-02],

[-1.4662e-02, 1.1036e-02, -1.2097e-02, ..., 3.5196e-02,

-9.5416e-03, 1.9230e-02],

...,

[ 2.5427e-02, 5.6405e-03, -1.9126e-02, ..., -2.7957e-02,

2.7399e-02, -6.7156e-03],

[ 7.9355e-03, -7.3354e-03, 3.9946e-02, ..., -2.5965e-02,

-1.3333e-02, 9.3739e-03],

[-1.7102e-02, -8.0857e-04, -1.4781e-02, ..., 3.7215e-03,

-1.5844e-02, -3.9169e-02]], device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Validation loss decreased (inf --> 1.398414). Saving model ...

training: 100%|██████████████████████████████████████████| 55/55 [00:10<00:00, 5.01it/s, loss=1.05e+02]

validation: 100%|███████████████████████████████████████████| 8/8 [00:03<00:00, 2.39it/s, mse=1.04e+02]

--------------------------------------

Average Train MSE = 105.338776

--------------------------------------

Average Test MSE = 103.971646

--------------------------------------

Epoch no. = 1

--------------------------------------

Generalization error = 1.367130

--------------------------------------

A= tensor([[-0.0245, -0.0132, 0.0184, ..., 0.0080, -0.0241, 0.0338],

[ 0.0341, -0.0482, -0.0084, ..., 0.0069, 0.0040, 0.0609],

[-0.0245, 0.0399, 0.0705, ..., 0.0024, 0.0134, -0.0222],

...,

[-0.0047, 0.0285, -0.0451, ..., 0.0493, 0.0584, -0.0404],

[ 0.0256, -0.0036, 0.0230, ..., 0.0007, -0.0268, -0.0407],

[-0.0181, -0.0022, -0.0705, ..., 0.0588, -0.0144, 0.0185]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[-0.0119, 0.0053, 0.0231, ..., 0.0197, 0.0286, -0.0030],

[ 0.0161, 0.0199, -0.0068, ..., 0.0030, -0.0160, -0.0211],

[-0.0094, 0.0060, -0.0096, ..., 0.0299, -0.0149, 0.0183],

...,

[ 0.0272, 0.0063, -0.0145, ..., -0.0330, 0.0329, -0.0012],

[ 0.0134, -0.0117, 0.0451, ..., -0.0304, -0.0169, 0.0041],

[-0.0225, 0.0046, -0.0105, ..., -0.0003, -0.0112, -0.0403]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Validation loss decreased (1.398414 --> 1.367130). Saving model ...

training: 100%|██████████████████████████████████████████████| 55/55 [00:11<00:00, 4.98it/s, loss=99.5]

validation: 100%|███████████████████████████████████████████████| 8/8 [00:03<00:00, 2.54it/s, mse=97.9]

--------------------------------------

Average Train MSE = 99.546641

--------------------------------------

Average Test MSE = 97.913426

--------------------------------------

Epoch no. = 2

--------------------------------------

Generalization error = 1.633215

--------------------------------------

A= tensor([[-0.0245, -0.0132, 0.0184, ..., 0.0080, -0.0241, 0.0338],

[ 0.0341, -0.0482, -0.0084, ..., 0.0069, 0.0040, 0.0609],

[-0.0245, 0.0399, 0.0705, ..., 0.0024, 0.0134, -0.0222],

...,

[-0.0047, 0.0285, -0.0451, ..., 0.0493, 0.0584, -0.0404],

[ 0.0256, -0.0036, 0.0230, ..., 0.0007, -0.0268, -0.0407],

[-0.0181, -0.0022, -0.0705, ..., 0.0588, -0.0144, 0.0185]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[-0.0172, 0.0102, 0.0283, ..., 0.0216, 0.0339, 0.0019],

[ 0.0194, 0.0206, -0.0121, ..., 0.0065, -0.0211, -0.0259],

[-0.0044, 0.0013, -0.0074, ..., 0.0247, -0.0205, 0.0185],

...,

[ 0.0299, 0.0062, -0.0101, ..., -0.0381, 0.0384, 0.0041],

[ 0.0187, -0.0157, 0.0500, ..., -0.0348, -0.0208, -0.0011],

[-0.0277, 0.0098, -0.0063, ..., -0.0043, -0.0068, -0.0432]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Patience used: 1 out of 5

training: 100%|██████████████████████████████████████████████| 55/55 [00:11<00:00, 4.99it/s, loss=94.1]

validation: 100%|███████████████████████████████████████████████| 8/8 [00:03<00:00, 2.47it/s, mse=92.5]

--------------------------------------

Average Train MSE = 94.112628

--------------------------------------

Average Test MSE = 92.478744

--------------------------------------

Epoch no. = 3

--------------------------------------

Generalization error = 1.633884

--------------------------------------

A= tensor([[-0.0245, -0.0132, 0.0184, ..., 0.0080, -0.0241, 0.0338],

[ 0.0341, -0.0482, -0.0084, ..., 0.0069, 0.0040, 0.0609],

[-0.0245, 0.0399, 0.0705, ..., 0.0024, 0.0134, -0.0222],

...,

[-0.0047, 0.0285, -0.0451, ..., 0.0493, 0.0584, -0.0404],

[ 0.0256, -0.0036, 0.0230, ..., 0.0007, -0.0268, -0.0407],

[-0.0181, -0.0022, -0.0705, ..., 0.0588, -0.0144, 0.0185]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[-0.0223, 0.0149, 0.0335, ..., 0.0224, 0.0392, 0.0066],

[ 0.0223, 0.0206, -0.0170, ..., 0.0096, -0.0262, -0.0307],

[ 0.0003, -0.0030, -0.0041, ..., 0.0195, -0.0257, 0.0189],

...,

[ 0.0327, 0.0064, -0.0060, ..., -0.0430, 0.0439, 0.0091],

[ 0.0239, -0.0191, 0.0548, ..., -0.0390, -0.0253, -0.0060],

[-0.0325, 0.0147, -0.0022, ..., -0.0083, -0.0025, -0.0459]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Patience used: 2 out of 5

training: 100%|██████████████████████████████████████████████| 55/55 [00:11<00:00, 4.93it/s, loss=88.9]

validation: 100%|███████████████████████████████████████████████| 8/8 [00:03<00:00, 2.42it/s, mse=87.7]

--------------------------------------

Average Train MSE = 88.923827

--------------------------------------

Average Test MSE = 87.668812

--------------------------------------

Epoch no. = 4

--------------------------------------

Generalization error = 1.255015

--------------------------------------

A= tensor([[-0.0245, -0.0132, 0.0184, ..., 0.0080, -0.0241, 0.0338],

[ 0.0341, -0.0482, -0.0084, ..., 0.0069, 0.0040, 0.0609],

[-0.0245, 0.0399, 0.0705, ..., 0.0024, 0.0134, -0.0222],

...,

[-0.0047, 0.0285, -0.0451, ..., 0.0493, 0.0584, -0.0404],

[ 0.0256, -0.0036, 0.0230, ..., 0.0007, -0.0268, -0.0407],

[-0.0181, -0.0022, -0.0705, ..., 0.0588, -0.0144, 0.0185]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[-0.0272, 0.0191, 0.0384, ..., 0.0228, 0.0442, 0.0111],

[ 0.0243, 0.0213, -0.0217, ..., 0.0134, -0.0312, -0.0351],

[ 0.0046, -0.0069, -0.0006, ..., 0.0143, -0.0308, 0.0210],

...,

[ 0.0362, 0.0065, -0.0021, ..., -0.0480, 0.0492, 0.0140],

[ 0.0290, -0.0217, 0.0595, ..., -0.0432, -0.0298, -0.0110],

[-0.0367, 0.0195, 0.0020, ..., -0.0123, 0.0020, -0.0487]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Validation loss decreased (1.367130 --> 1.255015). Saving model ...

training: 100%|██████████████████████████████████████████████| 55/55 [00:10<00:00, 5.05it/s, loss=84.1]

validation: 100%|███████████████████████████████████████████████| 8/8 [00:03<00:00, 2.52it/s, mse=83.1]

--------------------------------------

Average Train MSE = 84.104343

--------------------------------------

Average Test MSE = 83.085803

--------------------------------------

Epoch no. = 5

--------------------------------------

Generalization error = 1.018540

--------------------------------------

A= tensor([[-0.0245, -0.0132, 0.0184, ..., 0.0080, -0.0241, 0.0338],

[ 0.0341, -0.0482, -0.0084, ..., 0.0069, 0.0040, 0.0609],

[-0.0245, 0.0399, 0.0705, ..., 0.0024, 0.0134, -0.0222],

...,

[-0.0047, 0.0285, -0.0451, ..., 0.0493, 0.0584, -0.0404],

[ 0.0256, -0.0036, 0.0230, ..., 0.0007, -0.0268, -0.0407],

[-0.0181, -0.0022, -0.0705, ..., 0.0588, -0.0144, 0.0185]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[-0.0319, 0.0231, 0.0436, ..., 0.0223, 0.0491, 0.0152],

[ 0.0261, 0.0216, -0.0264, ..., 0.0176, -0.0362, -0.0393],

[ 0.0087, -0.0107, 0.0029, ..., 0.0094, -0.0356, 0.0238],

...,

[ 0.0399, 0.0065, 0.0021, ..., -0.0531, 0.0544, 0.0185],

[ 0.0338, -0.0235, 0.0644, ..., -0.0474, -0.0337, -0.0158],

[-0.0407, 0.0241, 0.0061, ..., -0.0164, 0.0061, -0.0518]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Validation loss decreased (1.255015 --> 1.018540). Saving model ...

training: 100%|██████████████████████████████████████████████| 55/55 [00:11<00:00, 4.91it/s, loss=79.6]

validation: 100%|███████████████████████████████████████████████| 8/8 [00:03<00:00, 2.51it/s, mse=78.4]

--------------------------------------

Average Train MSE = 79.557189

--------------------------------------

Average Test MSE = 78.437745

--------------------------------------

Epoch no. = 6

--------------------------------------

Generalization error = 1.119444

--------------------------------------

A= tensor([[-0.0245, -0.0132, 0.0184, ..., 0.0080, -0.0241, 0.0338],

[ 0.0341, -0.0482, -0.0084, ..., 0.0069, 0.0040, 0.0609],

[-0.0245, 0.0399, 0.0705, ..., 0.0024, 0.0134, -0.0222],

...,

[-0.0047, 0.0285, -0.0451, ..., 0.0493, 0.0584, -0.0404],

[ 0.0256, -0.0036, 0.0230, ..., 0.0007, -0.0268, -0.0407],

[-0.0181, -0.0022, -0.0705, ..., 0.0588, -0.0144, 0.0185]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[-0.0364, 0.0268, 0.0486, ..., 0.0220, 0.0540, 0.0193],

[ 0.0277, 0.0218, -0.0307, ..., 0.0220, -0.0410, -0.0435],

[ 0.0127, -0.0142, 0.0067, ..., 0.0044, -0.0405, 0.0267],

...,

[ 0.0438, 0.0068, 0.0061, ..., -0.0581, 0.0595, 0.0230],

[ 0.0386, -0.0248, 0.0693, ..., -0.0519, -0.0378, -0.0204],

[-0.0444, 0.0284, 0.0102, ..., -0.0205, 0.0100, -0.0545]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Patience used: 1 out of 5

training: 100%|██████████████████████████████████████████████| 55/55 [00:11<00:00, 4.99it/s, loss=75.1]

validation: 100%|███████████████████████████████████████████████| 8/8 [00:03<00:00, 2.44it/s, mse=74.2]

--------------------------------------

Average Train MSE = 75.078695

--------------------------------------

Average Test MSE = 74.182698

--------------------------------------

Epoch no. = 7

--------------------------------------

Generalization error = 0.895997

--------------------------------------

A= tensor([[-0.0245, -0.0132, 0.0184, ..., 0.0080, -0.0241, 0.0338],

[ 0.0341, -0.0482, -0.0084, ..., 0.0069, 0.0040, 0.0609],

[-0.0245, 0.0399, 0.0705, ..., 0.0024, 0.0134, -0.0222],

...,

[-0.0047, 0.0285, -0.0451, ..., 0.0493, 0.0584, -0.0404],

[ 0.0256, -0.0036, 0.0230, ..., 0.0007, -0.0268, -0.0407],

[-0.0181, -0.0022, -0.0705, ..., 0.0588, -0.0144, 0.0185]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[-0.0407, 0.0301, 0.0538, ..., 0.0208, 0.0587, 0.0233],

[ 0.0292, 0.0218, -0.0349, ..., 0.0258, -0.0458, -0.0475],

[ 0.0164, -0.0174, 0.0108, ..., -0.0005, -0.0451, 0.0293],

...,

[ 0.0475, 0.0072, 0.0103, ..., -0.0630, 0.0645, 0.0274],

[ 0.0432, -0.0256, 0.0739, ..., -0.0560, -0.0423, -0.0248],

[-0.0479, 0.0324, 0.0139, ..., -0.0244, 0.0138, -0.0572]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Validation loss decreased (1.018540 --> 0.895997). Saving model ...

training: 100%|██████████████████████████████████████████████| 55/55 [00:10<00:00, 5.02it/s, loss=71.1]

validation: 100%|███████████████████████████████████████████████| 8/8 [00:03<00:00, 2.47it/s, mse=70.2]

--------------------------------------

Average Train MSE = 71.078581

--------------------------------------

Average Test MSE = 70.249172

--------------------------------------

Epoch no. = 8

--------------------------------------

Generalization error = 0.829409

--------------------------------------

A= tensor([[-0.0245, -0.0132, 0.0184, ..., 0.0080, -0.0241, 0.0338],

[ 0.0341, -0.0482, -0.0084, ..., 0.0069, 0.0040, 0.0609],

[-0.0245, 0.0399, 0.0705, ..., 0.0024, 0.0134, -0.0222],

...,

[-0.0047, 0.0285, -0.0451, ..., 0.0493, 0.0584, -0.0404],

[ 0.0256, -0.0036, 0.0230, ..., 0.0007, -0.0268, -0.0407],

[-0.0181, -0.0022, -0.0705, ..., 0.0588, -0.0144, 0.0185]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[-0.0448, 0.0334, 0.0588, ..., 0.0193, 0.0634, 0.0270],

[ 0.0300, 0.0216, -0.0391, ..., 0.0302, -0.0505, -0.0515],

[ 0.0200, -0.0207, 0.0145, ..., -0.0051, -0.0497, 0.0325],

...,

[ 0.0515, 0.0075, 0.0146, ..., -0.0678, 0.0695, 0.0315],

[ 0.0477, -0.0262, 0.0788, ..., -0.0604, -0.0463, -0.0290],

[-0.0513, 0.0364, 0.0174, ..., -0.0284, 0.0176, -0.0596]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Validation loss decreased (0.895997 --> 0.829409). Saving model ...

training: 100%|██████████████████████████████████████████████| 55/55 [00:11<00:00, 4.97it/s, loss=67.3]

validation: 100%|███████████████████████████████████████████████| 8/8 [00:03<00:00, 2.24it/s, mse=66.7]

--------------------------------------

Average Train MSE = 67.275154

--------------------------------------

Average Test MSE = 66.710107

--------------------------------------

Epoch no. = 9

--------------------------------------

Generalization error = 0.565047

--------------------------------------

A= tensor([[-0.0245, -0.0132, 0.0184, ..., 0.0080, -0.0241, 0.0338],

[ 0.0341, -0.0482, -0.0084, ..., 0.0069, 0.0040, 0.0609],

[-0.0245, 0.0399, 0.0705, ..., 0.0024, 0.0134, -0.0222],

...,

[-0.0047, 0.0285, -0.0451, ..., 0.0493, 0.0584, -0.0404],

[ 0.0256, -0.0036, 0.0230, ..., 0.0007, -0.0268, -0.0407],

[-0.0181, -0.0022, -0.0705, ..., 0.0588, -0.0144, 0.0185]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[-0.0489, 0.0365, 0.0639, ..., 0.0176, 0.0679, 0.0306],

[ 0.0312, 0.0209, -0.0430, ..., 0.0340, -0.0552, -0.0553],

[ 0.0235, -0.0237, 0.0188, ..., -0.0097, -0.0542, 0.0352],

...,

[ 0.0554, 0.0080, 0.0188, ..., -0.0725, 0.0743, 0.0355],

[ 0.0521, -0.0263, 0.0836, ..., -0.0646, -0.0505, -0.0330],

[-0.0544, 0.0403, 0.0212, ..., -0.0323, 0.0212, -0.0618]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Validation loss decreased (0.829409 --> 0.565047). Saving model ...

training: 100%|██████████████████████████████████████████████| 55/55 [00:10<00:00, 5.01it/s, loss=63.9]

validation: 100%|███████████████████████████████████████████████| 8/8 [00:03<00:00, 2.45it/s, mse=63.1]

--------------------------------------

Average Train MSE = 63.939225

--------------------------------------

Average Test MSE = 63.131251

--------------------------------------

Epoch no. = 10

--------------------------------------

Generalization error = 0.807974

--------------------------------------

A= tensor([[-0.0245, -0.0132, 0.0184, ..., 0.0080, -0.0241, 0.0338],

[ 0.0341, -0.0482, -0.0084, ..., 0.0069, 0.0040, 0.0609],

[-0.0245, 0.0399, 0.0705, ..., 0.0024, 0.0134, -0.0222],

...,

[-0.0047, 0.0285, -0.0451, ..., 0.0493, 0.0584, -0.0404],

[ 0.0256, -0.0036, 0.0230, ..., 0.0007, -0.0268, -0.0407],

[-0.0181, -0.0022, -0.0705, ..., 0.0588, -0.0144, 0.0185]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[-0.0527, 0.0394, 0.0688, ..., 0.0155, 0.0724, 0.0341],

[ 0.0319, 0.0203, -0.0469, ..., 0.0377, -0.0596, -0.0590],

[ 0.0267, -0.0264, 0.0225, ..., -0.0141, -0.0586, 0.0381],

...,

[ 0.0594, 0.0086, 0.0228, ..., -0.0771, 0.0789, 0.0391],

[ 0.0563, -0.0262, 0.0882, ..., -0.0685, -0.0544, -0.0369],

[-0.0575, 0.0438, 0.0246, ..., -0.0359, 0.0251, -0.0635]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Patience used: 1 out of 5

training: 100%|██████████████████████████████████████████████| 55/55 [00:10<00:00, 5.01it/s, loss=60.6]

validation: 100%|███████████████████████████████████████████████| 8/8 [00:03<00:00, 2.48it/s, mse=60.1]

--------------------------------------

Average Train MSE = 60.621345

--------------------------------------

Average Test MSE = 60.082717

--------------------------------------

Epoch no. = 11

--------------------------------------

Generalization error = 0.538628

--------------------------------------

A= tensor([[-0.0245, -0.0132, 0.0184, ..., 0.0080, -0.0241, 0.0338],

[ 0.0341, -0.0482, -0.0084, ..., 0.0069, 0.0040, 0.0609],

[-0.0245, 0.0399, 0.0705, ..., 0.0024, 0.0134, -0.0222],

...,

[-0.0047, 0.0285, -0.0451, ..., 0.0493, 0.0584, -0.0404],

[ 0.0256, -0.0036, 0.0230, ..., 0.0007, -0.0268, -0.0407],

[-0.0181, -0.0022, -0.0705, ..., 0.0588, -0.0144, 0.0185]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[-0.0565, 0.0421, 0.0737, ..., 0.0134, 0.0768, 0.0374],

[ 0.0324, 0.0196, -0.0506, ..., 0.0416, -0.0641, -0.0627],

[ 0.0299, -0.0290, 0.0265, ..., -0.0184, -0.0628, 0.0403],

...,

[ 0.0634, 0.0090, 0.0268, ..., -0.0815, 0.0835, 0.0429],

[ 0.0605, -0.0257, 0.0928, ..., -0.0724, -0.0585, -0.0406],

[-0.0605, 0.0472, 0.0276, ..., -0.0391, 0.0287, -0.0657]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Validation loss decreased (0.565047 --> 0.538628). Saving model ...

training: 100%|██████████████████████████████████████████████| 55/55 [00:11<00:00, 4.86it/s, loss=57.6]

validation: 100%|███████████████████████████████████████████████| 8/8 [00:03<00:00, 2.28it/s, mse=57.1]

--------------------------------------

Average Train MSE = 57.610692

--------------------------------------

Average Test MSE = 57.093945

--------------------------------------

Epoch no. = 12

--------------------------------------

Generalization error = 0.516747

--------------------------------------

A= tensor([[-0.0245, -0.0132, 0.0184, ..., 0.0080, -0.0241, 0.0338],

[ 0.0341, -0.0482, -0.0084, ..., 0.0069, 0.0040, 0.0609],

[-0.0245, 0.0399, 0.0705, ..., 0.0024, 0.0134, -0.0222],

...,

[-0.0047, 0.0285, -0.0451, ..., 0.0493, 0.0584, -0.0404],

[ 0.0256, -0.0036, 0.0230, ..., 0.0007, -0.0268, -0.0407],

[-0.0181, -0.0022, -0.0705, ..., 0.0588, -0.0144, 0.0185]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[-0.0601, 0.0448, 0.0784, ..., 0.0114, 0.0812, 0.0406],

[ 0.0331, 0.0183, -0.0542, ..., 0.0449, -0.0685, -0.0662],

[ 0.0330, -0.0316, 0.0300, ..., -0.0225, -0.0672, 0.0424],

...,

[ 0.0669, 0.0101, 0.0308, ..., -0.0856, 0.0881, 0.0464],

[ 0.0644, -0.0255, 0.0974, ..., -0.0761, -0.0623, -0.0442],

[-0.0633, 0.0504, 0.0309, ..., -0.0425, 0.0322, -0.0669]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Validation loss decreased (0.538628 --> 0.516747). Saving model ...

training: 100%|██████████████████████████████████████████████| 55/55 [00:11<00:00, 4.92it/s, loss=54.9]

validation: 100%|███████████████████████████████████████████████| 8/8 [00:03<00:00, 2.45it/s, mse=54.6]

--------------------------------------

Average Train MSE = 54.933750

--------------------------------------

Average Test MSE = 54.551890

--------------------------------------

Epoch no. = 13

--------------------------------------

Generalization error = 0.381860

--------------------------------------

A= tensor([[-0.0245, -0.0132, 0.0184, ..., 0.0080, -0.0241, 0.0338],

[ 0.0341, -0.0482, -0.0084, ..., 0.0069, 0.0040, 0.0609],

[-0.0245, 0.0399, 0.0705, ..., 0.0024, 0.0134, -0.0222],

...,

[-0.0047, 0.0285, -0.0451, ..., 0.0493, 0.0584, -0.0404],

[ 0.0256, -0.0036, 0.0230, ..., 0.0007, -0.0268, -0.0407],

[-0.0181, -0.0022, -0.0705, ..., 0.0588, -0.0144, 0.0185]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[-0.0636, 0.0472, 0.0831, ..., 0.0095, 0.0854, 0.0436],

[ 0.0337, 0.0173, -0.0578, ..., 0.0484, -0.0728, -0.0697],

[ 0.0360, -0.0339, 0.0332, ..., -0.0264, -0.0713, 0.0440],

...,

[ 0.0704, 0.0108, 0.0347, ..., -0.0897, 0.0926, 0.0498],

[ 0.0684, -0.0251, 0.1018, ..., -0.0797, -0.0665, -0.0476],

[-0.0661, 0.0535, 0.0340, ..., -0.0456, 0.0356, -0.0685]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Validation loss decreased (0.516747 --> 0.381860). Saving model ...

training: 100%|██████████████████████████████████████████████| 55/55 [00:11<00:00, 4.91it/s, loss=52.4]

validation: 100%|███████████████████████████████████████████████| 8/8 [00:03<00:00, 2.46it/s, mse=52.2]

--------------------------------------

Average Train MSE = 52.420650

--------------------------------------

Average Test MSE = 52.200255

--------------------------------------

Epoch no. = 14

--------------------------------------

Generalization error = 0.220395

--------------------------------------

A= tensor([[-0.0245, -0.0132, 0.0184, ..., 0.0080, -0.0241, 0.0338],

[ 0.0341, -0.0482, -0.0084, ..., 0.0069, 0.0040, 0.0609],

[-0.0245, 0.0399, 0.0705, ..., 0.0024, 0.0134, -0.0222],

...,

[-0.0047, 0.0285, -0.0451, ..., 0.0493, 0.0584, -0.0404],

[ 0.0256, -0.0036, 0.0230, ..., 0.0007, -0.0268, -0.0407],

[-0.0181, -0.0022, -0.0705, ..., 0.0588, -0.0144, 0.0185]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[-0.0670, 0.0496, 0.0875, ..., 0.0070, 0.0895, 0.0465],

[ 0.0341, 0.0161, -0.0612, ..., 0.0518, -0.0770, -0.0730],

[ 0.0387, -0.0361, 0.0367, ..., -0.0303, -0.0751, 0.0460],

...,

[ 0.0739, 0.0115, 0.0384, ..., -0.0937, 0.0969, 0.0531],

[ 0.0721, -0.0249, 0.1059, ..., -0.0829, -0.0705, -0.0508],

[-0.0688, 0.0564, 0.0370, ..., -0.0487, 0.0390, -0.0699]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Validation loss decreased (0.381860 --> 0.220395). Saving model ...

training: 100%|██████████████████████████████████████████████| 55/55 [00:11<00:00, 4.94it/s, loss=50.2]

validation: 100%|███████████████████████████████████████████████| 8/8 [00:03<00:00, 2.51it/s, mse=49.9]

--------------------------------------

Average Train MSE = 50.232568

--------------------------------------

Average Test MSE = 49.937409

--------------------------------------

Epoch no. = 15

--------------------------------------

Generalization error = 0.295159

--------------------------------------

A= tensor([[-0.0245, -0.0132, 0.0184, ..., 0.0080, -0.0241, 0.0338],

[ 0.0341, -0.0482, -0.0084, ..., 0.0069, 0.0040, 0.0609],

[-0.0245, 0.0399, 0.0705, ..., 0.0024, 0.0134, -0.0222],

...,

[-0.0047, 0.0285, -0.0451, ..., 0.0493, 0.0584, -0.0404],

[ 0.0256, -0.0036, 0.0230, ..., 0.0007, -0.0268, -0.0407],

[-0.0181, -0.0022, -0.0705, ..., 0.0588, -0.0144, 0.0185]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[-0.0703, 0.0518, 0.0919, ..., 0.0048, 0.0936, 0.0493],

[ 0.0344, 0.0151, -0.0646, ..., 0.0551, -0.0811, -0.0762],

[ 0.0415, -0.0381, 0.0399, ..., -0.0341, -0.0790, 0.0475],

...,

[ 0.0772, 0.0124, 0.0421, ..., -0.0975, 0.1012, 0.0562],

[ 0.0758, -0.0243, 0.1100, ..., -0.0863, -0.0744, -0.0538],

[-0.0714, 0.0592, 0.0399, ..., -0.0516, 0.0422, -0.0712]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Patience used: 1 out of 5

training: 100%|██████████████████████████████████████████████| 55/55 [00:11<00:00, 5.00it/s, loss=48.3]

validation: 100%|███████████████████████████████████████████████| 8/8 [00:03<00:00, 2.50it/s, mse=48.2]

--------------------------------------

Average Train MSE = 48.253328

--------------------------------------

Average Test MSE = 48.194637

--------------------------------------

Epoch no. = 16

--------------------------------------

Generalization error = 0.058690

--------------------------------------

A= tensor([[-0.0245, -0.0132, 0.0184, ..., 0.0080, -0.0241, 0.0338],

[ 0.0341, -0.0482, -0.0084, ..., 0.0069, 0.0040, 0.0609],

[-0.0245, 0.0399, 0.0705, ..., 0.0024, 0.0134, -0.0222],

...,

[-0.0047, 0.0285, -0.0451, ..., 0.0493, 0.0584, -0.0404],

[ 0.0256, -0.0036, 0.0230, ..., 0.0007, -0.0268, -0.0407],

[-0.0181, -0.0022, -0.0705, ..., 0.0588, -0.0144, 0.0185]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[-0.0735, 0.0539, 0.0963, ..., 0.0027, 0.0975, 0.0520],

[ 0.0349, 0.0140, -0.0679, ..., 0.0580, -0.0852, -0.0793],

[ 0.0442, -0.0402, 0.0428, ..., -0.0378, -0.0830, 0.0491],

...,

[ 0.0804, 0.0134, 0.0457, ..., -0.1012, 0.1054, 0.0593],

[ 0.0794, -0.0238, 0.1140, ..., -0.0894, -0.0783, -0.0569],

[-0.0741, 0.0619, 0.0427, ..., -0.0545, 0.0452, -0.0729]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Validation loss decreased (0.220395 --> 0.058690). Saving model ...

training: 100%|██████████████████████████████████████████████| 55/55 [00:11<00:00, 4.99it/s, loss=46.5]

validation: 100%|███████████████████████████████████████████████| 8/8 [00:03<00:00, 2.49it/s, mse=46.5]

--------------------------------------

Average Train MSE = 46.531295

--------------------------------------

Average Test MSE = 46.490480

--------------------------------------

Epoch no. = 17

--------------------------------------

Generalization error = 0.040814

--------------------------------------

A= tensor([[-0.0245, -0.0132, 0.0184, ..., 0.0080, -0.0241, 0.0338],

[ 0.0341, -0.0482, -0.0084, ..., 0.0069, 0.0040, 0.0609],

[-0.0245, 0.0399, 0.0705, ..., 0.0024, 0.0134, -0.0222],

...,

[-0.0047, 0.0285, -0.0451, ..., 0.0493, 0.0584, -0.0404],

[ 0.0256, -0.0036, 0.0230, ..., 0.0007, -0.0268, -0.0407],

[-0.0181, -0.0022, -0.0705, ..., 0.0588, -0.0144, 0.0185]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[-0.0766, 0.0558, 0.1004, ..., 0.0005, 0.1015, 0.0547],

[ 0.0352, 0.0129, -0.0711, ..., 0.0610, -0.0892, -0.0821],

[ 0.0468, -0.0421, 0.0456, ..., -0.0414, -0.0868, 0.0503],

...,

[ 0.0835, 0.0140, 0.0491, ..., -0.1048, 0.1096, 0.0622],

[ 0.0830, -0.0232, 0.1179, ..., -0.0924, -0.0821, -0.0597],

[-0.0766, 0.0645, 0.0456, ..., -0.0574, 0.0484, -0.0742]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Validation loss decreased (0.058690 --> 0.040814). Saving model ...

training: 100%|██████████████████████████████████████████████| 55/55 [00:10<00:00, 5.02it/s, loss=45.0]

validation: 100%|███████████████████████████████████████████████| 8/8 [00:03<00:00, 2.45it/s, mse=45.1]

--------------------------------------

Average Train MSE = 45.001912

--------------------------------------

Average Test MSE = 45.119596

--------------------------------------

Epoch no. = 18

--------------------------------------

Generalization error = 0.117685

--------------------------------------

A= tensor([[-0.0245, -0.0132, 0.0184, ..., 0.0080, -0.0241, 0.0338],

[ 0.0341, -0.0482, -0.0084, ..., 0.0069, 0.0040, 0.0609],

[-0.0245, 0.0399, 0.0705, ..., 0.0024, 0.0134, -0.0222],

...,

[-0.0047, 0.0285, -0.0451, ..., 0.0493, 0.0584, -0.0404],

[ 0.0256, -0.0036, 0.0230, ..., 0.0007, -0.0268, -0.0407],

[-0.0181, -0.0022, -0.0705, ..., 0.0588, -0.0144, 0.0185]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[-0.0796, 0.0578, 0.1044, ..., -0.0013, 0.1052, 0.0572],

[ 0.0357, 0.0119, -0.0742, ..., 0.0638, -0.0930, -0.0849],

[ 0.0493, -0.0438, 0.0485, ..., -0.0447, -0.0904, 0.0521],

...,

[ 0.0866, 0.0151, 0.0524, ..., -0.1083, 0.1136, 0.0651],

[ 0.0864, -0.0232, 0.1216, ..., -0.0952, -0.0863, -0.0625],

[-0.0790, 0.0670, 0.0482, ..., -0.0600, 0.0514, -0.0758]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Patience used: 1 out of 5

training: 100%|██████████████████████████████████████████████| 55/55 [00:11<00:00, 4.98it/s, loss=43.7]

validation: 100%|███████████████████████████████████████████████| 8/8 [00:03<00:00, 2.46it/s, mse=43.7]

--------------------------------------

Average Train MSE = 43.692904

--------------------------------------

Average Test MSE = 43.732006

--------------------------------------

Epoch no. = 19

--------------------------------------

Generalization error = 0.039102

--------------------------------------

A= tensor([[-0.0245, -0.0132, 0.0184, ..., 0.0080, -0.0241, 0.0338],

[ 0.0341, -0.0482, -0.0084, ..., 0.0069, 0.0040, 0.0609],

[-0.0245, 0.0399, 0.0705, ..., 0.0024, 0.0134, -0.0222],

...,

[-0.0047, 0.0285, -0.0451, ..., 0.0493, 0.0584, -0.0404],

[ 0.0256, -0.0036, 0.0230, ..., 0.0007, -0.0268, -0.0407],

[-0.0181, -0.0022, -0.0705, ..., 0.0588, -0.0144, 0.0185]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[-0.0826, 0.0599, 0.1083, ..., -0.0028, 0.1089, 0.0598],

[ 0.0360, 0.0108, -0.0772, ..., 0.0667, -0.0967, -0.0877],

[ 0.0518, -0.0458, 0.0508, ..., -0.0481, -0.0940, 0.0530],

...,

[ 0.0898, 0.0158, 0.0557, ..., -0.1117, 0.1175, 0.0679],

[ 0.0898, -0.0224, 0.1253, ..., -0.0982, -0.0900, -0.0653],

[-0.0814, 0.0693, 0.0507, ..., -0.0624, 0.0542, -0.0772]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Validation loss decreased (0.040814 --> 0.039102). Saving model ...

training: 100%|██████████████████████████████████████████████| 55/55 [00:11<00:00, 4.94it/s, loss=42.6]

validation: 100%|███████████████████████████████████████████████| 8/8 [00:03<00:00, 2.49it/s, mse=42.9]

--------------------------------------

Average Train MSE = 42.613549

--------------------------------------

Average Test MSE = 42.893098

--------------------------------------

Epoch no. = 20

--------------------------------------

Generalization error = 0.279549

--------------------------------------

A= tensor([[-0.0245, -0.0132, 0.0184, ..., 0.0080, -0.0241, 0.0338],

[ 0.0341, -0.0482, -0.0084, ..., 0.0069, 0.0040, 0.0609],

[-0.0245, 0.0399, 0.0705, ..., 0.0024, 0.0134, -0.0222],

...,

[-0.0047, 0.0285, -0.0451, ..., 0.0493, 0.0584, -0.0404],

[ 0.0256, -0.0036, 0.0230, ..., 0.0007, -0.0268, -0.0407],

[-0.0181, -0.0022, -0.0705, ..., 0.0588, -0.0144, 0.0185]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[-0.0857, 0.0618, 0.1122, ..., -0.0042, 0.1126, 0.0623],

[ 0.0365, 0.0096, -0.0802, ..., 0.0693, -0.1004, -0.0903],

[ 0.0542, -0.0476, 0.0532, ..., -0.0514, -0.0975, 0.0544],

...,

[ 0.0926, 0.0167, 0.0592, ..., -0.1149, 0.1215, 0.0708],

[ 0.0931, -0.0220, 0.1289, ..., -0.1008, -0.0938, -0.0679],

[-0.0840, 0.0716, 0.0534, ..., -0.0649, 0.0573, -0.0786]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Patience used: 1 out of 5

training: 100%|██████████████████████████████████████████████| 55/55 [00:11<00:00, 4.98it/s, loss=41.8]

validation: 100%|███████████████████████████████████████████████| 8/8 [00:03<00:00, 2.48it/s, mse=42.0]

--------------------------------------

Average Train MSE = 41.764696

--------------------------------------

Average Test MSE = 42.026185

--------------------------------------

Epoch no. = 21

--------------------------------------

Generalization error = 0.261489

--------------------------------------

A= tensor([[-0.0245, -0.0132, 0.0184, ..., 0.0080, -0.0241, 0.0338],

[ 0.0341, -0.0482, -0.0084, ..., 0.0069, 0.0040, 0.0609],

[-0.0245, 0.0399, 0.0705, ..., 0.0024, 0.0134, -0.0222],

...,

[-0.0047, 0.0285, -0.0451, ..., 0.0493, 0.0584, -0.0404],

[ 0.0256, -0.0036, 0.0230, ..., 0.0007, -0.0268, -0.0407],

[-0.0181, -0.0022, -0.0705, ..., 0.0588, -0.0144, 0.0185]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[-0.0885, 0.0637, 0.1159, ..., -0.0058, 0.1161, 0.0647],

[ 0.0367, 0.0085, -0.0832, ..., 0.0721, -0.1040, -0.0931],

[ 0.0567, -0.0493, 0.0554, ..., -0.0546, -0.1011, 0.0555],

...,

[ 0.0958, 0.0177, 0.0624, ..., -0.1183, 0.1252, 0.0736],

[ 0.0963, -0.0214, 0.1326, ..., -0.1035, -0.0975, -0.0704],

[-0.0865, 0.0739, 0.0559, ..., -0.0672, 0.0598, -0.0803]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Patience used: 2 out of 5

training: 100%|██████████████████████████████████████████████| 55/55 [00:11<00:00, 4.98it/s, loss=41.1]

validation: 100%|███████████████████████████████████████████████| 8/8 [00:03<00:00, 2.49it/s, mse=41.5]

--------------------------------------

Average Train MSE = 41.123116

--------------------------------------

Average Test MSE = 41.484670

--------------------------------------

Epoch no. = 22

--------------------------------------

Generalization error = 0.361554

--------------------------------------

A= tensor([[-0.0245, -0.0132, 0.0184, ..., 0.0080, -0.0241, 0.0338],

[ 0.0341, -0.0482, -0.0084, ..., 0.0069, 0.0040, 0.0609],

[-0.0245, 0.0399, 0.0705, ..., 0.0024, 0.0134, -0.0222],

...,

[-0.0047, 0.0285, -0.0451, ..., 0.0493, 0.0584, -0.0404],

[ 0.0256, -0.0036, 0.0230, ..., 0.0007, -0.0268, -0.0407],

[-0.0181, -0.0022, -0.0705, ..., 0.0588, -0.0144, 0.0185]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[-0.0914, 0.0656, 0.1196, ..., -0.0069, 0.1196, 0.0671],

[ 0.0369, 0.0074, -0.0861, ..., 0.0746, -0.1075, -0.0957],

[ 0.0590, -0.0511, 0.0577, ..., -0.0578, -0.1045, 0.0567],

...,

[ 0.0986, 0.0182, 0.0655, ..., -0.1214, 0.1289, 0.0763],

[ 0.0996, -0.0209, 0.1360, ..., -0.1060, -0.1014, -0.0729],

[-0.0889, 0.0760, 0.0586, ..., -0.0696, 0.0625, -0.0816]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Patience used: 3 out of 5

training: 100%|██████████████████████████████████████████████| 55/55 [00:11<00:00, 4.98it/s, loss=40.6]

validation: 100%|███████████████████████████████████████████████| 8/8 [00:03<00:00, 2.49it/s, mse=40.9]

--------------------------------------

Average Train MSE = 40.570908

--------------------------------------

Average Test MSE = 40.922961

--------------------------------------

Epoch no. = 23

--------------------------------------

Generalization error = 0.352052

--------------------------------------

A= tensor([[-0.0245, -0.0132, 0.0184, ..., 0.0080, -0.0241, 0.0338],

[ 0.0341, -0.0482, -0.0084, ..., 0.0069, 0.0040, 0.0609],

[-0.0245, 0.0399, 0.0705, ..., 0.0024, 0.0134, -0.0222],

...,

[-0.0047, 0.0285, -0.0451, ..., 0.0493, 0.0584, -0.0404],

[ 0.0256, -0.0036, 0.0230, ..., 0.0007, -0.0268, -0.0407],

[-0.0181, -0.0022, -0.0705, ..., 0.0588, -0.0144, 0.0185]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[-0.0943, 0.0675, 0.1231, ..., -0.0080, 0.1230, 0.0695],

[ 0.0371, 0.0061, -0.0889, ..., 0.0772, -0.1109, -0.0983],

[ 0.0613, -0.0528, 0.0595, ..., -0.0609, -0.1080, 0.0576],

...,

[ 0.1016, 0.0191, 0.0686, ..., -0.1247, 0.1325, 0.0788],

[ 0.1028, -0.0202, 0.1396, ..., -0.1086, -0.1051, -0.0753],

[-0.0915, 0.0784, 0.0613, ..., -0.0721, 0.0653, -0.0836]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Patience used: 4 out of 5

training: 100%|██████████████████████████████████████████████| 55/55 [00:11<00:00, 4.98it/s, loss=40.2]

validation: 100%|███████████████████████████████████████████████| 8/8 [00:03<00:00, 2.54it/s, mse=40.5]

--------------------------------------

Average Train MSE = 40.238386

--------------------------------------

Average Test MSE = 40.548130

--------------------------------------

Epoch no. = 24

--------------------------------------

Generalization error = 0.309744

--------------------------------------

A= tensor([[-0.0245, -0.0132, 0.0184, ..., 0.0080, -0.0241, 0.0338],

[ 0.0341, -0.0482, -0.0084, ..., 0.0069, 0.0040, 0.0609],

[-0.0245, 0.0399, 0.0705, ..., 0.0024, 0.0134, -0.0222],

...,

[-0.0047, 0.0285, -0.0451, ..., 0.0493, 0.0584, -0.0404],

[ 0.0256, -0.0036, 0.0230, ..., 0.0007, -0.0268, -0.0407],

[-0.0181, -0.0022, -0.0705, ..., 0.0588, -0.0144, 0.0185]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[-0.0972, 0.0695, 0.1266, ..., -0.0094, 0.1265, 0.0720],

[ 0.0373, 0.0047, -0.0918, ..., 0.0797, -0.1144, -0.1007],

[ 0.0638, -0.0543, 0.0613, ..., -0.0640, -0.1115, 0.0589],

...,

[ 0.1044, 0.0197, 0.0717, ..., -0.1279, 0.1361, 0.0813],

[ 0.1060, -0.0201, 0.1429, ..., -0.1110, -0.1089, -0.0776],

[-0.0939, 0.0807, 0.0637, ..., -0.0744, 0.0678, -0.0854]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Patience used: 5 out of 5

4.10

ההרצות עד כה היו עם סיגמא=0.01 ב-Zt, ולא הכפלנו את Ct באף מספר.

כעת:

נרצה בהרצות הבאות **לשנות את סיגמא**: להכפיל ב-2, 10, וכך גם לחלק.

**+** אותו דבר עבור המטריצה Ct. – **זה שקול ללשנות את הsupport של v' מ-10 למספרים שלהלן. נעשה זאת!**

כך, להריץ מחדש על Z שיוצא.

לתעד:

MSE, normalized MSE

לשמור את המטריצות הנלמדות (כמובן) ולבחון בטסט את התפלגות הערכים אחרי ולפני האימון, בכל אחד מהסניורים. (להשלים בקובץ 'לאיתי').

יצרתי היום את הnotebook show\_results.ipynb והשתמשתי בטנסורים השמורים של **estimated\_Z\_test\_sig001\_vt\_supp=10.pt**, estimated\_X\_test\_sig001\_vt\_supp=10, estimated\_X-X\_Avg\_test\_sig001\_vt\_supp=10

**Z, Sigma=0.1, support=10**

Model Hyperparameters:

ambient\_dim=4000

measurements=1000

redundancy=40000

DECONET\_iterations=10

Step size 1 parameter=0.5

Step size 2 parameter=0.3

Type of initialization=kaiming

Beta parameter a=0.5

Beta parameter b=0.7

DECONET(

(phi): Parameter(40000, 4000)

(first\_activation): TruncationActivation()

(second\_activation): ShrinkageActivation()

)

training: 100%|██████████████████| 55/55 [00:09<00:00, 5.91it/s, loss=0.11]

validation: 100%|██████████████████| 8/8 [00:01<00:00, 6.69it/s, mse=0.104]

--------------------------------------

Average Train MSE = 0.109770

--------------------------------------

Average Test MSE = 0.103931

--------------------------------------

Epoch no. = 0

--------------------------------------

Generalization error = 0.005839

--------------------------------------

A= tensor([[-0.0373, 0.0231, 0.0137, ..., -0.0348, 0.0212, 0.0159],

[-0.0327, 0.0243, -0.0382, ..., 0.0146, 0.0169, 0.0448],

[-0.0147, 0.0625, 0.0323, ..., 0.0159, -0.0827, -0.0336],

...,

[ 0.0367, 0.0191, -0.0411, ..., -0.0340, -0.0137, -0.0020],

[ 0.0304, -0.0281, -0.0622, ..., 0.0203, 0.0222, -0.0124],

[ 0.0225, -0.0091, 0.0164, ..., -0.0222, 0.0182, -0.0092]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0187, 0.0126, -0.0162, ..., -0.0033, -0.0004, 0.0016],

[ 0.0095, 0.0010, -0.0122, ..., 0.0112, -0.0089, 0.0345],

[-0.0020, -0.0349, 0.0073, ..., 0.0090, -0.0305, 0.0350],

...,

[ 0.0375, -0.0263, 0.0083, ..., 0.0378, 0.0097, 0.0125],

[-0.0072, -0.0094, -0.0136, ..., -0.0064, 0.0301, 0.0042],

[-0.0294, 0.0322, 0.0021, ..., 0.0085, 0.0288, 0.0416]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Validation loss decreased (inf --> 0.005839). Saving model ...

training: 100%|████████████████| 55/55 [00:09<00:00, 6.11it/s, loss=0.0984]

validation: 100%|█████████████████| 8/8 [00:01<00:00, 7.00it/s, mse=0.0949]

--------------------------------------

Average Train MSE = 0.098414

--------------------------------------

Average Test MSE = 0.094901

--------------------------------------

Epoch no. = 1

--------------------------------------

Generalization error = 0.003513

--------------------------------------

A= tensor([[-0.0373, 0.0231, 0.0137, ..., -0.0348, 0.0212, 0.0159],

[-0.0327, 0.0243, -0.0382, ..., 0.0146, 0.0169, 0.0448],

[-0.0147, 0.0625, 0.0323, ..., 0.0159, -0.0827, -0.0336],

...,

[ 0.0367, 0.0191, -0.0411, ..., -0.0340, -0.0137, -0.0020],

[ 0.0304, -0.0281, -0.0622, ..., 0.0203, 0.0222, -0.0124],

[ 0.0225, -0.0091, 0.0164, ..., -0.0222, 0.0182, -0.0092]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0204, 0.0115, -0.0139, ..., -0.0023, 0.0002, 0.0020],

[ 0.0104, 0.0040, -0.0136, ..., 0.0119, -0.0079, 0.0363],

[-0.0011, -0.0359, 0.0062, ..., 0.0108, -0.0309, 0.0365],

...,

[ 0.0375, -0.0276, 0.0063, ..., 0.0377, 0.0089, 0.0152],

[-0.0057, -0.0076, -0.0156, ..., -0.0054, 0.0328, 0.0052],

[-0.0303, 0.0350, 0.0003, ..., 0.0083, 0.0318, 0.0421]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Validation loss decreased (0.005839 --> 0.003513). Saving model ...

training: 100%|████████████████| 55/55 [00:09<00:00, 6.09it/s, loss=0.0889]

validation: 100%|█████████████████| 8/8 [00:01<00:00, 6.91it/s, mse=0.0875]

--------------------------------------

Average Train MSE = 0.088875

--------------------------------------

Average Test MSE = 0.087535

--------------------------------------

Epoch no. = 2

--------------------------------------

Generalization error = 0.001340

--------------------------------------

A= tensor([[-0.0373, 0.0231, 0.0137, ..., -0.0348, 0.0212, 0.0159],

[-0.0327, 0.0243, -0.0382, ..., 0.0146, 0.0169, 0.0448],

[-0.0147, 0.0625, 0.0323, ..., 0.0159, -0.0827, -0.0336],

...,

[ 0.0367, 0.0191, -0.0411, ..., -0.0340, -0.0137, -0.0020],

[ 0.0304, -0.0281, -0.0622, ..., 0.0203, 0.0222, -0.0124],

[ 0.0225, -0.0091, 0.0164, ..., -0.0222, 0.0182, -0.0092]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0218, 0.0102, -0.0123, ..., -0.0008, 0.0009, 0.0022],

[ 0.0118, 0.0065, -0.0149, ..., 0.0123, -0.0069, 0.0381],

[-0.0005, -0.0369, 0.0053, ..., 0.0118, -0.0306, 0.0375],

...,

[ 0.0372, -0.0279, 0.0050, ..., 0.0381, 0.0079, 0.0175],

[-0.0047, -0.0062, -0.0178, ..., -0.0038, 0.0350, 0.0053],

[-0.0316, 0.0372, -0.0014, ..., 0.0087, 0.0345, 0.0431]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Validation loss decreased (0.003513 --> 0.001340). Saving model ...

training: 100%|█████████████████| 55/55 [00:09<00:00, 6.06it/s, loss=0.081]

validation: 100%|█████████████████| 8/8 [00:01<00:00, 7.03it/s, mse=0.0813]

--------------------------------------

Average Train MSE = 0.081001

--------------------------------------

Average Test MSE = 0.081341

--------------------------------------

Epoch no. = 3

--------------------------------------

Generalization error = 0.000340

--------------------------------------

A= tensor([[-0.0373, 0.0231, 0.0137, ..., -0.0348, 0.0212, 0.0159],

[-0.0327, 0.0243, -0.0382, ..., 0.0146, 0.0169, 0.0448],

[-0.0147, 0.0625, 0.0323, ..., 0.0159, -0.0827, -0.0336],

...,

[ 0.0367, 0.0191, -0.0411, ..., -0.0340, -0.0137, -0.0020],

[ 0.0304, -0.0281, -0.0622, ..., 0.0203, 0.0222, -0.0124],

[ 0.0225, -0.0091, 0.0164, ..., -0.0222, 0.0182, -0.0092]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 2.3591e-02, 9.1185e-03, -1.0865e-02, ..., 2.0428e-04,

1.6664e-03, 2.2716e-03],

[ 1.2829e-02, 8.6871e-03, -1.6310e-02, ..., 1.2789e-02,

-6.2052e-03, 4.0009e-02],

[ 1.4186e-05, -3.7679e-02, 4.6095e-03, ..., 1.3164e-02,

-3.0060e-02, 3.8423e-02],

...,

[ 3.6946e-02, -2.8356e-02, 3.0716e-03, ..., 3.8746e-02,

6.9468e-03, 1.9866e-02],

[-3.6188e-03, -4.6701e-03, -1.9587e-02, ..., -2.8493e-03,

3.7407e-02, 6.0785e-03],

[-3.2890e-02, 3.9843e-02, -2.9702e-03, ..., 8.8636e-03,

3.6890e-02, 4.3558e-02]], device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Validation loss decreased (0.001340 --> 0.000340). Saving model ...

training: 100%|████████████████| 55/55 [00:09<00:00, 6.05it/s, loss=0.0745]

validation: 100%|█████████████████| 8/8 [00:01<00:00, 6.91it/s, mse=0.0763]

--------------------------------------

Average Train MSE = 0.074490

--------------------------------------

Average Test MSE = 0.076270

--------------------------------------

Epoch no. = 4

--------------------------------------

Generalization error = 0.001780

--------------------------------------

A= tensor([[-0.0373, 0.0231, 0.0137, ..., -0.0348, 0.0212, 0.0159],

[-0.0327, 0.0243, -0.0382, ..., 0.0146, 0.0169, 0.0448],

[-0.0147, 0.0625, 0.0323, ..., 0.0159, -0.0827, -0.0336],

...,

[ 0.0367, 0.0191, -0.0411, ..., -0.0340, -0.0137, -0.0020],

[ 0.0304, -0.0281, -0.0622, ..., 0.0203, 0.0222, -0.0124],

[ 0.0225, -0.0091, 0.0164, ..., -0.0222, 0.0182, -0.0092]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0250, 0.0086, -0.0090, ..., 0.0013, 0.0024, 0.0026],

[ 0.0136, 0.0106, -0.0172, ..., 0.0132, -0.0056, 0.0412],

[ 0.0003, -0.0386, 0.0039, ..., 0.0141, -0.0299, 0.0395],

...,

[ 0.0366, -0.0288, 0.0016, ..., 0.0391, 0.0061, 0.0220],

[-0.0025, -0.0035, -0.0217, ..., -0.0019, 0.0397, 0.0060],

[-0.0342, 0.0421, -0.0041, ..., 0.0088, 0.0389, 0.0437]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Patience used: 1 out of 5

training: 100%|████████████████| 55/55 [00:09<00:00, 6.05it/s, loss=0.0692]

validation: 100%|█████████████████| 8/8 [00:01<00:00, 7.00it/s, mse=0.0721]

--------------------------------------

Average Train MSE = 0.069175

--------------------------------------

Average Test MSE = 0.072067

--------------------------------------

Epoch no. = 5

--------------------------------------

Generalization error = 0.002893

--------------------------------------

A= tensor([[-0.0373, 0.0231, 0.0137, ..., -0.0348, 0.0212, 0.0159],

[-0.0327, 0.0243, -0.0382, ..., 0.0146, 0.0169, 0.0448],

[-0.0147, 0.0625, 0.0323, ..., 0.0159, -0.0827, -0.0336],

...,

[ 0.0367, 0.0191, -0.0411, ..., -0.0340, -0.0137, -0.0020],

[ 0.0304, -0.0281, -0.0622, ..., 0.0203, 0.0222, -0.0124],

[ 0.0225, -0.0091, 0.0164, ..., -0.0222, 0.0182, -0.0092]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 2.6090e-02, 8.3862e-03, -7.5350e-03, ..., 1.7929e-03,

2.6704e-03, 2.7890e-03],

[ 1.4536e-02, 1.2700e-02, -1.8191e-02, ..., 1.2829e-02,

-5.1669e-03, 4.2531e-02],

[ 4.7698e-04, -3.8981e-02, 2.9244e-03, ..., 1.5122e-02,

-3.0095e-02, 4.0262e-02],

...,

[ 3.6412e-02, -2.9036e-02, 8.3410e-05, ..., 3.9560e-02,

5.4424e-03, 2.3750e-02],

[-1.5361e-03, -2.4168e-03, -2.3286e-02, ..., -8.8827e-04,

4.1850e-02, 6.4628e-03],

[-3.5109e-02, 4.4007e-02, -5.5069e-03, ..., 8.7130e-03,

4.1074e-02, 4.3706e-02]], device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Patience used: 2 out of 5

training: 100%|████████████████| 55/55 [00:09<00:00, 6.04it/s, loss=0.0646]

validation: 100%|█████████████████| 8/8 [00:01<00:00, 6.99it/s, mse=0.0685]

--------------------------------------

Average Train MSE = 0.064646

--------------------------------------

Average Test MSE = 0.068532

--------------------------------------

Epoch no. = 6

--------------------------------------

Generalization error = 0.003886

--------------------------------------

A= tensor([[-0.0373, 0.0231, 0.0137, ..., -0.0348, 0.0212, 0.0159],

[-0.0327, 0.0243, -0.0382, ..., 0.0146, 0.0169, 0.0448],

[-0.0147, 0.0625, 0.0323, ..., 0.0159, -0.0827, -0.0336],

...,

[ 0.0367, 0.0191, -0.0411, ..., -0.0340, -0.0137, -0.0020],

[ 0.0304, -0.0281, -0.0622, ..., 0.0203, 0.0222, -0.0124],

[ 0.0225, -0.0091, 0.0164, ..., -0.0222, 0.0182, -0.0092]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0275, 0.0079, -0.0059, ..., 0.0027, 0.0032, 0.0026],

[ 0.0156, 0.0147, -0.0193, ..., 0.0130, -0.0041, 0.0440],

[ 0.0005, -0.0396, 0.0024, ..., 0.0157, -0.0297, 0.0409],

...,

[ 0.0362, -0.0292, -0.0015, ..., 0.0397, 0.0047, 0.0254],

[-0.0005, -0.0018, -0.0255, ..., -0.0008, 0.0444, 0.0065],

[-0.0361, 0.0456, -0.0064, ..., 0.0088, 0.0431, 0.0437]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Patience used: 3 out of 5

training: 100%|████████████████| 55/55 [00:09<00:00, 6.04it/s, loss=0.0608]

validation: 100%|█████████████████| 8/8 [00:01<00:00, 7.01it/s, mse=0.0655]

--------------------------------------

Average Train MSE = 0.060802

--------------------------------------

Average Test MSE = 0.065456

--------------------------------------

Epoch no. = 7

--------------------------------------

Generalization error = 0.004653

--------------------------------------

A= tensor([[-0.0373, 0.0231, 0.0137, ..., -0.0348, 0.0212, 0.0159],

[-0.0327, 0.0243, -0.0382, ..., 0.0146, 0.0169, 0.0448],

[-0.0147, 0.0625, 0.0323, ..., 0.0159, -0.0827, -0.0336],

...,

[ 0.0367, 0.0191, -0.0411, ..., -0.0340, -0.0137, -0.0020],

[ 0.0304, -0.0281, -0.0622, ..., 0.0203, 0.0222, -0.0124],

[ 0.0225, -0.0091, 0.0164, ..., -0.0222, 0.0182, -0.0092]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 2.8701e-02, 7.9155e-03, -4.4755e-03, ..., 3.4033e-03,

3.2250e-03, 2.7879e-03],

[ 1.6232e-02, 1.6149e-02, -1.9874e-02, ..., 1.2596e-02,

-4.0679e-03, 4.4740e-02],

[ 8.0747e-04, -4.0385e-02, 1.3646e-03, ..., 1.6141e-02,

-2.9565e-02, 4.1640e-02],

...,

[ 3.5791e-02, -2.9648e-02, -2.4437e-03, ..., 3.9945e-02,

3.5871e-03, 2.7138e-02],

[ 3.0404e-04, -9.1849e-04, -2.7073e-02, ..., 3.2198e-05,

4.6433e-02, 6.9191e-03],

[-3.7018e-02, 4.7188e-02, -7.6403e-03, ..., 8.8041e-03,

4.4605e-02, 4.3371e-02]], device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Patience used: 4 out of 5

training: 100%|████████████████| 55/55 [00:09<00:00, 6.03it/s, loss=0.0575]

validation: 100%|█████████████████| 8/8 [00:01<00:00, 7.01it/s, mse=0.0629]

--------------------------------------

Average Train MSE = 0.057526

--------------------------------------

Average Test MSE = 0.062851

--------------------------------------

Epoch no. = 8

--------------------------------------

Generalization error = 0.005325

--------------------------------------

A= tensor([[-0.0373, 0.0231, 0.0137, ..., -0.0348, 0.0212, 0.0159],

[-0.0327, 0.0243, -0.0382, ..., 0.0146, 0.0169, 0.0448],

[-0.0147, 0.0625, 0.0323, ..., 0.0159, -0.0827, -0.0336],

...,

[ 0.0367, 0.0191, -0.0411, ..., -0.0340, -0.0137, -0.0020],

[ 0.0304, -0.0281, -0.0622, ..., 0.0203, 0.0222, -0.0124],

[ 0.0225, -0.0091, 0.0164, ..., -0.0222, 0.0182, -0.0092]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0297, 0.0079, -0.0033, ..., 0.0038, 0.0033, 0.0029],

[ 0.0174, 0.0177, -0.0206, ..., 0.0122, -0.0038, 0.0455],

[ 0.0013, -0.0409, 0.0009, ..., 0.0167, -0.0299, 0.0419],

...,

[ 0.0356, -0.0298, -0.0038, ..., 0.0400, 0.0027, 0.0287],

[ 0.0016, -0.0003, -0.0286, ..., 0.0004, 0.0484, 0.0067],

[-0.0376, 0.0485, -0.0087, ..., 0.0088, 0.0466, 0.0432]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Patience used: 5 out of 5

**Z, Sigma=0.001, support=10**

Model Hyperparameters:

ambient\_dim=4000

measurements=1000

redundancy=40000

DECONET\_iterations=10

Step size 1 parameter=0.5

Step size 2 parameter=0.3

Type of initialization=kaiming

Beta parameter a=0.5

Beta parameter b=0.7

DECONET(

(phi): Parameter(40000, 4000)

(first\_activation): TruncationActivation()

(second\_activation): ShrinkageActivation()

)

training: 100%|██████████████████| 55/55 [00:09<00:00, 5.92it/s, loss=0.0872]

validation: 100%|███████████████████| 8/8 [00:01<00:00, 7.08it/s, mse=0.0829]

--------------------------------------

Average Train MSE = 0.087234

--------------------------------------

Average Test MSE = 0.082915

--------------------------------------

Epoch no. = 0

--------------------------------------

Generalization error = 0.004319

--------------------------------------

A= tensor([[ 0.0348, 0.0130, 0.0167, ..., -0.0424, 0.0018, 0.0371],

[-0.0127, 0.0634, -0.0146, ..., 0.0030, -0.0165, 0.0439],

[-0.0008, 0.0112, 0.0020, ..., 0.0534, 0.0345, -0.0378],

...,

[-0.0044, -0.0068, 0.0158, ..., 0.0059, -0.0252, -0.0461],

[-0.0300, 0.0066, 0.0034, ..., 0.0505, -0.0411, -0.0267],

[ 0.0324, -0.0062, 0.0175, ..., -0.0299, 0.0034, 0.0319]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0048, -0.0234, -0.0026, ..., 0.0020, 0.0232, -0.0014],

[-0.0223, 0.0239, -0.0180, ..., 0.0018, -0.0360, -0.0390],

[-0.0007, 0.0334, -0.0220, ..., 0.0209, 0.0041, -0.0042],

...,

[ 0.0179, 0.0223, -0.0119, ..., -0.0078, 0.0064, -0.0083],

[ 0.0152, -0.0099, 0.0079, ..., 0.0097, -0.0023, 0.0250],

[ 0.0373, 0.0124, 0.0086, ..., -0.0172, 0.0335, -0.0283]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Validation loss decreased (inf --> 0.004319). Saving model ...

training: 100%|██████████████████| 55/55 [00:09<00:00, 6.10it/s, loss=0.0775]

validation: 100%|███████████████████| 8/8 [00:01<00:00, 6.93it/s, mse=0.0749]

--------------------------------------

Average Train MSE = 0.077499

--------------------------------------

Average Test MSE = 0.074881

--------------------------------------

Epoch no. = 1

--------------------------------------

Generalization error = 0.002618

--------------------------------------

A= tensor([[ 0.0348, 0.0130, 0.0167, ..., -0.0424, 0.0018, 0.0371],

[-0.0127, 0.0634, -0.0146, ..., 0.0030, -0.0165, 0.0439],

[-0.0008, 0.0112, 0.0020, ..., 0.0534, 0.0345, -0.0378],

...,

[-0.0044, -0.0068, 0.0158, ..., 0.0059, -0.0252, -0.0461],

[-0.0300, 0.0066, 0.0034, ..., 0.0505, -0.0411, -0.0267],

[ 0.0324, -0.0062, 0.0175, ..., -0.0299, 0.0034, 0.0319]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0065, -0.0240, -0.0048, ..., 0.0039, 0.0253, -0.0008],

[-0.0223, 0.0237, -0.0185, ..., 0.0009, -0.0343, -0.0415],

[-0.0018, 0.0325, -0.0223, ..., 0.0213, 0.0037, -0.0038],

...,

[ 0.0166, 0.0231, -0.0115, ..., -0.0095, 0.0064, -0.0092],

[ 0.0162, -0.0096, 0.0088, ..., 0.0112, -0.0026, 0.0224],

[ 0.0357, 0.0144, 0.0089, ..., -0.0194, 0.0349, -0.0276]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Validation loss decreased (0.004319 --> 0.002618). Saving model ...

training: 100%|██████████████████| 55/55 [00:09<00:00, 6.07it/s, loss=0.0694]

validation: 100%|███████████████████| 8/8 [00:01<00:00, 7.00it/s, mse=0.0685]

--------------------------------------

Average Train MSE = 0.069442

--------------------------------------

Average Test MSE = 0.068541

--------------------------------------

Epoch no. = 2

--------------------------------------

Generalization error = 0.000901

--------------------------------------

A= tensor([[ 0.0348, 0.0130, 0.0167, ..., -0.0424, 0.0018, 0.0371],

[-0.0127, 0.0634, -0.0146, ..., 0.0030, -0.0165, 0.0439],

[-0.0008, 0.0112, 0.0020, ..., 0.0534, 0.0345, -0.0378],

...,

[-0.0044, -0.0068, 0.0158, ..., 0.0059, -0.0252, -0.0461],

[-0.0300, 0.0066, 0.0034, ..., 0.0505, -0.0411, -0.0267],

[ 0.0324, -0.0062, 0.0175, ..., -0.0299, 0.0034, 0.0319]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0074, -0.0244, -0.0070, ..., 0.0058, 0.0276, -0.0007],

[-0.0226, 0.0232, -0.0187, ..., 0.0002, -0.0328, -0.0438],

[-0.0027, 0.0316, -0.0230, ..., 0.0217, 0.0042, -0.0044],

...,

[ 0.0152, 0.0247, -0.0116, ..., -0.0110, 0.0068, -0.0102],

[ 0.0166, -0.0092, 0.0099, ..., 0.0124, -0.0033, 0.0203],

[ 0.0344, 0.0162, 0.0086, ..., -0.0210, 0.0362, -0.0272]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Validation loss decreased (0.002618 --> 0.000901). Saving model ...

training: 100%|███████████████████| 55/55 [00:09<00:00, 6.05it/s, loss=0.063]

validation: 100%|███████████████████| 8/8 [00:01<00:00, 6.91it/s, mse=0.0634]

--------------------------------------

Average Train MSE = 0.062959

--------------------------------------

Average Test MSE = 0.063374

--------------------------------------

Epoch no. = 3

--------------------------------------

Generalization error = 0.000415

--------------------------------------

A= tensor([[ 0.0348, 0.0130, 0.0167, ..., -0.0424, 0.0018, 0.0371],

[-0.0127, 0.0634, -0.0146, ..., 0.0030, -0.0165, 0.0439],

[-0.0008, 0.0112, 0.0020, ..., 0.0534, 0.0345, -0.0378],

...,

[-0.0044, -0.0068, 0.0158, ..., 0.0059, -0.0252, -0.0461],

[-0.0300, 0.0066, 0.0034, ..., 0.0505, -0.0411, -0.0267],

[ 0.0324, -0.0062, 0.0175, ..., -0.0299, 0.0034, 0.0319]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0086, -0.0246, -0.0092, ..., 0.0074, 0.0297, 0.0001],

[-0.0229, 0.0227, -0.0193, ..., -0.0007, -0.0317, -0.0459],

[-0.0036, 0.0311, -0.0237, ..., 0.0222, 0.0043, -0.0042],

...,

[ 0.0145, 0.0259, -0.0118, ..., -0.0121, 0.0072, -0.0110],

[ 0.0169, -0.0087, 0.0105, ..., 0.0138, -0.0040, 0.0181],

[ 0.0330, 0.0177, 0.0084, ..., -0.0229, 0.0370, -0.0268]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Validation loss decreased (0.000901 --> 0.000415). Saving model ...

training: 100%|██████████████████| 55/55 [00:09<00:00, 6.03it/s, loss=0.0577]

validation: 100%|███████████████████| 8/8 [00:01<00:00, 6.96it/s, mse=0.0591]

--------------------------------------

Average Train MSE = 0.057668

--------------------------------------

Average Test MSE = 0.059129

--------------------------------------

Epoch no. = 4

--------------------------------------

Generalization error = 0.001461

--------------------------------------

A= tensor([[ 0.0348, 0.0130, 0.0167, ..., -0.0424, 0.0018, 0.0371],

[-0.0127, 0.0634, -0.0146, ..., 0.0030, -0.0165, 0.0439],

[-0.0008, 0.0112, 0.0020, ..., 0.0534, 0.0345, -0.0378],

...,

[-0.0044, -0.0068, 0.0158, ..., 0.0059, -0.0252, -0.0461],

[-0.0300, 0.0066, 0.0034, ..., 0.0505, -0.0411, -0.0267],

[ 0.0324, -0.0062, 0.0175, ..., -0.0299, 0.0034, 0.0319]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0091, -0.0249, -0.0114, ..., 0.0094, 0.0320, 0.0004],

[-0.0233, 0.0221, -0.0194, ..., -0.0011, -0.0301, -0.0478],

[-0.0041, 0.0307, -0.0248, ..., 0.0221, 0.0041, -0.0041],

...,

[ 0.0138, 0.0273, -0.0122, ..., -0.0133, 0.0076, -0.0118],

[ 0.0174, -0.0082, 0.0104, ..., 0.0147, -0.0044, 0.0163],

[ 0.0320, 0.0188, 0.0084, ..., -0.0246, 0.0378, -0.0268]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Patience used: 1 out of 5

training: 100%|██████████████████| 55/55 [00:09<00:00, 6.03it/s, loss=0.0534]

validation: 100%|███████████████████| 8/8 [00:01<00:00, 6.96it/s, mse=0.0558]

--------------------------------------

Average Train MSE = 0.053363

--------------------------------------

Average Test MSE = 0.055796

--------------------------------------

Epoch no. = 5

--------------------------------------

Generalization error = 0.002433

--------------------------------------

A= tensor([[ 0.0348, 0.0130, 0.0167, ..., -0.0424, 0.0018, 0.0371],

[-0.0127, 0.0634, -0.0146, ..., 0.0030, -0.0165, 0.0439],

[-0.0008, 0.0112, 0.0020, ..., 0.0534, 0.0345, -0.0378],

...,

[-0.0044, -0.0068, 0.0158, ..., 0.0059, -0.0252, -0.0461],

[-0.0300, 0.0066, 0.0034, ..., 0.0505, -0.0411, -0.0267],

[ 0.0324, -0.0062, 0.0175, ..., -0.0299, 0.0034, 0.0319]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0102, -0.0247, -0.0135, ..., 0.0111, 0.0337, 0.0008],

[-0.0236, 0.0218, -0.0195, ..., -0.0011, -0.0298, -0.0496],

[-0.0047, 0.0301, -0.0251, ..., 0.0224, 0.0040, -0.0041],

...,

[ 0.0134, 0.0284, -0.0124, ..., -0.0140, 0.0082, -0.0122],

[ 0.0177, -0.0080, 0.0112, ..., 0.0153, -0.0050, 0.0148],

[ 0.0310, 0.0196, 0.0080, ..., -0.0259, 0.0383, -0.0268]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Patience used: 2 out of 5

training: 100%|██████████████████| 55/55 [00:09<00:00, 6.02it/s, loss=0.0498]

validation: 100%|███████████████████| 8/8 [00:01<00:00, 6.95it/s, mse=0.0529]

--------------------------------------

Average Train MSE = 0.049807

--------------------------------------

Average Test MSE = 0.052936

--------------------------------------

Epoch no. = 6

--------------------------------------

Generalization error = 0.003130

--------------------------------------

A= tensor([[ 0.0348, 0.0130, 0.0167, ..., -0.0424, 0.0018, 0.0371],

[-0.0127, 0.0634, -0.0146, ..., 0.0030, -0.0165, 0.0439],

[-0.0008, 0.0112, 0.0020, ..., 0.0534, 0.0345, -0.0378],

...,

[-0.0044, -0.0068, 0.0158, ..., 0.0059, -0.0252, -0.0461],

[-0.0300, 0.0066, 0.0034, ..., 0.0505, -0.0411, -0.0267],

[ 0.0324, -0.0062, 0.0175, ..., -0.0299, 0.0034, 0.0319]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0107, -0.0246, -0.0154, ..., 0.0126, 0.0353, 0.0006],

[-0.0242, 0.0214, -0.0193, ..., -0.0018, -0.0288, -0.0509],

[-0.0055, 0.0300, -0.0259, ..., 0.0223, 0.0035, -0.0038],

...,

[ 0.0130, 0.0298, -0.0135, ..., -0.0149, 0.0086, -0.0130],

[ 0.0183, -0.0074, 0.0113, ..., 0.0161, -0.0060, 0.0134],

[ 0.0306, 0.0204, 0.0078, ..., -0.0270, 0.0388, -0.0266]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Patience used: 3 out of 5

training: 100%|██████████████████| 55/55 [00:09<00:00, 6.01it/s, loss=0.0468]

validation: 100%|███████████████████| 8/8 [00:01<00:00, 6.75it/s, mse=0.0506]

--------------------------------------

Average Train MSE = 0.046831

--------------------------------------

Average Test MSE = 0.050635

--------------------------------------

Epoch no. = 7

--------------------------------------

Generalization error = 0.003804

--------------------------------------

A= tensor([[ 0.0348, 0.0130, 0.0167, ..., -0.0424, 0.0018, 0.0371],

[-0.0127, 0.0634, -0.0146, ..., 0.0030, -0.0165, 0.0439],

[-0.0008, 0.0112, 0.0020, ..., 0.0534, 0.0345, -0.0378],

...,

[-0.0044, -0.0068, 0.0158, ..., 0.0059, -0.0252, -0.0461],

[-0.0300, 0.0066, 0.0034, ..., 0.0505, -0.0411, -0.0267],

[ 0.0324, -0.0062, 0.0175, ..., -0.0299, 0.0034, 0.0319]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0109, -0.0245, -0.0176, ..., 0.0141, 0.0369, 0.0010],

[-0.0244, 0.0210, -0.0197, ..., -0.0022, -0.0283, -0.0527],

[-0.0062, 0.0300, -0.0264, ..., 0.0225, 0.0037, -0.0037],

...,

[ 0.0132, 0.0313, -0.0141, ..., -0.0152, 0.0091, -0.0135],

[ 0.0186, -0.0072, 0.0116, ..., 0.0167, -0.0062, 0.0120],

[ 0.0302, 0.0210, 0.0072, ..., -0.0284, 0.0394, -0.0269]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Patience used: 4 out of 5

training: 100%|██████████████████| 55/55 [00:09<00:00, 6.01it/s, loss=0.0443]

validation: 100%|███████████████████| 8/8 [00:01<00:00, 6.79it/s, mse=0.0487]

--------------------------------------

Average Train MSE = 0.044334

--------------------------------------

Average Test MSE = 0.048663

--------------------------------------

Epoch no. = 8

--------------------------------------

Generalization error = 0.004329

--------------------------------------

A= tensor([[ 0.0348, 0.0130, 0.0167, ..., -0.0424, 0.0018, 0.0371],

[-0.0127, 0.0634, -0.0146, ..., 0.0030, -0.0165, 0.0439],

[-0.0008, 0.0112, 0.0020, ..., 0.0534, 0.0345, -0.0378],

...,

[-0.0044, -0.0068, 0.0158, ..., 0.0059, -0.0252, -0.0461],

[-0.0300, 0.0066, 0.0034, ..., 0.0505, -0.0411, -0.0267],

[ 0.0324, -0.0062, 0.0175, ..., -0.0299, 0.0034, 0.0319]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0114, -0.0245, -0.0193, ..., 0.0153, 0.0382, 0.0012],

[-0.0248, 0.0208, -0.0198, ..., -0.0021, -0.0278, -0.0542],

[-0.0066, 0.0298, -0.0272, ..., 0.0222, 0.0031, -0.0031],

...,

[ 0.0133, 0.0320, -0.0146, ..., -0.0156, 0.0096, -0.0140],

[ 0.0187, -0.0069, 0.0117, ..., 0.0175, -0.0071, 0.0106],

[ 0.0296, 0.0212, 0.0064, ..., -0.0293, 0.0397, -0.0270]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Patience used: 5 out of 5

**Sigma=0.02, support=10**

or more details). In a future release, the default value for `weights\_only` will be flipped to `True`. This limits the functions that could be executed during unpickling. Arbitrary objects will no longer be allowed to be loaded via this mode unless they are explicitly allowlisted by the user via `torch.serialization.add\_safe\_globals`. We recommend you start setting `weights\_only=True` for any use case where you don't have full control of the loaded file. Please open an issue on GitHub for any issues related to this experimental feature.

loaded\_datasets = torch.load(checkpoint\_name)

Model Hyperparameters:

ambient\_dim=4000

measurements=1000

redundancy=40000

DECONET\_iterations=10

Step size 1 parameter=0.5

Step size 2 parameter=0.3

Type of initialization=kaiming

Beta parameter a=0.5

Beta parameter b=0.7

DECONET(

(phi): Parameter(40000, 4000)

(first\_activation): TruncationActivation()

(second\_activation): ShrinkageActivation()

)

training: 100%|███████████████████| 55/55 [00:09<00:00, 5.89it/s, loss=0.088]

validation: 100%|███████████████████| 8/8 [00:01<00:00, 6.98it/s, mse=0.0836]

--------------------------------------

Average Train MSE = 0.088013

--------------------------------------

Average Test MSE = 0.083592

--------------------------------------

Epoch no. = 0

--------------------------------------

Generalization error = 0.004421

--------------------------------------

A= tensor([[ 0.0213, 0.0050, 0.0146, ..., 0.0300, -0.0352, -0.0167],

[-0.0010, -0.0404, -0.0272, ..., -0.0170, 0.0763, 0.0016],

[ 0.0041, 0.0098, 0.0315, ..., 0.0322, 0.0269, 0.0174],

...,

[-0.0125, 0.0225, 0.0049, ..., -0.0576, -0.0225, 0.0375],

[ 0.0111, -0.0078, -0.0175, ..., -0.0460, -0.0371, 0.0029],

[-0.0125, -0.0077, -0.0499, ..., -0.0165, 0.0222, 0.0098]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[-0.0003, 0.0013, 0.0478, ..., 0.0440, -0.0028, 0.0021],

[-0.0216, -0.0169, 0.0164, ..., -0.0162, 0.0229, -0.0411],

[ 0.0110, 0.0386, 0.0379, ..., 0.0037, 0.0010, 0.0077],

...,

[-0.0500, -0.0223, -0.0116, ..., 0.0380, -0.0021, 0.0366],

[-0.0161, 0.0323, 0.0064, ..., 0.0463, -0.0143, -0.0167],

[ 0.0229, -0.0334, 0.0060, ..., 0.0444, -0.0173, 0.0266]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Validation loss decreased (inf --> 0.004421). Saving model ...

training: 100%|██████████████████| 55/55 [00:09<00:00, 6.07it/s, loss=0.0781]

validation: 100%|███████████████████| 8/8 [00:01<00:00, 6.89it/s, mse=0.0754]

--------------------------------------

Average Train MSE = 0.078063

--------------------------------------

Average Test MSE = 0.075444

--------------------------------------

Epoch no. = 1

--------------------------------------

Generalization error = 0.002619

--------------------------------------

A= tensor([[ 0.0213, 0.0050, 0.0146, ..., 0.0300, -0.0352, -0.0167],

[-0.0010, -0.0404, -0.0272, ..., -0.0170, 0.0763, 0.0016],

[ 0.0041, 0.0098, 0.0315, ..., 0.0322, 0.0269, 0.0174],

...,

[-0.0125, 0.0225, 0.0049, ..., -0.0576, -0.0225, 0.0375],

[ 0.0111, -0.0078, -0.0175, ..., -0.0460, -0.0371, 0.0029],

[-0.0125, -0.0077, -0.0499, ..., -0.0165, 0.0222, 0.0098]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0011, 0.0046, 0.0493, ..., 0.0455, -0.0032, 0.0026],

[-0.0211, -0.0152, 0.0148, ..., -0.0143, 0.0249, -0.0427],

[ 0.0104, 0.0407, 0.0360, ..., 0.0042, -0.0011, 0.0073],

...,

[-0.0500, -0.0218, -0.0101, ..., 0.0394, -0.0001, 0.0355],

[-0.0129, 0.0340, 0.0069, ..., 0.0453, -0.0124, -0.0172],

[ 0.0250, -0.0329, 0.0095, ..., 0.0443, -0.0173, 0.0250]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Validation loss decreased (0.004421 --> 0.002619). Saving model ...

training: 100%|████████████████████| 55/55 [00:09<00:00, 6.08it/s, loss=0.07]

validation: 100%|███████████████████| 8/8 [00:01<00:00, 6.89it/s, mse=0.0692]

--------------------------------------

Average Train MSE = 0.069992

--------------------------------------

Average Test MSE = 0.069247

--------------------------------------

Epoch no. = 2

--------------------------------------

Generalization error = 0.000745

--------------------------------------

A= tensor([[ 0.0213, 0.0050, 0.0146, ..., 0.0300, -0.0352, -0.0167],

[-0.0010, -0.0404, -0.0272, ..., -0.0170, 0.0763, 0.0016],

[ 0.0041, 0.0098, 0.0315, ..., 0.0322, 0.0269, 0.0174],

...,

[-0.0125, 0.0225, 0.0049, ..., -0.0576, -0.0225, 0.0375],

[ 0.0111, -0.0078, -0.0175, ..., -0.0460, -0.0371, 0.0029],

[-0.0125, -0.0077, -0.0499, ..., -0.0165, 0.0222, 0.0098]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0026, 0.0065, 0.0509, ..., 0.0468, -0.0032, 0.0031],

[-0.0208, -0.0141, 0.0132, ..., -0.0128, 0.0269, -0.0442],

[ 0.0100, 0.0423, 0.0350, ..., 0.0043, -0.0028, 0.0064],

...,

[-0.0504, -0.0218, -0.0081, ..., 0.0406, 0.0015, 0.0347],

[-0.0101, 0.0357, 0.0075, ..., 0.0443, -0.0109, -0.0173],

[ 0.0269, -0.0331, 0.0127, ..., 0.0442, -0.0180, 0.0234]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Validation loss decreased (0.002619 --> 0.000745). Saving model ...

training: 100%|██████████████████| 55/55 [00:09<00:00, 6.04it/s, loss=0.0635]

validation: 100%|████████████████████| 8/8 [00:01<00:00, 6.85it/s, mse=0.064]

--------------------------------------

Average Train MSE = 0.063494

--------------------------------------

Average Test MSE = 0.064021

--------------------------------------

Epoch no. = 3

--------------------------------------

Generalization error = 0.000527

--------------------------------------

A= tensor([[ 0.0213, 0.0050, 0.0146, ..., 0.0300, -0.0352, -0.0167],

[-0.0010, -0.0404, -0.0272, ..., -0.0170, 0.0763, 0.0016],

[ 0.0041, 0.0098, 0.0315, ..., 0.0322, 0.0269, 0.0174],

...,

[-0.0125, 0.0225, 0.0049, ..., -0.0576, -0.0225, 0.0375],

[ 0.0111, -0.0078, -0.0175, ..., -0.0460, -0.0371, 0.0029],

[-0.0125, -0.0077, -0.0499, ..., -0.0165, 0.0222, 0.0098]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0035, 0.0088, 0.0521, ..., 0.0484, -0.0037, 0.0031],

[-0.0200, -0.0130, 0.0122, ..., -0.0116, 0.0282, -0.0452],

[ 0.0096, 0.0435, 0.0342, ..., 0.0039, -0.0044, 0.0054],

...,

[-0.0509, -0.0218, -0.0064, ..., 0.0417, 0.0029, 0.0341],

[-0.0076, 0.0378, 0.0075, ..., 0.0435, -0.0091, -0.0180],

[ 0.0287, -0.0333, 0.0158, ..., 0.0438, -0.0189, 0.0220]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Validation loss decreased (0.000745 --> 0.000527). Saving model ...

training: 100%|██████████████████| 55/55 [00:09<00:00, 6.02it/s, loss=0.0582]

validation: 100%|███████████████████| 8/8 [00:01<00:00, 6.87it/s, mse=0.0599]

--------------------------------------

Average Train MSE = 0.058176

--------------------------------------

Average Test MSE = 0.059854

--------------------------------------

Epoch no. = 4

--------------------------------------

Generalization error = 0.001678

--------------------------------------

A= tensor([[ 0.0213, 0.0050, 0.0146, ..., 0.0300, -0.0352, -0.0167],

[-0.0010, -0.0404, -0.0272, ..., -0.0170, 0.0763, 0.0016],

[ 0.0041, 0.0098, 0.0315, ..., 0.0322, 0.0269, 0.0174],

...,

[-0.0125, 0.0225, 0.0049, ..., -0.0576, -0.0225, 0.0375],

[ 0.0111, -0.0078, -0.0175, ..., -0.0460, -0.0371, 0.0029],

[-0.0125, -0.0077, -0.0499, ..., -0.0165, 0.0222, 0.0098]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0045, 0.0102, 0.0530, ..., 0.0497, -0.0039, 0.0037],

[-0.0202, -0.0121, 0.0113, ..., -0.0113, 0.0293, -0.0462],

[ 0.0096, 0.0445, 0.0328, ..., 0.0037, -0.0064, 0.0044],

...,

[-0.0515, -0.0217, -0.0047, ..., 0.0427, 0.0040, 0.0336],

[-0.0051, 0.0395, 0.0076, ..., 0.0427, -0.0077, -0.0181],

[ 0.0301, -0.0331, 0.0185, ..., 0.0433, -0.0194, 0.0210]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Patience used: 1 out of 5

training: 100%|██████████████████| 55/55 [00:09<00:00, 6.05it/s, loss=0.0538]

validation: 100%|███████████████████| 8/8 [00:01<00:00, 6.86it/s, mse=0.0564]

--------------------------------------

Average Train MSE = 0.053827

--------------------------------------

Average Test MSE = 0.056415

--------------------------------------

Epoch no. = 5

--------------------------------------

Generalization error = 0.002589

--------------------------------------

A= tensor([[ 0.0213, 0.0050, 0.0146, ..., 0.0300, -0.0352, -0.0167],

[-0.0010, -0.0404, -0.0272, ..., -0.0170, 0.0763, 0.0016],

[ 0.0041, 0.0098, 0.0315, ..., 0.0322, 0.0269, 0.0174],

...,

[-0.0125, 0.0225, 0.0049, ..., -0.0576, -0.0225, 0.0375],

[ 0.0111, -0.0078, -0.0175, ..., -0.0460, -0.0371, 0.0029],

[-0.0125, -0.0077, -0.0499, ..., -0.0165, 0.0222, 0.0098]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0055, 0.0113, 0.0539, ..., 0.0504, -0.0038, 0.0040],

[-0.0199, -0.0118, 0.0107, ..., -0.0103, 0.0300, -0.0473],

[ 0.0097, 0.0449, 0.0318, ..., 0.0032, -0.0081, 0.0033],

...,

[-0.0514, -0.0224, -0.0027, ..., 0.0434, 0.0054, 0.0334],

[-0.0029, 0.0414, 0.0078, ..., 0.0418, -0.0061, -0.0185],

[ 0.0312, -0.0335, 0.0215, ..., 0.0429, -0.0203, 0.0198]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Patience used: 2 out of 5

training: 100%|██████████████████| 55/55 [00:09<00:00, 6.05it/s, loss=0.0503]

validation: 100%|███████████████████| 8/8 [00:01<00:00, 7.00it/s, mse=0.0536]

--------------------------------------

Average Train MSE = 0.050273

--------------------------------------

Average Test MSE = 0.053565

--------------------------------------

Epoch no. = 6

--------------------------------------

Generalization error = 0.003292

--------------------------------------

A= tensor([[ 0.0213, 0.0050, 0.0146, ..., 0.0300, -0.0352, -0.0167],

[-0.0010, -0.0404, -0.0272, ..., -0.0170, 0.0763, 0.0016],

[ 0.0041, 0.0098, 0.0315, ..., 0.0322, 0.0269, 0.0174],

...,

[-0.0125, 0.0225, 0.0049, ..., -0.0576, -0.0225, 0.0375],

[ 0.0111, -0.0078, -0.0175, ..., -0.0460, -0.0371, 0.0029],

[-0.0125, -0.0077, -0.0499, ..., -0.0165, 0.0222, 0.0098]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0060, 0.0121, 0.0547, ..., 0.0512, -0.0041, 0.0046],

[-0.0195, -0.0111, 0.0102, ..., -0.0095, 0.0308, -0.0480],

[ 0.0099, 0.0457, 0.0307, ..., 0.0033, -0.0103, 0.0023],

...,

[-0.0517, -0.0224, -0.0013, ..., 0.0440, 0.0063, 0.0336],

[-0.0011, 0.0430, 0.0078, ..., 0.0411, -0.0047, -0.0181],

[ 0.0325, -0.0335, 0.0237, ..., 0.0423, -0.0212, 0.0184]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Patience used: 3 out of 5

training: 100%|██████████████████| 55/55 [00:09<00:00, 6.03it/s, loss=0.0473]

validation: 100%|███████████████████| 8/8 [00:01<00:00, 6.79it/s, mse=0.0512]

--------------------------------------

Average Train MSE = 0.047265

--------------------------------------

Average Test MSE = 0.051220

--------------------------------------

Epoch no. = 7

--------------------------------------

Generalization error = 0.003955

--------------------------------------

A= tensor([[ 0.0213, 0.0050, 0.0146, ..., 0.0300, -0.0352, -0.0167],

[-0.0010, -0.0404, -0.0272, ..., -0.0170, 0.0763, 0.0016],

[ 0.0041, 0.0098, 0.0315, ..., 0.0322, 0.0269, 0.0174],

...,

[-0.0125, 0.0225, 0.0049, ..., -0.0576, -0.0225, 0.0375],

[ 0.0111, -0.0078, -0.0175, ..., -0.0460, -0.0371, 0.0029],

[-0.0125, -0.0077, -0.0499, ..., -0.0165, 0.0222, 0.0098]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0068, 0.0131, 0.0552, ..., 0.0522, -0.0040, 0.0049],

[-0.0194, -0.0105, 0.0102, ..., -0.0089, 0.0311, -0.0486],

[ 0.0104, 0.0463, 0.0300, ..., 0.0026, -0.0121, 0.0010],

...,

[-0.0517, -0.0225, 0.0001, ..., 0.0443, 0.0067, 0.0339],

[ 0.0007, 0.0445, 0.0076, ..., 0.0403, -0.0036, -0.0176],

[ 0.0340, -0.0338, 0.0260, ..., 0.0418, -0.0220, 0.0175]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Patience used: 4 out of 5

training: 100%|██████████████████| 55/55 [00:09<00:00, 6.01it/s, loss=0.0448]

validation: 100%|███████████████████| 8/8 [00:01<00:00, 6.95it/s, mse=0.0492]

--------------------------------------

Average Train MSE = 0.044761

--------------------------------------

Average Test MSE = 0.049203

--------------------------------------

Epoch no. = 8

--------------------------------------

Generalization error = 0.004442

--------------------------------------

A= tensor([[ 0.0213, 0.0050, 0.0146, ..., 0.0300, -0.0352, -0.0167],

[-0.0010, -0.0404, -0.0272, ..., -0.0170, 0.0763, 0.0016],

[ 0.0041, 0.0098, 0.0315, ..., 0.0322, 0.0269, 0.0174],

...,

[-0.0125, 0.0225, 0.0049, ..., -0.0576, -0.0225, 0.0375],

[ 0.0111, -0.0078, -0.0175, ..., -0.0460, -0.0371, 0.0029],

[-0.0125, -0.0077, -0.0499, ..., -0.0165, 0.0222, 0.0098]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 7.1587e-03, 1.3458e-02, 5.5897e-02, ..., 5.2894e-02,

-4.0382e-03, 5.4810e-03],

[-1.9262e-02, -9.9587e-03, 9.8955e-03, ..., -8.4595e-03,

3.1626e-02, -4.9597e-02],

[ 1.0774e-02, 4.6801e-02, 2.8961e-02, ..., 2.2096e-03,

-1.3905e-02, -7.3894e-05],

...,

[-5.2126e-02, -2.2871e-02, 2.0816e-03, ..., 4.4581e-02,

7.5237e-03, 3.4355e-02],

[ 1.9177e-03, 4.5897e-02, 7.4884e-03, ..., 3.9703e-02,

-2.2085e-03, -1.7413e-02],

[ 3.4582e-02, -3.4025e-02, 2.8015e-02, ..., 4.1086e-02,

-2.3196e-02, 1.6563e-02]], device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Patience used: 5 out of 5

**Sigma=0.005, support=10**

Model Hyperparameters:

ambient\_dim=4000

measurements=1000

redundancy=40000

DECONET\_iterations=10

Step size 1 parameter=0.5

Step size 2 parameter=0.3

Type of initialization=kaiming

Beta parameter a=0.5

Beta parameter b=0.7

DECONET(

(phi): Parameter(40000, 4000)

(first\_activation): TruncationActivation()

(second\_activation): ShrinkageActivation()

)

training: 100%|██████████████████| 55/55 [00:09<00:00, 5.89it/s, loss=0.0873]

validation: 100%|███████████████████| 8/8 [00:01<00:00, 6.87it/s, mse=0.0826]

--------------------------------------

Average Train MSE = 0.087342

--------------------------------------

Average Test MSE = 0.082564

--------------------------------------

Epoch no. = 0

--------------------------------------

Generalization error = 0.004778

--------------------------------------

A= tensor([[ 0.0166, 0.0436, -0.0288, ..., -0.0671, 0.0242, -0.0032],

[-0.0316, 0.0414, -0.0173, ..., 0.0558, -0.0045, 0.0382],

[-0.0335, 0.0188, 0.0164, ..., -0.0451, -0.0249, -0.0077],

...,

[ 0.0274, 0.0177, -0.0183, ..., -0.0281, -0.0353, -0.0030],

[-0.0240, -0.0255, 0.0235, ..., 0.0024, 0.0069, 0.0003],

[-0.0354, -0.0213, -0.0010, ..., -0.0244, -0.0309, 0.0482]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[-0.0292, -0.0355, 0.0492, ..., 0.0161, -0.0096, 0.0180],

[-0.0299, -0.0042, -0.0049, ..., -0.0192, 0.0595, 0.0429],

[-0.0106, -0.0059, 0.0042, ..., -0.0363, 0.0472, -0.0111],

...,

[-0.0226, 0.0013, -0.0210, ..., -0.0146, 0.0201, 0.0034],

[ 0.0582, -0.0225, -0.0069, ..., 0.0222, 0.0402, 0.0088],

[ 0.0159, -0.0404, -0.0014, ..., 0.0190, -0.0272, 0.0319]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Validation loss decreased (inf --> 0.004778). Saving model ...

training: 100%|██████████████████| 55/55 [00:09<00:00, 6.04it/s, loss=0.0774]

validation: 100%|███████████████████| 8/8 [00:01<00:00, 6.90it/s, mse=0.0747]

--------------------------------------

Average Train MSE = 0.077438

--------------------------------------

Average Test MSE = 0.074688

--------------------------------------

Epoch no. = 1

--------------------------------------

Generalization error = 0.002750

--------------------------------------

A= tensor([[ 0.0166, 0.0436, -0.0288, ..., -0.0671, 0.0242, -0.0032],

[-0.0316, 0.0414, -0.0173, ..., 0.0558, -0.0045, 0.0382],

[-0.0335, 0.0188, 0.0164, ..., -0.0451, -0.0249, -0.0077],

...,

[ 0.0274, 0.0177, -0.0183, ..., -0.0281, -0.0353, -0.0030],

[-0.0240, -0.0255, 0.0235, ..., 0.0024, 0.0069, 0.0003],

[-0.0354, -0.0213, -0.0010, ..., -0.0244, -0.0309, 0.0482]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[-0.0295, -0.0339, 0.0500, ..., 0.0158, -0.0106, 0.0168],

[-0.0329, -0.0031, -0.0083, ..., -0.0170, 0.0600, 0.0446],

[-0.0108, -0.0067, 0.0032, ..., -0.0359, 0.0475, -0.0128],

...,

[-0.0217, 0.0007, -0.0234, ..., -0.0140, 0.0191, 0.0047],

[ 0.0607, -0.0219, -0.0061, ..., 0.0235, 0.0417, 0.0093],

[ 0.0179, -0.0419, -0.0024, ..., 0.0172, -0.0292, 0.0352]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Validation loss decreased (0.004778 --> 0.002750). Saving model ...

training: 100%|██████████████████| 55/55 [00:09<00:00, 6.06it/s, loss=0.0693]

validation: 100%|███████████████████| 8/8 [00:01<00:00, 6.87it/s, mse=0.0682]

--------------------------------------

Average Train MSE = 0.069277

--------------------------------------

Average Test MSE = 0.068238

--------------------------------------

Epoch no. = 2

--------------------------------------

Generalization error = 0.001040

--------------------------------------

A= tensor([[ 0.0166, 0.0436, -0.0288, ..., -0.0671, 0.0242, -0.0032],

[-0.0316, 0.0414, -0.0173, ..., 0.0558, -0.0045, 0.0382],

[-0.0335, 0.0188, 0.0164, ..., -0.0451, -0.0249, -0.0077],

...,

[ 0.0274, 0.0177, -0.0183, ..., -0.0281, -0.0353, -0.0030],

[-0.0240, -0.0255, 0.0235, ..., 0.0024, 0.0069, 0.0003],

[-0.0354, -0.0213, -0.0010, ..., -0.0244, -0.0309, 0.0482]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[-0.0302, -0.0328, 0.0510, ..., 0.0155, -0.0111, 0.0162],

[-0.0358, -0.0026, -0.0107, ..., -0.0154, 0.0608, 0.0462],

[-0.0110, -0.0073, 0.0019, ..., -0.0356, 0.0483, -0.0143],

...,

[-0.0209, 0.0007, -0.0251, ..., -0.0139, 0.0185, 0.0059],

[ 0.0632, -0.0219, -0.0056, ..., 0.0249, 0.0430, 0.0101],

[ 0.0193, -0.0434, -0.0028, ..., 0.0156, -0.0305, 0.0380]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Validation loss decreased (0.002750 --> 0.001040). Saving model ...

training: 100%|██████████████████| 55/55 [00:09<00:00, 6.05it/s, loss=0.0628]

validation: 100%|███████████████████| 8/8 [00:01<00:00, 6.85it/s, mse=0.0632]

--------------------------------------

Average Train MSE = 0.062844

--------------------------------------

Average Test MSE = 0.063157

--------------------------------------

Epoch no. = 3

--------------------------------------

Generalization error = 0.000313

--------------------------------------

A= tensor([[ 0.0166, 0.0436, -0.0288, ..., -0.0671, 0.0242, -0.0032],

[-0.0316, 0.0414, -0.0173, ..., 0.0558, -0.0045, 0.0382],

[-0.0335, 0.0188, 0.0164, ..., -0.0451, -0.0249, -0.0077],

...,

[ 0.0274, 0.0177, -0.0183, ..., -0.0281, -0.0353, -0.0030],

[-0.0240, -0.0255, 0.0235, ..., 0.0024, 0.0069, 0.0003],

[-0.0354, -0.0213, -0.0010, ..., -0.0244, -0.0309, 0.0482]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[-0.0309, -0.0315, 0.0513, ..., 0.0154, -0.0121, 0.0153],

[-0.0386, -0.0014, -0.0135, ..., -0.0139, 0.0614, 0.0476],

[-0.0109, -0.0084, 0.0007, ..., -0.0346, 0.0488, -0.0160],

...,

[-0.0201, 0.0004, -0.0272, ..., -0.0135, 0.0176, 0.0070],

[ 0.0650, -0.0217, -0.0054, ..., 0.0262, 0.0441, 0.0110],

[ 0.0208, -0.0448, -0.0038, ..., 0.0144, -0.0317, 0.0409]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Validation loss decreased (0.001040 --> 0.000313). Saving model ...

training: 100%|██████████████████| 55/55 [00:09<00:00, 6.02it/s, loss=0.0576]

validation: 100%|███████████████████| 8/8 [00:01<00:00, 6.97it/s, mse=0.0591]

--------------------------------------

Average Train MSE = 0.057558

--------------------------------------

Average Test MSE = 0.059056

--------------------------------------

Epoch no. = 4

--------------------------------------

Generalization error = 0.001499

--------------------------------------

A= tensor([[ 0.0166, 0.0436, -0.0288, ..., -0.0671, 0.0242, -0.0032],

[-0.0316, 0.0414, -0.0173, ..., 0.0558, -0.0045, 0.0382],

[-0.0335, 0.0188, 0.0164, ..., -0.0451, -0.0249, -0.0077],

...,

[ 0.0274, 0.0177, -0.0183, ..., -0.0281, -0.0353, -0.0030],

[-0.0240, -0.0255, 0.0235, ..., 0.0024, 0.0069, 0.0003],

[-0.0354, -0.0213, -0.0010, ..., -0.0244, -0.0309, 0.0482]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[-3.1583e-02, -3.0479e-02, 5.1388e-02, ..., 1.5171e-02,

-1.2300e-02, 1.4535e-02],

[-4.1254e-02, -5.6059e-04, -1.5808e-02, ..., -1.2704e-02,

6.1679e-02, 4.9197e-02],

[-1.1051e-02, -9.7598e-03, -5.1356e-04, ..., -3.4171e-02,

4.9897e-02, -1.7743e-02],

...,

[-1.9438e-02, 4.9321e-05, -2.8677e-02, ..., -1.3313e-02,

1.6725e-02, 7.6691e-03],

[ 6.7646e-02, -2.1646e-02, -4.9659e-03, ..., 2.6655e-02,

4.5232e-02, 1.1583e-02],

[ 2.2344e-02, -4.6386e-02, -5.2580e-03, ..., 1.3605e-02,

-3.2456e-02, 4.3542e-02]], device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Patience used: 1 out of 5

training: 100%|██████████████████| 55/55 [00:09<00:00, 6.04it/s, loss=0.0533]

validation: 100%|███████████████████| 8/8 [00:01<00:00, 6.85it/s, mse=0.0557]

--------------------------------------

Average Train MSE = 0.053255

--------------------------------------

Average Test MSE = 0.055721

--------------------------------------

Epoch no. = 5

--------------------------------------

Generalization error = 0.002465

--------------------------------------

A= tensor([[ 0.0166, 0.0436, -0.0288, ..., -0.0671, 0.0242, -0.0032],

[-0.0316, 0.0414, -0.0173, ..., 0.0558, -0.0045, 0.0382],

[-0.0335, 0.0188, 0.0164, ..., -0.0451, -0.0249, -0.0077],

...,

[ 0.0274, 0.0177, -0.0183, ..., -0.0281, -0.0353, -0.0030],

[-0.0240, -0.0255, 0.0235, ..., 0.0024, 0.0069, 0.0003],

[-0.0354, -0.0213, -0.0010, ..., -0.0244, -0.0309, 0.0482]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[-3.2087e-02, -2.9745e-02, 5.1930e-02, ..., 1.4779e-02,

-1.2727e-02, 1.4126e-02],

[-4.3379e-02, 3.9194e-04, -1.7674e-02, ..., -1.1729e-02,

6.1993e-02, 5.0445e-02],

[-1.1438e-02, -1.0582e-02, -1.6469e-03, ..., -3.3648e-02,

5.0717e-02, -1.9719e-02],

...,

[-1.9053e-02, -1.7422e-05, -2.9933e-02, ..., -1.3035e-02,

1.5878e-02, 8.3478e-03],

[ 6.9877e-02, -2.1786e-02, -4.6218e-03, ..., 2.7896e-02,

4.6418e-02, 1.2292e-02],

[ 2.3674e-02, -4.7296e-02, -6.3444e-03, ..., 1.2807e-02,

-3.3230e-02, 4.5734e-02]], device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Patience used: 2 out of 5

training: 100%|██████████████████| 55/55 [00:09<00:00, 6.00it/s, loss=0.0497]

validation: 100%|███████████████████| 8/8 [00:01<00:00, 6.91it/s, mse=0.0529]

--------------------------------------

Average Train MSE = 0.049710

--------------------------------------

Average Test MSE = 0.052913

--------------------------------------

Epoch no. = 6

--------------------------------------

Generalization error = 0.003203

--------------------------------------

A= tensor([[ 0.0166, 0.0436, -0.0288, ..., -0.0671, 0.0242, -0.0032],

[-0.0316, 0.0414, -0.0173, ..., 0.0558, -0.0045, 0.0382],

[-0.0335, 0.0188, 0.0164, ..., -0.0451, -0.0249, -0.0077],

...,

[ 0.0274, 0.0177, -0.0183, ..., -0.0281, -0.0353, -0.0030],

[-0.0240, -0.0255, 0.0235, ..., 0.0024, 0.0069, 0.0003],

[-0.0354, -0.0213, -0.0010, ..., -0.0244, -0.0309, 0.0482]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[-0.0324, -0.0292, 0.0520, ..., 0.0150, -0.0129, 0.0138],

[-0.0459, 0.0013, -0.0197, ..., -0.0109, 0.0623, 0.0520],

[-0.0116, -0.0120, -0.0028, ..., -0.0329, 0.0516, -0.0219],

...,

[-0.0182, -0.0004, -0.0313, ..., -0.0133, 0.0151, 0.0094],

[ 0.0720, -0.0219, -0.0046, ..., 0.0284, 0.0469, 0.0128],

[ 0.0248, -0.0488, -0.0081, ..., 0.0117, -0.0341, 0.0478]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Patience used: 3 out of 5

training: 100%|██████████████████| 55/55 [00:09<00:00, 6.00it/s, loss=0.0467]

validation: 100%|███████████████████| 8/8 [00:01<00:00, 6.82it/s, mse=0.0506]

--------------------------------------

Average Train MSE = 0.046748

--------------------------------------

Average Test MSE = 0.050575

--------------------------------------

Epoch no. = 7

--------------------------------------

Generalization error = 0.003827

--------------------------------------

A= tensor([[ 0.0166, 0.0436, -0.0288, ..., -0.0671, 0.0242, -0.0032],

[-0.0316, 0.0414, -0.0173, ..., 0.0558, -0.0045, 0.0382],

[-0.0335, 0.0188, 0.0164, ..., -0.0451, -0.0249, -0.0077],

...,

[ 0.0274, 0.0177, -0.0183, ..., -0.0281, -0.0353, -0.0030],

[-0.0240, -0.0255, 0.0235, ..., 0.0024, 0.0069, 0.0003],

[-0.0354, -0.0213, -0.0010, ..., -0.0244, -0.0309, 0.0482]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[-0.0328, -0.0286, 0.0523, ..., 0.0150, -0.0133, 0.0131],

[-0.0476, 0.0019, -0.0212, ..., -0.0100, 0.0622, 0.0529],

[-0.0119, -0.0132, -0.0038, ..., -0.0323, 0.0526, -0.0240],

...,

[-0.0182, -0.0006, -0.0323, ..., -0.0133, 0.0143, 0.0098],

[ 0.0740, -0.0218, -0.0044, ..., 0.0293, 0.0479, 0.0134],

[ 0.0257, -0.0498, -0.0089, ..., 0.0113, -0.0345, 0.0494]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Patience used: 4 out of 5

training: 100%|██████████████████| 55/55 [00:09<00:00, 6.01it/s, loss=0.0443]

validation: 100%|███████████████████| 8/8 [00:01<00:00, 6.74it/s, mse=0.0486]

--------------------------------------

Average Train MSE = 0.044265

--------------------------------------

Average Test MSE = 0.048625

--------------------------------------

Epoch no. = 8

--------------------------------------

Generalization error = 0.004360

--------------------------------------

A= tensor([[ 0.0166, 0.0436, -0.0288, ..., -0.0671, 0.0242, -0.0032],

[-0.0316, 0.0414, -0.0173, ..., 0.0558, -0.0045, 0.0382],

[-0.0335, 0.0188, 0.0164, ..., -0.0451, -0.0249, -0.0077],

...,

[ 0.0274, 0.0177, -0.0183, ..., -0.0281, -0.0353, -0.0030],

[-0.0240, -0.0255, 0.0235, ..., 0.0024, 0.0069, 0.0003],

[-0.0354, -0.0213, -0.0010, ..., -0.0244, -0.0309, 0.0482]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[-0.0329, -0.0278, 0.0527, ..., 0.0149, -0.0134, 0.0133],

[-0.0493, 0.0028, -0.0231, ..., -0.0096, 0.0625, 0.0538],

[-0.0122, -0.0149, -0.0047, ..., -0.0319, 0.0539, -0.0258],

...,

[-0.0178, -0.0009, -0.0332, ..., -0.0132, 0.0138, 0.0104],

[ 0.0760, -0.0221, -0.0043, ..., 0.0298, 0.0488, 0.0138],

[ 0.0269, -0.0508, -0.0103, ..., 0.0111, -0.0348, 0.0513]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Patience used: 5 out of 5

**Sigma=0.01, support=100**

Model Hyperparameters:

ambient\_dim=4000

measurements=1000

redundancy=40000

DECONET\_iterations=10

Step size 1 parameter=0.5

Step size 2 parameter=0.3

Type of initialization=kaiming

Beta parameter a=0.5

Beta parameter b=0.7

DECONET(

(phi): Parameter(40000, 4000)

(first\_activation): TruncationActivation()

(second\_activation): ShrinkageActivation()

)

training: 100%|██████████████████████████████████████████████| 55/55 [00:09<00:00, 5.94it/s, loss=0.0875]

validation: 100%|███████████████████████████████████████████████| 8/8 [00:01<00:00, 7.01it/s, mse=0.0836]

--------------------------------------

Average Train MSE = 0.087452

--------------------------------------

Average Test MSE = 0.083558

--------------------------------------

Epoch no. = 0

--------------------------------------

Generalization error = 0.003893

--------------------------------------

A= tensor([[ 0.0634, 0.0131, 0.0198, ..., 0.0103, 0.0136, 0.0099],

[ 0.0606, -0.0134, 0.0421, ..., 0.0154, -0.0051, -0.0446],

[-0.0241, -0.0090, -0.0154, ..., -0.0521, -0.0093, 0.0090],

...,

[ 0.0358, 0.0558, 0.0181, ..., -0.0181, 0.0573, 0.0361],

[-0.0465, 0.0149, 0.0167, ..., -0.0665, -0.0350, 0.0043],

[ 0.0272, -0.0172, -0.0786, ..., 0.0303, 0.0008, 0.0108]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0238, 0.0267, 0.0252, ..., -0.0154, 0.0211, -0.0251],

[-0.0079, -0.0053, -0.0033, ..., -0.0699, 0.0013, -0.0242],

[-0.0229, 0.0221, -0.0024, ..., 0.0079, -0.0437, -0.0044],

...,

[-0.0180, 0.0146, -0.0131, ..., -0.0070, 0.0099, 0.0266],

[-0.0385, -0.0109, -0.0151, ..., 0.0112, 0.0213, -0.0039],

[ 0.0129, 0.0023, -0.0169, ..., 0.0041, 0.0252, 0.0033]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Validation loss decreased (inf --> 0.003893). Saving model ...

training: 100%|██████████████████████████████████████████████| 55/55 [00:09<00:00, 6.08it/s, loss=0.0776]

validation: 100%|███████████████████████████████████████████████| 8/8 [00:01<00:00, 6.95it/s, mse=0.0754]

--------------------------------------

Average Train MSE = 0.077586

--------------------------------------

Average Test MSE = 0.075437

--------------------------------------

Epoch no. = 1

--------------------------------------

Generalization error = 0.002148

--------------------------------------

A= tensor([[ 0.0634, 0.0131, 0.0198, ..., 0.0103, 0.0136, 0.0099],

[ 0.0606, -0.0134, 0.0421, ..., 0.0154, -0.0051, -0.0446],

[-0.0241, -0.0090, -0.0154, ..., -0.0521, -0.0093, 0.0090],

...,

[ 0.0358, 0.0558, 0.0181, ..., -0.0181, 0.0573, 0.0361],

[-0.0465, 0.0149, 0.0167, ..., -0.0665, -0.0350, 0.0043],

[ 0.0272, -0.0172, -0.0786, ..., 0.0303, 0.0008, 0.0108]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0245, 0.0251, 0.0257, ..., -0.0143, 0.0207, -0.0257],

[-0.0067, -0.0083, -0.0058, ..., -0.0735, 0.0025, -0.0260],

[-0.0238, 0.0241, -0.0018, ..., 0.0085, -0.0443, -0.0040],

...,

[-0.0191, 0.0140, -0.0157, ..., -0.0059, 0.0119, 0.0254],

[-0.0417, -0.0127, -0.0147, ..., 0.0112, 0.0217, -0.0067],

[ 0.0117, 0.0024, -0.0188, ..., 0.0034, 0.0244, 0.0053]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Validation loss decreased (0.003893 --> 0.002148). Saving model ...

training: 100%|██████████████████████████████████████████████| 55/55 [00:09<00:00, 6.06it/s, loss=0.0694]

validation: 100%|███████████████████████████████████████████████| 8/8 [00:01<00:00, 7.02it/s, mse=0.0689]

--------------------------------------

Average Train MSE = 0.069391

--------------------------------------

Average Test MSE = 0.068937

--------------------------------------

Epoch no. = 2

--------------------------------------

Generalization error = 0.000454

--------------------------------------

A= tensor([[ 0.0634, 0.0131, 0.0198, ..., 0.0103, 0.0136, 0.0099],

[ 0.0606, -0.0134, 0.0421, ..., 0.0154, -0.0051, -0.0446],

[-0.0241, -0.0090, -0.0154, ..., -0.0521, -0.0093, 0.0090],

...,

[ 0.0358, 0.0558, 0.0181, ..., -0.0181, 0.0573, 0.0361],

[-0.0465, 0.0149, 0.0167, ..., -0.0665, -0.0350, 0.0043],

[ 0.0272, -0.0172, -0.0786, ..., 0.0303, 0.0008, 0.0108]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0254, 0.0238, 0.0269, ..., -0.0131, 0.0199, -0.0259],

[-0.0054, -0.0112, -0.0077, ..., -0.0769, 0.0035, -0.0278],

[-0.0251, 0.0259, -0.0013, ..., 0.0086, -0.0459, -0.0032],

...,

[-0.0209, 0.0133, -0.0180, ..., -0.0049, 0.0136, 0.0243],

[-0.0442, -0.0143, -0.0140, ..., 0.0109, 0.0214, -0.0090],

[ 0.0104, 0.0025, -0.0201, ..., 0.0027, 0.0239, 0.0073]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Validation loss decreased (0.002148 --> 0.000454). Saving model ...

training: 100%|███████████████████████████████████████████████| 55/55 [00:09<00:00, 6.06it/s, loss=0.063]

validation: 100%|███████████████████████████████████████████████| 8/8 [00:01<00:00, 6.97it/s, mse=0.0637]

--------------------------------------

Average Train MSE = 0.062971

--------------------------------------

Average Test MSE = 0.063733

--------------------------------------

Epoch no. = 3

--------------------------------------

Generalization error = 0.000762

--------------------------------------

A= tensor([[ 0.0634, 0.0131, 0.0198, ..., 0.0103, 0.0136, 0.0099],

[ 0.0606, -0.0134, 0.0421, ..., 0.0154, -0.0051, -0.0446],

[-0.0241, -0.0090, -0.0154, ..., -0.0521, -0.0093, 0.0090],

...,

[ 0.0358, 0.0558, 0.0181, ..., -0.0181, 0.0573, 0.0361],

[-0.0465, 0.0149, 0.0167, ..., -0.0665, -0.0350, 0.0043],

[ 0.0272, -0.0172, -0.0786, ..., 0.0303, 0.0008, 0.0108]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0262, 0.0228, 0.0273, ..., -0.0129, 0.0196, -0.0268],

[-0.0045, -0.0133, -0.0095, ..., -0.0798, 0.0044, -0.0290],

[-0.0258, 0.0276, -0.0009, ..., 0.0088, -0.0465, -0.0025],

...,

[-0.0223, 0.0128, -0.0201, ..., -0.0038, 0.0154, 0.0236],

[-0.0469, -0.0155, -0.0135, ..., 0.0103, 0.0211, -0.0111],

[ 0.0097, 0.0027, -0.0216, ..., 0.0026, 0.0238, 0.0093]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Patience used: 1 out of 5

training: 100%|██████████████████████████████████████████████| 55/55 [00:09<00:00, 6.02it/s, loss=0.0577]

validation: 100%|███████████████████████████████████████████████| 8/8 [00:01<00:00, 6.91it/s, mse=0.0595]

--------------------------------------

Average Train MSE = 0.057661

--------------------------------------

Average Test MSE = 0.059545

--------------------------------------

Epoch no. = 4

--------------------------------------

Generalization error = 0.001884

--------------------------------------

A= tensor([[ 0.0634, 0.0131, 0.0198, ..., 0.0103, 0.0136, 0.0099],

[ 0.0606, -0.0134, 0.0421, ..., 0.0154, -0.0051, -0.0446],

[-0.0241, -0.0090, -0.0154, ..., -0.0521, -0.0093, 0.0090],

...,

[ 0.0358, 0.0558, 0.0181, ..., -0.0181, 0.0573, 0.0361],

[-0.0465, 0.0149, 0.0167, ..., -0.0665, -0.0350, 0.0043],

[ 0.0272, -0.0172, -0.0786, ..., 0.0303, 0.0008, 0.0108]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0271, 0.0220, 0.0278, ..., -0.0120, 0.0191, -0.0271],

[-0.0036, -0.0161, -0.0110, ..., -0.0827, 0.0050, -0.0303],

[-0.0265, 0.0289, -0.0010, ..., 0.0087, -0.0476, -0.0018],

...,

[-0.0238, 0.0123, -0.0222, ..., -0.0028, 0.0165, 0.0226],

[-0.0493, -0.0165, -0.0129, ..., 0.0095, 0.0209, -0.0131],

[ 0.0095, 0.0027, -0.0228, ..., 0.0021, 0.0238, 0.0113]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Patience used: 2 out of 5

training: 100%|██████████████████████████████████████████████| 55/55 [00:09<00:00, 6.06it/s, loss=0.0533]

validation: 100%|███████████████████████████████████████████████| 8/8 [00:01<00:00, 7.00it/s, mse=0.0561]

--------------------------------------

Average Train MSE = 0.053339

--------------------------------------

Average Test MSE = 0.056101

--------------------------------------

Epoch no. = 5

--------------------------------------

Generalization error = 0.002762

--------------------------------------

A= tensor([[ 0.0634, 0.0131, 0.0198, ..., 0.0103, 0.0136, 0.0099],

[ 0.0606, -0.0134, 0.0421, ..., 0.0154, -0.0051, -0.0446],

[-0.0241, -0.0090, -0.0154, ..., -0.0521, -0.0093, 0.0090],

...,

[ 0.0358, 0.0558, 0.0181, ..., -0.0181, 0.0573, 0.0361],

[-0.0465, 0.0149, 0.0167, ..., -0.0665, -0.0350, 0.0043],

[ 0.0272, -0.0172, -0.0786, ..., 0.0303, 0.0008, 0.0108]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0279, 0.0217, 0.0285, ..., -0.0117, 0.0188, -0.0276],

[-0.0026, -0.0182, -0.0127, ..., -0.0852, 0.0060, -0.0315],

[-0.0269, 0.0303, -0.0008, ..., 0.0087, -0.0487, -0.0012],

...,

[-0.0250, 0.0125, -0.0239, ..., -0.0024, 0.0181, 0.0222],

[-0.0518, -0.0170, -0.0127, ..., 0.0088, 0.0214, -0.0151],

[ 0.0091, 0.0028, -0.0234, ..., 0.0021, 0.0235, 0.0135]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Patience used: 3 out of 5

training: 100%|██████████████████████████████████████████████| 55/55 [00:09<00:00, 6.03it/s, loss=0.0498]

validation: 100%|███████████████████████████████████████████████| 8/8 [00:01<00:00, 6.94it/s, mse=0.0533]

--------------------------------------

Average Train MSE = 0.049801

--------------------------------------

Average Test MSE = 0.053258

--------------------------------------

Epoch no. = 6

--------------------------------------

Generalization error = 0.003457

--------------------------------------

A= tensor([[ 0.0634, 0.0131, 0.0198, ..., 0.0103, 0.0136, 0.0099],

[ 0.0606, -0.0134, 0.0421, ..., 0.0154, -0.0051, -0.0446],

[-0.0241, -0.0090, -0.0154, ..., -0.0521, -0.0093, 0.0090],

...,

[ 0.0358, 0.0558, 0.0181, ..., -0.0181, 0.0573, 0.0361],

[-0.0465, 0.0149, 0.0167, ..., -0.0665, -0.0350, 0.0043],

[ 0.0272, -0.0172, -0.0786, ..., 0.0303, 0.0008, 0.0108]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0290, 0.0213, 0.0290, ..., -0.0109, 0.0190, -0.0278],

[-0.0020, -0.0201, -0.0134, ..., -0.0877, 0.0065, -0.0326],

[-0.0276, 0.0312, -0.0011, ..., 0.0084, -0.0499, -0.0008],

...,

[-0.0261, 0.0122, -0.0253, ..., -0.0014, 0.0190, 0.0216],

[-0.0543, -0.0175, -0.0122, ..., 0.0082, 0.0212, -0.0169],

[ 0.0087, 0.0030, -0.0238, ..., 0.0020, 0.0238, 0.0152]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Patience used: 4 out of 5

training: 100%|██████████████████████████████████████████████| 55/55 [00:09<00:00, 6.03it/s, loss=0.0468]

validation: 100%|███████████████████████████████████████████████| 8/8 [00:01<00:00, 6.94it/s, mse=0.0509]

--------------------------------------

Average Train MSE = 0.046838

--------------------------------------

Average Test MSE = 0.050919

--------------------------------------

Epoch no. = 7

--------------------------------------

Generalization error = 0.004081

--------------------------------------

A= tensor([[ 0.0634, 0.0131, 0.0198, ..., 0.0103, 0.0136, 0.0099],

[ 0.0606, -0.0134, 0.0421, ..., 0.0154, -0.0051, -0.0446],

[-0.0241, -0.0090, -0.0154, ..., -0.0521, -0.0093, 0.0090],

...,

[ 0.0358, 0.0558, 0.0181, ..., -0.0181, 0.0573, 0.0361],

[-0.0465, 0.0149, 0.0167, ..., -0.0665, -0.0350, 0.0043],

[ 0.0272, -0.0172, -0.0786, ..., 0.0303, 0.0008, 0.0108]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0302, 0.0210, 0.0296, ..., -0.0106, 0.0186, -0.0280],

[-0.0017, -0.0222, -0.0146, ..., -0.0898, 0.0072, -0.0334],

[-0.0280, 0.0321, -0.0011, ..., 0.0084, -0.0508, -0.0005],

...,

[-0.0275, 0.0117, -0.0263, ..., -0.0010, 0.0204, 0.0213],

[-0.0564, -0.0181, -0.0117, ..., 0.0074, 0.0215, -0.0184],

[ 0.0079, 0.0035, -0.0241, ..., 0.0018, 0.0236, 0.0170]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Patience used: 5 out of 5

**Sigma=0.01, support=20**

Model Hyperparameters:

ambient\_dim=4000

measurements=1000

redundancy=40000

DECONET\_iterations=10

Step size 1 parameter=0.5

Step size 2 parameter=0.3

Type of initialization=kaiming

Beta parameter a=0.5

Beta parameter b=0.7

DECONET(

(phi): Parameter(40000, 4000)

(first\_activation): TruncationActivation()

(second\_activation): ShrinkageActivation()

)

training: 100%|██████████████████████████████████████████████| 55/55 [00:09<00:00, 5.93it/s, loss=0.0875]

validation: 100%|███████████████████████████████████████████████| 8/8 [00:01<00:00, 7.00it/s, mse=0.0827]

--------------------------------------

Average Train MSE = 0.087502

--------------------------------------

Average Test MSE = 0.082744

--------------------------------------

Epoch no. = 0

--------------------------------------

Generalization error = 0.004758

--------------------------------------

A= tensor([[-0.0274, 0.0560, -0.0098, ..., 0.0033, 0.0232, 0.0619],

[-0.0104, 0.0450, -0.0310, ..., 0.0011, 0.0426, -0.0087],

[-0.0342, -0.0041, -0.0236, ..., -0.0161, -0.0195, -0.0015],

...,

[ 0.0286, -0.0283, -0.0132, ..., -0.0217, 0.0184, -0.0453],

[-0.0432, 0.0078, -0.0128, ..., -0.0206, -0.0011, 0.0022],

[-0.0135, 0.0202, 0.0222, ..., 0.0140, -0.0069, -0.0039]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0074, -0.0277, 0.0009, ..., 0.0253, -0.0125, -0.0210],

[-0.0031, 0.0087, 0.0276, ..., 0.0124, -0.0395, -0.0260],

[ 0.0351, -0.0041, 0.0034, ..., -0.0150, -0.0241, 0.0068],

...,

[-0.0127, -0.0111, 0.0280, ..., -0.0492, -0.0461, 0.0228],

[ 0.0416, -0.0007, 0.0079, ..., -0.0359, 0.0253, -0.0360],

[ 0.0432, -0.0038, -0.0181, ..., -0.0425, 0.0271, 0.0058]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Validation loss decreased (inf --> 0.004758). Saving model ...

training: 100%|██████████████████████████████████████████████| 55/55 [00:09<00:00, 6.06it/s, loss=0.0776]

validation: 100%|███████████████████████████████████████████████| 8/8 [00:01<00:00, 6.92it/s, mse=0.0749]

--------------------------------------

Average Train MSE = 0.077641

--------------------------------------

Average Test MSE = 0.074890

--------------------------------------

Epoch no. = 1

--------------------------------------

Generalization error = 0.002751

--------------------------------------

A= tensor([[-0.0274, 0.0560, -0.0098, ..., 0.0033, 0.0232, 0.0619],

[-0.0104, 0.0450, -0.0310, ..., 0.0011, 0.0426, -0.0087],

[-0.0342, -0.0041, -0.0236, ..., -0.0161, -0.0195, -0.0015],

...,

[ 0.0286, -0.0283, -0.0132, ..., -0.0217, 0.0184, -0.0453],

[-0.0432, 0.0078, -0.0128, ..., -0.0206, -0.0011, 0.0022],

[-0.0135, 0.0202, 0.0222, ..., 0.0140, -0.0069, -0.0039]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0072, -0.0273, -0.0024, ..., 0.0247, -0.0104, -0.0213],

[-0.0024, 0.0097, 0.0307, ..., 0.0120, -0.0395, -0.0283],

[ 0.0343, -0.0062, 0.0044, ..., -0.0162, -0.0252, 0.0069],

...,

[-0.0148, -0.0089, 0.0301, ..., -0.0521, -0.0489, 0.0252],

[ 0.0389, -0.0022, 0.0061, ..., -0.0369, 0.0242, -0.0344],

[ 0.0438, -0.0036, -0.0179, ..., -0.0407, 0.0290, 0.0060]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Validation loss decreased (0.004758 --> 0.002751). Saving model ...

training: 100%|██████████████████████████████████████████████| 55/55 [00:09<00:00, 6.05it/s, loss=0.0696]

validation: 100%|███████████████████████████████████████████████| 8/8 [00:01<00:00, 6.93it/s, mse=0.0686]

--------------------------------------

Average Train MSE = 0.069569

--------------------------------------

Average Test MSE = 0.068561

--------------------------------------

Epoch no. = 2

--------------------------------------

Generalization error = 0.001009

--------------------------------------

A= tensor([[-0.0274, 0.0560, -0.0098, ..., 0.0033, 0.0232, 0.0619],

[-0.0104, 0.0450, -0.0310, ..., 0.0011, 0.0426, -0.0087],

[-0.0342, -0.0041, -0.0236, ..., -0.0161, -0.0195, -0.0015],

...,

[ 0.0286, -0.0283, -0.0132, ..., -0.0217, 0.0184, -0.0453],

[-0.0432, 0.0078, -0.0128, ..., -0.0206, -0.0011, 0.0022],

[-0.0135, 0.0202, 0.0222, ..., 0.0140, -0.0069, -0.0039]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0064, -0.0269, -0.0055, ..., 0.0247, -0.0082, -0.0212],

[-0.0014, 0.0111, 0.0332, ..., 0.0117, -0.0391, -0.0300],

[ 0.0333, -0.0081, 0.0050, ..., -0.0171, -0.0260, 0.0068],

...,

[-0.0164, -0.0068, 0.0323, ..., -0.0549, -0.0512, 0.0271],

[ 0.0366, -0.0037, 0.0050, ..., -0.0372, 0.0233, -0.0331],

[ 0.0445, -0.0037, -0.0182, ..., -0.0393, 0.0305, 0.0059]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Validation loss decreased (0.002751 --> 0.001009). Saving model ...

training: 100%|███████████████████████████████████████████████| 55/55 [00:09<00:00, 6.05it/s, loss=0.063]

validation: 100%|███████████████████████████████████████████████| 8/8 [00:01<00:00, 6.90it/s, mse=0.0634]

--------------------------------------

Average Train MSE = 0.063013

--------------------------------------

Average Test MSE = 0.063419

--------------------------------------

Epoch no. = 3

--------------------------------------

Generalization error = 0.000406

--------------------------------------

A= tensor([[-0.0274, 0.0560, -0.0098, ..., 0.0033, 0.0232, 0.0619],

[-0.0104, 0.0450, -0.0310, ..., 0.0011, 0.0426, -0.0087],

[-0.0342, -0.0041, -0.0236, ..., -0.0161, -0.0195, -0.0015],

...,

[ 0.0286, -0.0283, -0.0132, ..., -0.0217, 0.0184, -0.0453],

[-0.0432, 0.0078, -0.0128, ..., -0.0206, -0.0011, 0.0022],

[-0.0135, 0.0202, 0.0222, ..., 0.0140, -0.0069, -0.0039]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0055, -0.0269, -0.0083, ..., 0.0250, -0.0066, -0.0214],

[-0.0009, 0.0121, 0.0360, ..., 0.0114, -0.0389, -0.0320],

[ 0.0326, -0.0094, 0.0060, ..., -0.0177, -0.0264, 0.0069],

...,

[-0.0181, -0.0050, 0.0348, ..., -0.0573, -0.0539, 0.0288],

[ 0.0351, -0.0048, 0.0039, ..., -0.0380, 0.0222, -0.0321],

[ 0.0448, -0.0035, -0.0177, ..., -0.0376, 0.0318, 0.0056]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Validation loss decreased (0.001009 --> 0.000406). Saving model ...

training: 100%|██████████████████████████████████████████████| 55/55 [00:09<00:00, 6.04it/s, loss=0.0577]

validation: 100%|███████████████████████████████████████████████| 8/8 [00:01<00:00, 7.00it/s, mse=0.0592]

--------------------------------------

Average Train MSE = 0.057715

--------------------------------------

Average Test MSE = 0.059187

--------------------------------------

Epoch no. = 4

--------------------------------------

Generalization error = 0.001472

--------------------------------------

A= tensor([[-0.0274, 0.0560, -0.0098, ..., 0.0033, 0.0232, 0.0619],

[-0.0104, 0.0450, -0.0310, ..., 0.0011, 0.0426, -0.0087],

[-0.0342, -0.0041, -0.0236, ..., -0.0161, -0.0195, -0.0015],

...,

[ 0.0286, -0.0283, -0.0132, ..., -0.0217, 0.0184, -0.0453],

[-0.0432, 0.0078, -0.0128, ..., -0.0206, -0.0011, 0.0022],

[-0.0135, 0.0202, 0.0222, ..., 0.0140, -0.0069, -0.0039]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0048, -0.0273, -0.0108, ..., 0.0252, -0.0053, -0.0214],

[-0.0007, 0.0139, 0.0384, ..., 0.0109, -0.0389, -0.0332],

[ 0.0319, -0.0106, 0.0073, ..., -0.0183, -0.0273, 0.0068],

...,

[-0.0198, -0.0037, 0.0368, ..., -0.0596, -0.0560, 0.0299],

[ 0.0334, -0.0056, 0.0032, ..., -0.0384, 0.0214, -0.0308],

[ 0.0456, -0.0035, -0.0180, ..., -0.0360, 0.0330, 0.0059]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Patience used: 1 out of 5

training: 100%|██████████████████████████████████████████████| 55/55 [00:09<00:00, 6.02it/s, loss=0.0534]

validation: 100%|███████████████████████████████████████████████| 8/8 [00:01<00:00, 6.93it/s, mse=0.0558]

--------------------------------------

Average Train MSE = 0.053418

--------------------------------------

Average Test MSE = 0.055821

--------------------------------------

Epoch no. = 5

--------------------------------------

Generalization error = 0.002403

--------------------------------------

A= tensor([[-0.0274, 0.0560, -0.0098, ..., 0.0033, 0.0232, 0.0619],

[-0.0104, 0.0450, -0.0310, ..., 0.0011, 0.0426, -0.0087],

[-0.0342, -0.0041, -0.0236, ..., -0.0161, -0.0195, -0.0015],

...,

[ 0.0286, -0.0283, -0.0132, ..., -0.0217, 0.0184, -0.0453],

[-0.0432, 0.0078, -0.0128, ..., -0.0206, -0.0011, 0.0022],

[-0.0135, 0.0202, 0.0222, ..., 0.0140, -0.0069, -0.0039]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0042, -0.0272, -0.0133, ..., 0.0257, -0.0041, -0.0218],

[-0.0006, 0.0146, 0.0407, ..., 0.0107, -0.0393, -0.0347],

[ 0.0312, -0.0116, 0.0081, ..., -0.0191, -0.0279, 0.0068],

...,

[-0.0214, -0.0020, 0.0388, ..., -0.0620, -0.0579, 0.0309],

[ 0.0320, -0.0068, 0.0020, ..., -0.0392, 0.0207, -0.0300],

[ 0.0460, -0.0036, -0.0179, ..., -0.0343, 0.0337, 0.0054]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Patience used: 2 out of 5

training: 100%|██████████████████████████████████████████████| 55/55 [00:09<00:00, 6.01it/s, loss=0.0498]

validation: 100%|████████████████████████████████████████████████| 8/8 [00:01<00:00, 6.96it/s, mse=0.053]

--------------------------------------

Average Train MSE = 0.049837

--------------------------------------

Average Test MSE = 0.053041

--------------------------------------

Epoch no. = 6

--------------------------------------

Generalization error = 0.003204

--------------------------------------

A= tensor([[-0.0274, 0.0560, -0.0098, ..., 0.0033, 0.0232, 0.0619],

[-0.0104, 0.0450, -0.0310, ..., 0.0011, 0.0426, -0.0087],

[-0.0342, -0.0041, -0.0236, ..., -0.0161, -0.0195, -0.0015],

...,

[ 0.0286, -0.0283, -0.0132, ..., -0.0217, 0.0184, -0.0453],

[-0.0432, 0.0078, -0.0128, ..., -0.0206, -0.0011, 0.0022],

[-0.0135, 0.0202, 0.0222, ..., 0.0140, -0.0069, -0.0039]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0037, -0.0278, -0.0155, ..., 0.0260, -0.0026, -0.0214],

[-0.0008, 0.0157, 0.0424, ..., 0.0107, -0.0393, -0.0360],

[ 0.0307, -0.0121, 0.0096, ..., -0.0194, -0.0287, 0.0074],

...,

[-0.0231, -0.0007, 0.0405, ..., -0.0639, -0.0601, 0.0318],

[ 0.0310, -0.0076, 0.0012, ..., -0.0398, 0.0199, -0.0293],

[ 0.0461, -0.0035, -0.0180, ..., -0.0330, 0.0344, 0.0051]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Patience used: 3 out of 5

training: 100%|██████████████████████████████████████████████| 55/55 [00:09<00:00, 6.00it/s, loss=0.0469]

validation: 100%|███████████████████████████████████████████████| 8/8 [00:01<00:00, 6.99it/s, mse=0.0507]

--------------------------------------

Average Train MSE = 0.046874

--------------------------------------

Average Test MSE = 0.050683

--------------------------------------

Epoch no. = 7

--------------------------------------

Generalization error = 0.003809

--------------------------------------

A= tensor([[-0.0274, 0.0560, -0.0098, ..., 0.0033, 0.0232, 0.0619],

[-0.0104, 0.0450, -0.0310, ..., 0.0011, 0.0426, -0.0087],

[-0.0342, -0.0041, -0.0236, ..., -0.0161, -0.0195, -0.0015],

...,

[ 0.0286, -0.0283, -0.0132, ..., -0.0217, 0.0184, -0.0453],

[-0.0432, 0.0078, -0.0128, ..., -0.0206, -0.0011, 0.0022],

[-0.0135, 0.0202, 0.0222, ..., 0.0140, -0.0069, -0.0039]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0031, -0.0283, -0.0176, ..., 0.0261, -0.0019, -0.0215],

[-0.0014, 0.0169, 0.0445, ..., 0.0101, -0.0392, -0.0368],

[ 0.0303, -0.0130, 0.0107, ..., -0.0195, -0.0291, 0.0072],

...,

[-0.0244, 0.0005, 0.0422, ..., -0.0661, -0.0620, 0.0323],

[ 0.0298, -0.0082, 0.0001, ..., -0.0405, 0.0188, -0.0290],

[ 0.0465, -0.0037, -0.0177, ..., -0.0313, 0.0353, 0.0052]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Patience used: 4 out of 5

training: 100%|██████████████████████████████████████████████| 55/55 [00:09<00:00, 6.01it/s, loss=0.0444]

validation: 100%|███████████████████████████████████████████████| 8/8 [00:01<00:00, 6.88it/s, mse=0.0487]

--------------------------------------

Average Train MSE = 0.044378

--------------------------------------

Average Test MSE = 0.048740

--------------------------------------

Epoch no. = 8

--------------------------------------

Generalization error = 0.004362

--------------------------------------

A= tensor([[-0.0274, 0.0560, -0.0098, ..., 0.0033, 0.0232, 0.0619],

[-0.0104, 0.0450, -0.0310, ..., 0.0011, 0.0426, -0.0087],

[-0.0342, -0.0041, -0.0236, ..., -0.0161, -0.0195, -0.0015],

...,

[ 0.0286, -0.0283, -0.0132, ..., -0.0217, 0.0184, -0.0453],

[-0.0432, 0.0078, -0.0128, ..., -0.0206, -0.0011, 0.0022],

[-0.0135, 0.0202, 0.0222, ..., 0.0140, -0.0069, -0.0039]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0026, -0.0285, -0.0194, ..., 0.0268, -0.0013, -0.0215],

[-0.0018, 0.0181, 0.0461, ..., 0.0098, -0.0395, -0.0380],

[ 0.0299, -0.0132, 0.0118, ..., -0.0199, -0.0298, 0.0076],

...,

[-0.0257, 0.0016, 0.0443, ..., -0.0676, -0.0639, 0.0327],

[ 0.0293, -0.0089, -0.0009, ..., -0.0412, 0.0184, -0.0281],

[ 0.0467, -0.0038, -0.0176, ..., -0.0297, 0.0357, 0.0050]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Patience used: 5 out of 5

**Sigma=0.01, support=5**

Model Hyperparameters:

ambient\_dim=4000

measurements=1000

redundancy=40000

DECONET\_iterations=10

Step size 1 parameter=0.5

Step size 2 parameter=0.3

Type of initialization=kaiming

Beta parameter a=0.5

Beta parameter b=0.7

DECONET(

(phi): Parameter(40000, 4000)

(first\_activation): TruncationActivation()

(second\_activation): ShrinkageActivation()

)

training: 100%|██████████████████████████████████████████████| 55/55 [00:09<00:00, 5.90it/s, loss=0.0876]

validation: 100%|███████████████████████████████████████████████| 8/8 [00:01<00:00, 6.97it/s, mse=0.0826]

--------------------------------------

Average Train MSE = 0.087574

--------------------------------------

Average Test MSE = 0.082573

--------------------------------------

Epoch no. = 0

--------------------------------------

Generalization error = 0.005001

--------------------------------------

A= tensor([[-0.0028, 0.0068, 0.0004, ..., -0.0436, 0.0113, -0.0661],

[-0.0337, -0.0623, 0.0141, ..., 0.0145, -0.0566, 0.0177],

[ 0.0068, 0.0059, -0.0837, ..., -0.0046, 0.0342, 0.0426],

...,

[-0.0129, -0.0173, 0.0323, ..., 0.0615, 0.0006, -0.0239],

[ 0.0250, -0.0070, 0.0002, ..., -0.0489, -0.0068, 0.0373],

[ 0.0008, 0.0104, 0.0127, ..., -0.0044, -0.0422, 0.0121]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0340, 0.0362, 0.0277, ..., -0.0176, -0.0296, 0.0501],

[ 0.0057, -0.0140, -0.0609, ..., 0.0286, 0.0078, 0.0146],

[-0.0083, -0.0397, 0.0101, ..., -0.0088, 0.0001, 0.0061],

...,

[ 0.0516, -0.0115, -0.0384, ..., -0.0054, 0.0256, -0.0432],

[ 0.0025, 0.0003, -0.0295, ..., -0.0262, -0.0053, 0.0340],

[ 0.0166, 0.0157, 0.0599, ..., -0.0049, -0.0118, -0.0058]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Validation loss decreased (inf --> 0.005001). Saving model ...

training: 100%|██████████████████████████████████████████████| 55/55 [00:09<00:00, 6.07it/s, loss=0.0778]

validation: 100%|███████████████████████████████████████████████| 8/8 [00:01<00:00, 6.70it/s, mse=0.0747]

--------------------------------------

Average Train MSE = 0.077805

--------------------------------------

Average Test MSE = 0.074679

--------------------------------------

Epoch no. = 1

--------------------------------------

Generalization error = 0.003126

--------------------------------------

A= tensor([[-0.0028, 0.0068, 0.0004, ..., -0.0436, 0.0113, -0.0661],

[-0.0337, -0.0623, 0.0141, ..., 0.0145, -0.0566, 0.0177],

[ 0.0068, 0.0059, -0.0837, ..., -0.0046, 0.0342, 0.0426],

...,

[-0.0129, -0.0173, 0.0323, ..., 0.0615, 0.0006, -0.0239],

[ 0.0250, -0.0070, 0.0002, ..., -0.0489, -0.0068, 0.0373],

[ 0.0008, 0.0104, 0.0127, ..., -0.0044, -0.0422, 0.0121]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0350, 0.0386, 0.0306, ..., -0.0173, -0.0299, 0.0524],

[ 0.0072, -0.0121, -0.0644, ..., 0.0308, 0.0066, 0.0159],

[-0.0082, -0.0409, 0.0119, ..., -0.0074, -0.0021, 0.0070],

...,

[ 0.0529, -0.0087, -0.0375, ..., -0.0042, 0.0278, -0.0455],

[ 0.0032, -0.0013, -0.0323, ..., -0.0267, -0.0057, 0.0333],

[ 0.0169, 0.0159, 0.0622, ..., -0.0025, -0.0132, -0.0073]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Validation loss decreased (0.005001 --> 0.003126). Saving model ...

training: 100%|██████████████████████████████████████████████| 55/55 [00:09<00:00, 6.05it/s, loss=0.0697]

validation: 100%|███████████████████████████████████████████████| 8/8 [00:01<00:00, 6.98it/s, mse=0.0683]

--------------------------------------

Average Train MSE = 0.069654

--------------------------------------

Average Test MSE = 0.068333

--------------------------------------

Epoch no. = 2

--------------------------------------

Generalization error = 0.001321

--------------------------------------

A= tensor([[-0.0028, 0.0068, 0.0004, ..., -0.0436, 0.0113, -0.0661],

[-0.0337, -0.0623, 0.0141, ..., 0.0145, -0.0566, 0.0177],

[ 0.0068, 0.0059, -0.0837, ..., -0.0046, 0.0342, 0.0426],

...,

[-0.0129, -0.0173, 0.0323, ..., 0.0615, 0.0006, -0.0239],

[ 0.0250, -0.0070, 0.0002, ..., -0.0489, -0.0068, 0.0373],

[ 0.0008, 0.0104, 0.0127, ..., -0.0044, -0.0422, 0.0121]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0362, 0.0407, 0.0333, ..., -0.0167, -0.0299, 0.0548],

[ 0.0083, -0.0101, -0.0679, ..., 0.0332, 0.0057, 0.0175],

[-0.0082, -0.0421, 0.0133, ..., -0.0063, -0.0039, 0.0081],

...,

[ 0.0538, -0.0065, -0.0365, ..., -0.0029, 0.0296, -0.0477],

[ 0.0042, -0.0033, -0.0349, ..., -0.0269, -0.0062, 0.0325],

[ 0.0175, 0.0167, 0.0645, ..., -0.0003, -0.0137, -0.0092]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Validation loss decreased (0.003126 --> 0.001321). Saving model ...

training: 100%|██████████████████████████████████████████████| 55/55 [00:09<00:00, 6.03it/s, loss=0.0631]

validation: 100%|███████████████████████████████████████████████| 8/8 [00:01<00:00, 6.86it/s, mse=0.0632]

--------------------------------------

Average Train MSE = 0.063099

--------------------------------------

Average Test MSE = 0.063237

--------------------------------------

Epoch no. = 3

--------------------------------------

Generalization error = 0.000138

--------------------------------------

A= tensor([[-0.0028, 0.0068, 0.0004, ..., -0.0436, 0.0113, -0.0661],

[-0.0337, -0.0623, 0.0141, ..., 0.0145, -0.0566, 0.0177],

[ 0.0068, 0.0059, -0.0837, ..., -0.0046, 0.0342, 0.0426],

...,

[-0.0129, -0.0173, 0.0323, ..., 0.0615, 0.0006, -0.0239],

[ 0.0250, -0.0070, 0.0002, ..., -0.0489, -0.0068, 0.0373],

[ 0.0008, 0.0104, 0.0127, ..., -0.0044, -0.0422, 0.0121]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0371, 0.0422, 0.0357, ..., -0.0163, -0.0301, 0.0564],

[ 0.0091, -0.0085, -0.0709, ..., 0.0354, 0.0044, 0.0188],

[-0.0075, -0.0434, 0.0144, ..., -0.0053, -0.0054, 0.0094],

...,

[ 0.0544, -0.0045, -0.0352, ..., -0.0019, 0.0313, -0.0498],

[ 0.0046, -0.0053, -0.0377, ..., -0.0272, -0.0065, 0.0323],

[ 0.0180, 0.0171, 0.0665, ..., 0.0019, -0.0144, -0.0107]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Validation loss decreased (0.001321 --> 0.000138). Saving model ...

training: 100%|██████████████████████████████████████████████| 55/55 [00:09<00:00, 6.05it/s, loss=0.0578]

validation: 100%|███████████████████████████████████████████████| 8/8 [00:01<00:00, 6.81it/s, mse=0.0592]

--------------------------------------

Average Train MSE = 0.057827

--------------------------------------

Average Test MSE = 0.059157

--------------------------------------

Epoch no. = 4

--------------------------------------

Generalization error = 0.001330

--------------------------------------

A= tensor([[-0.0028, 0.0068, 0.0004, ..., -0.0436, 0.0113, -0.0661],

[-0.0337, -0.0623, 0.0141, ..., 0.0145, -0.0566, 0.0177],

[ 0.0068, 0.0059, -0.0837, ..., -0.0046, 0.0342, 0.0426],

...,

[-0.0129, -0.0173, 0.0323, ..., 0.0615, 0.0006, -0.0239],

[ 0.0250, -0.0070, 0.0002, ..., -0.0489, -0.0068, 0.0373],

[ 0.0008, 0.0104, 0.0127, ..., -0.0044, -0.0422, 0.0121]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0379, 0.0436, 0.0378, ..., -0.0160, -0.0301, 0.0579],

[ 0.0102, -0.0069, -0.0738, ..., 0.0373, 0.0034, 0.0199],

[-0.0070, -0.0440, 0.0152, ..., -0.0045, -0.0071, 0.0110],

...,

[ 0.0545, -0.0025, -0.0347, ..., -0.0012, 0.0330, -0.0521],

[ 0.0049, -0.0067, -0.0399, ..., -0.0274, -0.0067, 0.0317],

[ 0.0186, 0.0177, 0.0682, ..., 0.0040, -0.0147, -0.0122]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Patience used: 1 out of 5

training: 100%|██████████████████████████████████████████████| 55/55 [00:09<00:00, 6.03it/s, loss=0.0535]

validation: 100%|███████████████████████████████████████████████| 8/8 [00:01<00:00, 6.89it/s, mse=0.0558]

--------------------------------------

Average Train MSE = 0.053495

--------------------------------------

Average Test MSE = 0.055820

--------------------------------------

Epoch no. = 5

--------------------------------------

Generalization error = 0.002325

--------------------------------------

A= tensor([[-0.0028, 0.0068, 0.0004, ..., -0.0436, 0.0113, -0.0661],

[-0.0337, -0.0623, 0.0141, ..., 0.0145, -0.0566, 0.0177],

[ 0.0068, 0.0059, -0.0837, ..., -0.0046, 0.0342, 0.0426],

...,

[-0.0129, -0.0173, 0.0323, ..., 0.0615, 0.0006, -0.0239],

[ 0.0250, -0.0070, 0.0002, ..., -0.0489, -0.0068, 0.0373],

[ 0.0008, 0.0104, 0.0127, ..., -0.0044, -0.0422, 0.0121]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0381, 0.0452, 0.0399, ..., -0.0154, -0.0298, 0.0595],

[ 0.0105, -0.0056, -0.0766, ..., 0.0391, 0.0026, 0.0206],

[-0.0069, -0.0452, 0.0163, ..., -0.0036, -0.0084, 0.0121],

...,

[ 0.0542, -0.0013, -0.0339, ..., -0.0003, 0.0341, -0.0537],

[ 0.0052, -0.0083, -0.0418, ..., -0.0276, -0.0073, 0.0316],

[ 0.0195, 0.0185, 0.0700, ..., 0.0062, -0.0153, -0.0136]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Patience used: 2 out of 5

training: 100%|██████████████████████████████████████████████| 55/55 [00:09<00:00, 6.05it/s, loss=0.0499]

validation: 100%|████████████████████████████████████████████████| 8/8 [00:01<00:00, 7.05it/s, mse=0.053]

--------------------------------------

Average Train MSE = 0.049932

--------------------------------------

Average Test MSE = 0.053009

--------------------------------------

Epoch no. = 6

--------------------------------------

Generalization error = 0.003077

--------------------------------------

A= tensor([[-0.0028, 0.0068, 0.0004, ..., -0.0436, 0.0113, -0.0661],

[-0.0337, -0.0623, 0.0141, ..., 0.0145, -0.0566, 0.0177],

[ 0.0068, 0.0059, -0.0837, ..., -0.0046, 0.0342, 0.0426],

...,

[-0.0129, -0.0173, 0.0323, ..., 0.0615, 0.0006, -0.0239],

[ 0.0250, -0.0070, 0.0002, ..., -0.0489, -0.0068, 0.0373],

[ 0.0008, 0.0104, 0.0127, ..., -0.0044, -0.0422, 0.0121]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 3.8412e-02, 4.6473e-02, 4.1374e-02, ..., -1.4824e-02,

-3.0070e-02, 6.0550e-02],

[ 1.0650e-02, -4.4282e-03, -7.9258e-02, ..., 4.1019e-02,

1.4215e-03, 2.1466e-02],

[-6.2337e-03, -4.5701e-02, 1.6726e-02, ..., -2.7370e-03,

-9.1183e-03, 1.2995e-02],

...,

[ 5.4315e-02, 5.0688e-06, -3.3113e-02, ..., 2.4381e-04,

3.5419e-02, -5.5215e-02],

[ 5.5289e-03, -9.7737e-03, -4.3796e-02, ..., -2.7769e-02,

-7.8218e-03, 3.1311e-02],

[ 2.0307e-02, 1.9235e-02, 7.0867e-02, ..., 8.0105e-03,

-1.5965e-02, -1.5170e-02]], device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Patience used: 3 out of 5

training: 100%|██████████████████████████████████████████████| 55/55 [00:09<00:00, 6.01it/s, loss=0.0469]

validation: 100%|███████████████████████████████████████████████| 8/8 [00:01<00:00, 6.99it/s, mse=0.0507]

--------------------------------------

Average Train MSE = 0.046949

--------------------------------------

Average Test MSE = 0.050676

--------------------------------------

Epoch no. = 7

--------------------------------------

Generalization error = 0.003726

--------------------------------------

A= tensor([[-0.0028, 0.0068, 0.0004, ..., -0.0436, 0.0113, -0.0661],

[-0.0337, -0.0623, 0.0141, ..., 0.0145, -0.0566, 0.0177],

[ 0.0068, 0.0059, -0.0837, ..., -0.0046, 0.0342, 0.0426],

...,

[-0.0129, -0.0173, 0.0323, ..., 0.0615, 0.0006, -0.0239],

[ 0.0250, -0.0070, 0.0002, ..., -0.0489, -0.0068, 0.0373],

[ 0.0008, 0.0104, 0.0127, ..., -0.0044, -0.0422, 0.0121]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0389, 0.0477, 0.0428, ..., -0.0143, -0.0301, 0.0615],

[ 0.0109, -0.0035, -0.0816, ..., 0.0426, 0.0007, 0.0223],

[-0.0057, -0.0465, 0.0175, ..., -0.0022, -0.0103, 0.0142],

...,

[ 0.0539, 0.0013, -0.0323, ..., 0.0007, 0.0362, -0.0564],

[ 0.0057, -0.0112, -0.0456, ..., -0.0283, -0.0078, 0.0311],

[ 0.0207, 0.0199, 0.0721, ..., 0.0097, -0.0161, -0.0162]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Patience used: 4 out of 5

training: 100%|██████████████████████████████████████████████| 55/55 [00:09<00:00, 6.03it/s, loss=0.0444]

validation: 100%|███████████████████████████████████████████████| 8/8 [00:01<00:00, 6.97it/s, mse=0.0487]

--------------------------------------

Average Train MSE = 0.044437

--------------------------------------

Average Test MSE = 0.048736

--------------------------------------

Epoch no. = 8

--------------------------------------

Generalization error = 0.004300

--------------------------------------

A= tensor([[-0.0028, 0.0068, 0.0004, ..., -0.0436, 0.0113, -0.0661],

[-0.0337, -0.0623, 0.0141, ..., 0.0145, -0.0566, 0.0177],

[ 0.0068, 0.0059, -0.0837, ..., -0.0046, 0.0342, 0.0426],

...,

[-0.0129, -0.0173, 0.0323, ..., 0.0615, 0.0006, -0.0239],

[ 0.0250, -0.0070, 0.0002, ..., -0.0489, -0.0068, 0.0373],

[ 0.0008, 0.0104, 0.0127, ..., -0.0044, -0.0422, 0.0121]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 3.8858e-02, 4.8481e-02, 4.4154e-02, ..., -1.4205e-02,

-2.9953e-02, 6.2485e-02],

[ 1.0787e-02, -2.2223e-03, -8.3661e-02, ..., 4.3915e-02,

-2.5584e-05, 2.2890e-02],

[-5.4574e-03, -4.7222e-02, 1.7994e-02, ..., -1.6619e-03,

-1.0915e-02, 1.4931e-02],

...,

[ 5.3458e-02, 2.0181e-03, -3.1963e-02, ..., 7.8319e-04,

3.6831e-02, -5.7858e-02],

[ 5.7929e-03, -1.2378e-02, -4.6922e-02, ..., -2.8623e-02,

-8.2523e-03, 3.0833e-02],

[ 2.1034e-02, 2.0587e-02, 7.3223e-02, ..., 1.1440e-02,

-1.6398e-02, -1.7415e-02]], device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Patience used: 5 out of 5

**Sigma=0.01, support=1**

Model Hyperparameters:

ambient\_dim=4000

measurements=1000

redundancy=40000

DECONET\_iterations=10

Step size 1 parameter=0.5

Step size 2 parameter=0.3

Type of initialization=kaiming

Beta parameter a=0.5

Beta parameter b=0.7

DECONET(

(phi): Parameter(40000, 4000)

(first\_activation): TruncationActivation()

(second\_activation): ShrinkageActivation()

)

training: 100%|██████████████████████████████████████████████| 55/55 [00:09<00:00, 5.88it/s, loss=0.0875]

validation: 100%|███████████████████████████████████████████████| 8/8 [00:01<00:00, 6.78it/s, mse=0.0822]

--------------------------------------

Average Train MSE = 0.087503

--------------------------------------

Average Test MSE = 0.082159

--------------------------------------

Epoch no. = 0

--------------------------------------

Generalization error = 0.005345

--------------------------------------

A= tensor([[-0.0412, 0.0073, 0.0627, ..., 0.0350, 0.0015, -0.0350],

[-0.0148, -0.0020, 0.0148, ..., -0.0045, -0.0374, -0.0753],

[-0.0097, 0.0444, 0.0083, ..., 0.0107, 0.0324, -0.0257],

...,

[-0.0161, 0.0549, -0.0219, ..., -0.0092, 0.0243, 0.0273],

[ 0.0131, 0.0157, -0.0219, ..., -0.0307, 0.0536, -0.0025],

[-0.0287, 0.0033, -0.0173, ..., 0.0234, 0.0199, -0.0261]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0038, -0.0194, 0.0121, ..., -0.0291, 0.0001, -0.0064],

[-0.0337, -0.0297, 0.0314, ..., 0.0323, 0.0053, 0.0088],

[ 0.0246, 0.0353, 0.0312, ..., -0.0339, 0.0246, -0.0003],

...,

[-0.0447, -0.0177, 0.0409, ..., -0.0228, -0.0378, 0.0145],

[ 0.0243, -0.0083, -0.0219, ..., -0.0048, 0.0461, -0.0092],

[-0.0068, -0.0141, 0.0266, ..., -0.0032, 0.0035, 0.0190]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Validation loss decreased (inf --> 0.005345). Saving model ...

training: 100%|██████████████████████████████████████████████| 55/55 [00:09<00:00, 6.04it/s, loss=0.0776]

validation: 100%|███████████████████████████████████████████████| 8/8 [00:01<00:00, 6.83it/s, mse=0.0748]

--------------------------------------

Average Train MSE = 0.077642

--------------------------------------

Average Test MSE = 0.074830

--------------------------------------

Epoch no. = 1

--------------------------------------

Generalization error = 0.002812

--------------------------------------

A= tensor([[-0.0412, 0.0073, 0.0627, ..., 0.0350, 0.0015, -0.0350],

[-0.0148, -0.0020, 0.0148, ..., -0.0045, -0.0374, -0.0753],

[-0.0097, 0.0444, 0.0083, ..., 0.0107, 0.0324, -0.0257],

...,

[-0.0161, 0.0549, -0.0219, ..., -0.0092, 0.0243, 0.0273],

[ 0.0131, 0.0157, -0.0219, ..., -0.0307, 0.0536, -0.0025],

[-0.0287, 0.0033, -0.0173, ..., 0.0234, 0.0199, -0.0261]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0063, -0.0224, 0.0133, ..., -0.0306, -0.0019, -0.0061],

[-0.0345, -0.0294, 0.0313, ..., 0.0352, 0.0060, 0.0082],

[ 0.0254, 0.0317, 0.0354, ..., -0.0332, 0.0250, -0.0010],

...,

[-0.0451, -0.0172, 0.0427, ..., -0.0252, -0.0387, 0.0132],

[ 0.0246, -0.0093, -0.0215, ..., -0.0033, 0.0446, -0.0124],

[-0.0101, -0.0142, 0.0251, ..., -0.0035, 0.0019, 0.0190]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Validation loss decreased (0.005345 --> 0.002812). Saving model ...

training: 100%|██████████████████████████████████████████████| 55/55 [00:09<00:00, 6.05it/s, loss=0.0695]

validation: 100%|███████████████████████████████████████████████| 8/8 [00:01<00:00, 6.81it/s, mse=0.0682]

--------------------------------------

Average Train MSE = 0.069497

--------------------------------------

Average Test MSE = 0.068244

--------------------------------------

Epoch no. = 2

--------------------------------------

Generalization error = 0.001253

--------------------------------------

A= tensor([[-0.0412, 0.0073, 0.0627, ..., 0.0350, 0.0015, -0.0350],

[-0.0148, -0.0020, 0.0148, ..., -0.0045, -0.0374, -0.0753],

[-0.0097, 0.0444, 0.0083, ..., 0.0107, 0.0324, -0.0257],

...,

[-0.0161, 0.0549, -0.0219, ..., -0.0092, 0.0243, 0.0273],

[ 0.0131, 0.0157, -0.0219, ..., -0.0307, 0.0536, -0.0025],

[-0.0287, 0.0033, -0.0173, ..., 0.0234, 0.0199, -0.0261]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0086, -0.0251, 0.0139, ..., -0.0321, -0.0038, -0.0059],

[-0.0356, -0.0288, 0.0313, ..., 0.0382, 0.0063, 0.0082],

[ 0.0256, 0.0280, 0.0396, ..., -0.0330, 0.0252, -0.0015],

...,

[-0.0450, -0.0164, 0.0442, ..., -0.0275, -0.0396, 0.0125],

[ 0.0249, -0.0102, -0.0215, ..., -0.0021, 0.0432, -0.0152],

[-0.0135, -0.0139, 0.0234, ..., -0.0037, 0.0004, 0.0188]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Validation loss decreased (0.002812 --> 0.001253). Saving model ...

training: 100%|██████████████████████████████████████████████| 55/55 [00:09<00:00, 6.04it/s, loss=0.0629]

validation: 100%|███████████████████████████████████████████████| 8/8 [00:01<00:00, 6.99it/s, mse=0.0632]

--------------------------------------

Average Train MSE = 0.062926

--------------------------------------

Average Test MSE = 0.063248

--------------------------------------

Epoch no. = 3

--------------------------------------

Generalization error = 0.000322

--------------------------------------

A= tensor([[-0.0412, 0.0073, 0.0627, ..., 0.0350, 0.0015, -0.0350],

[-0.0148, -0.0020, 0.0148, ..., -0.0045, -0.0374, -0.0753],

[-0.0097, 0.0444, 0.0083, ..., 0.0107, 0.0324, -0.0257],

...,

[-0.0161, 0.0549, -0.0219, ..., -0.0092, 0.0243, 0.0273],

[ 0.0131, 0.0157, -0.0219, ..., -0.0307, 0.0536, -0.0025],

[-0.0287, 0.0033, -0.0173, ..., 0.0234, 0.0199, -0.0261]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0106, -0.0276, 0.0149, ..., -0.0334, -0.0055, -0.0056],

[-0.0365, -0.0286, 0.0312, ..., 0.0409, 0.0069, 0.0077],

[ 0.0263, 0.0253, 0.0433, ..., -0.0333, 0.0257, -0.0021],

...,

[-0.0451, -0.0156, 0.0456, ..., -0.0295, -0.0399, 0.0117],

[ 0.0247, -0.0108, -0.0211, ..., -0.0013, 0.0424, -0.0178],

[-0.0164, -0.0137, 0.0218, ..., -0.0038, -0.0008, 0.0192]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Validation loss decreased (0.001253 --> 0.000322). Saving model ...

training: 100%|██████████████████████████████████████████████| 55/55 [00:09<00:00, 6.03it/s, loss=0.0577]

validation: 100%|████████████████████████████████████████████████| 8/8 [00:01<00:00, 6.95it/s, mse=0.059]

--------------------------------------

Average Train MSE = 0.057651

--------------------------------------

Average Test MSE = 0.059038

--------------------------------------

Epoch no. = 4

--------------------------------------

Generalization error = 0.001387

--------------------------------------

A= tensor([[-0.0412, 0.0073, 0.0627, ..., 0.0350, 0.0015, -0.0350],

[-0.0148, -0.0020, 0.0148, ..., -0.0045, -0.0374, -0.0753],

[-0.0097, 0.0444, 0.0083, ..., 0.0107, 0.0324, -0.0257],

...,

[-0.0161, 0.0549, -0.0219, ..., -0.0092, 0.0243, 0.0273],

[ 0.0131, 0.0157, -0.0219, ..., -0.0307, 0.0536, -0.0025],

[-0.0287, 0.0033, -0.0173, ..., 0.0234, 0.0199, -0.0261]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 1.2622e-02, -2.9601e-02, 1.5698e-02, ..., -3.4851e-02,

-6.6619e-03, -5.3936e-03],

[-3.6839e-02, -2.7839e-02, 3.0751e-02, ..., 4.3193e-02,

7.3663e-03, 7.3753e-03],

[ 2.7029e-02, 2.2453e-02, 4.6486e-02, ..., -3.3623e-02,

2.6498e-02, -2.0146e-03],

...,

[-4.4867e-02, -1.5524e-02, 4.6752e-02, ..., -3.1910e-02,

-4.0760e-02, 1.0628e-02],

[ 2.4540e-02, -1.1265e-02, -2.1387e-02, ..., 1.0351e-05,

4.1677e-02, -2.0176e-02],

[-1.9188e-02, -1.3427e-02, 2.0342e-02, ..., -4.2970e-03,

-1.8174e-03, 1.9081e-02]], device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Patience used: 1 out of 5

training: 100%|██████████████████████████████████████████████| 55/55 [00:09<00:00, 6.04it/s, loss=0.0533]

validation: 100%|███████████████████████████████████████████████| 8/8 [00:01<00:00, 6.92it/s, mse=0.0557]

--------------------------------------

Average Train MSE = 0.053307

--------------------------------------

Average Test MSE = 0.055719

--------------------------------------

Epoch no. = 5

--------------------------------------

Generalization error = 0.002412

--------------------------------------

A= tensor([[-0.0412, 0.0073, 0.0627, ..., 0.0350, 0.0015, -0.0350],

[-0.0148, -0.0020, 0.0148, ..., -0.0045, -0.0374, -0.0753],

[-0.0097, 0.0444, 0.0083, ..., 0.0107, 0.0324, -0.0257],

...,

[-0.0161, 0.0549, -0.0219, ..., -0.0092, 0.0243, 0.0273],

[ 0.0131, 0.0157, -0.0219, ..., -0.0307, 0.0536, -0.0025],

[-0.0287, 0.0033, -0.0173, ..., 0.0234, 0.0199, -0.0261]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0143, -0.0314, 0.0169, ..., -0.0358, -0.0079, -0.0056],

[-0.0379, -0.0275, 0.0304, ..., 0.0456, 0.0077, 0.0074],

[ 0.0279, 0.0204, 0.0497, ..., -0.0339, 0.0270, -0.0022],

...,

[-0.0448, -0.0154, 0.0478, ..., -0.0338, -0.0411, 0.0103],

[ 0.0242, -0.0112, -0.0214, ..., 0.0009, 0.0406, -0.0225],

[-0.0219, -0.0135, 0.0191, ..., -0.0051, -0.0031, 0.0190]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Patience used: 2 out of 5

training: 100%|██████████████████████████████████████████████| 55/55 [00:09<00:00, 6.03it/s, loss=0.0498]

validation: 100%|███████████████████████████████████████████████| 8/8 [00:01<00:00, 6.96it/s, mse=0.0529]

--------------------------------------

Average Train MSE = 0.049782

--------------------------------------

Average Test MSE = 0.052919

--------------------------------------

Epoch no. = 6

--------------------------------------

Generalization error = 0.003137

--------------------------------------

A= tensor([[-0.0412, 0.0073, 0.0627, ..., 0.0350, 0.0015, -0.0350],

[-0.0148, -0.0020, 0.0148, ..., -0.0045, -0.0374, -0.0753],

[-0.0097, 0.0444, 0.0083, ..., 0.0107, 0.0324, -0.0257],

...,

[-0.0161, 0.0549, -0.0219, ..., -0.0092, 0.0243, 0.0273],

[ 0.0131, 0.0157, -0.0219, ..., -0.0307, 0.0536, -0.0025],

[-0.0287, 0.0033, -0.0173, ..., 0.0234, 0.0199, -0.0261]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0156, -0.0329, 0.0175, ..., -0.0370, -0.0092, -0.0055],

[-0.0385, -0.0270, 0.0298, ..., 0.0479, 0.0079, 0.0074],

[ 0.0285, 0.0180, 0.0529, ..., -0.0343, 0.0274, -0.0021],

...,

[-0.0451, -0.0155, 0.0488, ..., -0.0357, -0.0412, 0.0094],

[ 0.0242, -0.0112, -0.0216, ..., 0.0018, 0.0401, -0.0246],

[-0.0245, -0.0130, 0.0182, ..., -0.0059, -0.0044, 0.0189]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Patience used: 3 out of 5

training: 100%|██████████████████████████████████████████████| 55/55 [00:09<00:00, 6.02it/s, loss=0.0468]

validation: 100%|███████████████████████████████████████████████| 8/8 [00:01<00:00, 6.88it/s, mse=0.0506]

--------------------------------------

Average Train MSE = 0.046802

--------------------------------------

Average Test MSE = 0.050628

--------------------------------------

Epoch no. = 7

--------------------------------------

Generalization error = 0.003826

--------------------------------------

A= tensor([[-0.0412, 0.0073, 0.0627, ..., 0.0350, 0.0015, -0.0350],

[-0.0148, -0.0020, 0.0148, ..., -0.0045, -0.0374, -0.0753],

[-0.0097, 0.0444, 0.0083, ..., 0.0107, 0.0324, -0.0257],

...,

[-0.0161, 0.0549, -0.0219, ..., -0.0092, 0.0243, 0.0273],

[ 0.0131, 0.0157, -0.0219, ..., -0.0307, 0.0536, -0.0025],

[-0.0287, 0.0033, -0.0173, ..., 0.0234, 0.0199, -0.0261]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0171, -0.0343, 0.0184, ..., -0.0381, -0.0099, -0.0056],

[-0.0390, -0.0268, 0.0296, ..., 0.0498, 0.0086, 0.0074],

[ 0.0294, 0.0158, 0.0555, ..., -0.0350, 0.0283, -0.0017],

...,

[-0.0450, -0.0151, 0.0494, ..., -0.0376, -0.0416, 0.0089],

[ 0.0242, -0.0111, -0.0214, ..., 0.0025, 0.0396, -0.0262],

[-0.0266, -0.0131, 0.0171, ..., -0.0069, -0.0052, 0.0187]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Patience used: 4 out of 5

training: 100%|██████████████████████████████████████████████| 55/55 [00:09<00:00, 6.03it/s, loss=0.0443]

validation: 100%|███████████████████████████████████████████████| 8/8 [00:01<00:00, 6.95it/s, mse=0.0487]

--------------------------------------

Average Train MSE = 0.044322

--------------------------------------

Average Test MSE = 0.048669

--------------------------------------

Epoch no. = 8

--------------------------------------

Generalization error = 0.004348

--------------------------------------

A= tensor([[-0.0412, 0.0073, 0.0627, ..., 0.0350, 0.0015, -0.0350],

[-0.0148, -0.0020, 0.0148, ..., -0.0045, -0.0374, -0.0753],

[-0.0097, 0.0444, 0.0083, ..., 0.0107, 0.0324, -0.0257],

...,

[-0.0161, 0.0549, -0.0219, ..., -0.0092, 0.0243, 0.0273],

[ 0.0131, 0.0157, -0.0219, ..., -0.0307, 0.0536, -0.0025],

[-0.0287, 0.0033, -0.0173, ..., 0.0234, 0.0199, -0.0261]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0183, -0.0357, 0.0188, ..., -0.0386, -0.0107, -0.0055],

[-0.0396, -0.0263, 0.0291, ..., 0.0513, 0.0089, 0.0077],

[ 0.0299, 0.0139, 0.0581, ..., -0.0356, 0.0289, -0.0014],

...,

[-0.0455, -0.0151, 0.0502, ..., -0.0392, -0.0418, 0.0082],

[ 0.0239, -0.0107, -0.0216, ..., 0.0035, 0.0392, -0.0279],

[-0.0288, -0.0129, 0.0165, ..., -0.0080, -0.0059, 0.0182]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Patience used: 5 out of 5

**Sigma=0.01, support=10. CS ratio=1/16:**

Model Hyperparameters:

ambient\_dim=4000

measurements=250

redundancy=40000

DECONET\_iterations=10

Step size 1 parameter=0.5

Step size 2 parameter=0.3

Type of initialization=kaiming

Beta parameter a=0.5

Beta parameter b=0.7

DECONET(

(phi): Parameter(40000, 4000)

(first\_activation): TruncationActivation()

(second\_activation): ShrinkageActivation()

)

training: 100%|█████████████████████| 55/55 [00:09<00:00, 6.00it/s, loss=0.23]

validation: 100%|█████████████████████| 8/8 [00:01<00:00, 7.07it/s, mse=0.216]

--------------------------------------

Average Train MSE = 0.230177

--------------------------------------

Average Test MSE = 0.216318

--------------------------------------

Epoch no. = 0

--------------------------------------

Generalization error = 0.013859

--------------------------------------

A= tensor([[ 2.4456e-02, 3.4333e-02, 7.2544e-02, ..., -4.0500e-02,

-1.4519e-01, -5.0096e-02],

[-3.9362e-02, 5.1652e-02, -3.4444e-03, ..., 3.6797e-02,

1.7862e-02, -4.4387e-02],

[ 7.2129e-03, -2.8035e-02, 7.3016e-03, ..., 4.0088e-02,

-3.5236e-05, 6.3287e-02],

...,

[ 6.6119e-02, 1.2728e-01, -1.6342e-02, ..., -8.7573e-03,

-3.6810e-02, -1.3903e-02],

[ 5.1528e-02, 1.4842e-01, 1.8867e-02, ..., 6.4752e-03,

-2.1710e-02, 4.6675e-02],

[-3.8884e-02, -8.1907e-02, 5.1284e-02, ..., -6.3037e-02,

-2.0922e-02, 3.3418e-02]], device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[-0.0092, -0.0162, 0.0363, ..., 0.0240, -0.0513, -0.0160],

[ 0.0025, 0.0250, -0.0141, ..., -0.0116, -0.0153, 0.0052],

[-0.0035, -0.0290, 0.0167, ..., 0.0269, -0.0185, 0.0038],

...,

[-0.0021, 0.0261, -0.0251, ..., 0.0351, -0.0116, -0.0022],

[-0.0009, -0.0315, 0.0143, ..., -0.0278, -0.0065, 0.0169],

[ 0.0067, 0.0323, -0.0405, ..., -0.0424, -0.0217, 0.0429]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Validation loss decreased (inf --> 0.013859). Saving model ...

training: 100%|████████████████████| 55/55 [00:08<00:00, 6.19it/s, loss=0.207]

validation: 100%|█████████████████████| 8/8 [00:01<00:00, 6.94it/s, mse=0.195]

--------------------------------------

Average Train MSE = 0.207363

--------------------------------------

Average Test MSE = 0.195321

--------------------------------------

Epoch no. = 1

--------------------------------------

Generalization error = 0.012042

--------------------------------------

A= tensor([[ 2.4456e-02, 3.4333e-02, 7.2544e-02, ..., -4.0500e-02,

-1.4519e-01, -5.0096e-02],

[-3.9362e-02, 5.1652e-02, -3.4444e-03, ..., 3.6797e-02,

1.7862e-02, -4.4387e-02],

[ 7.2129e-03, -2.8035e-02, 7.3016e-03, ..., 4.0088e-02,

-3.5236e-05, 6.3287e-02],

...,

[ 6.6119e-02, 1.2728e-01, -1.6342e-02, ..., -8.7573e-03,

-3.6810e-02, -1.3903e-02],

[ 5.1528e-02, 1.4842e-01, 1.8867e-02, ..., 6.4752e-03,

-2.1710e-02, 4.6675e-02],

[-3.8884e-02, -8.1907e-02, 5.1284e-02, ..., -6.3037e-02,

-2.0922e-02, 3.3418e-02]], device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[-0.0091, -0.0187, 0.0390, ..., 0.0267, -0.0513, -0.0176],

[-0.0004, 0.0245, -0.0166, ..., -0.0129, -0.0162, 0.0034],

[-0.0016, -0.0315, 0.0153, ..., 0.0277, -0.0164, 0.0039],

...,

[-0.0034, 0.0288, -0.0274, ..., 0.0351, -0.0081, -0.0040],

[ 0.0024, -0.0349, 0.0172, ..., -0.0303, -0.0089, 0.0166],

[ 0.0068, 0.0332, -0.0386, ..., -0.0393, -0.0231, 0.0405]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Validation loss decreased (0.013859 --> 0.012042). Saving model ...

training: 100%|████████████████████| 55/55 [00:08<00:00, 6.14it/s, loss=0.185]

validation: 100%|█████████████████████| 8/8 [00:01<00:00, 7.01it/s, mse=0.179]

--------------------------------------

Average Train MSE = 0.185307

--------------------------------------

Average Test MSE = 0.178610

--------------------------------------

Epoch no. = 2

--------------------------------------

Generalization error = 0.006697

--------------------------------------

A= tensor([[ 2.4456e-02, 3.4333e-02, 7.2544e-02, ..., -4.0500e-02,

-1.4519e-01, -5.0096e-02],

[-3.9362e-02, 5.1652e-02, -3.4444e-03, ..., 3.6797e-02,

1.7862e-02, -4.4387e-02],

[ 7.2129e-03, -2.8035e-02, 7.3016e-03, ..., 4.0088e-02,

-3.5236e-05, 6.3287e-02],

...,

[ 6.6119e-02, 1.2728e-01, -1.6342e-02, ..., -8.7573e-03,

-3.6810e-02, -1.3903e-02],

[ 5.1528e-02, 1.4842e-01, 1.8867e-02, ..., 6.4752e-03,

-2.1710e-02, 4.6675e-02],

[-3.8884e-02, -8.1907e-02, 5.1284e-02, ..., -6.3037e-02,

-2.0922e-02, 3.3418e-02]], device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[-0.0094, -0.0217, 0.0422, ..., 0.0290, -0.0518, -0.0198],

[-0.0034, 0.0244, -0.0196, ..., -0.0143, -0.0172, 0.0017],

[ 0.0002, -0.0339, 0.0143, ..., 0.0273, -0.0145, 0.0037],

...,

[-0.0049, 0.0307, -0.0298, ..., 0.0348, -0.0049, -0.0057],

[ 0.0052, -0.0383, 0.0198, ..., -0.0328, -0.0115, 0.0159],

[ 0.0069, 0.0337, -0.0370, ..., -0.0370, -0.0241, 0.0378]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Validation loss decreased (0.012042 --> 0.006697). Saving model ...

training: 100%|████████████████████| 55/55 [00:08<00:00, 6.14it/s, loss=0.167]

validation: 100%|█████████████████████| 8/8 [00:01<00:00, 7.06it/s, mse=0.163]

--------------------------------------

Average Train MSE = 0.166781

--------------------------------------

Average Test MSE = 0.162532

--------------------------------------

Epoch no. = 3

--------------------------------------

Generalization error = 0.004249

--------------------------------------

A= tensor([[ 2.4456e-02, 3.4333e-02, 7.2544e-02, ..., -4.0500e-02,

-1.4519e-01, -5.0096e-02],

[-3.9362e-02, 5.1652e-02, -3.4444e-03, ..., 3.6797e-02,

1.7862e-02, -4.4387e-02],

[ 7.2129e-03, -2.8035e-02, 7.3016e-03, ..., 4.0088e-02,

-3.5236e-05, 6.3287e-02],

...,

[ 6.6119e-02, 1.2728e-01, -1.6342e-02, ..., -8.7573e-03,

-3.6810e-02, -1.3903e-02],

[ 5.1528e-02, 1.4842e-01, 1.8867e-02, ..., 6.4752e-03,

-2.1710e-02, 4.6675e-02],

[-3.8884e-02, -8.1907e-02, 5.1284e-02, ..., -6.3037e-02,

-2.0922e-02, 3.3418e-02]], device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[-0.0099, -0.0252, 0.0449, ..., 0.0310, -0.0524, -0.0215],

[-0.0060, 0.0244, -0.0227, ..., -0.0146, -0.0179, 0.0008],

[ 0.0016, -0.0364, 0.0126, ..., 0.0280, -0.0129, 0.0036],

...,

[-0.0058, 0.0330, -0.0320, ..., 0.0340, -0.0022, -0.0067],

[ 0.0074, -0.0418, 0.0222, ..., -0.0351, -0.0143, 0.0149],

[ 0.0075, 0.0345, -0.0352, ..., -0.0340, -0.0249, 0.0357]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Validation loss decreased (0.006697 --> 0.004249). Saving model ...

training: 100%|█████████████████████| 55/55 [00:09<00:00, 6.10it/s, loss=0.15]

validation: 100%|█████████████████████| 8/8 [00:01<00:00, 7.00it/s, mse=0.147]

--------------------------------------

Average Train MSE = 0.149742

--------------------------------------

Average Test MSE = 0.146659

--------------------------------------

Epoch no. = 4

--------------------------------------

Generalization error = 0.003083

--------------------------------------

A= tensor([[ 2.4456e-02, 3.4333e-02, 7.2544e-02, ..., -4.0500e-02,

-1.4519e-01, -5.0096e-02],

[-3.9362e-02, 5.1652e-02, -3.4444e-03, ..., 3.6797e-02,

1.7862e-02, -4.4387e-02],

[ 7.2129e-03, -2.8035e-02, 7.3016e-03, ..., 4.0088e-02,

-3.5236e-05, 6.3287e-02],

...,

[ 6.6119e-02, 1.2728e-01, -1.6342e-02, ..., -8.7573e-03,

-3.6810e-02, -1.3903e-02],

[ 5.1528e-02, 1.4842e-01, 1.8867e-02, ..., 6.4752e-03,

-2.1710e-02, 4.6675e-02],

[-3.8884e-02, -8.1907e-02, 5.1284e-02, ..., -6.3037e-02,

-2.0922e-02, 3.3418e-02]], device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[-0.0102, -0.0282, 0.0477, ..., 0.0333, -0.0534, -0.0239],

[-0.0083, 0.0247, -0.0256, ..., -0.0150, -0.0185, -0.0001],

[ 0.0023, -0.0389, 0.0109, ..., 0.0278, -0.0120, 0.0033],

...,

[-0.0071, 0.0347, -0.0343, ..., 0.0331, 0.0006, -0.0081],

[ 0.0097, -0.0449, 0.0244, ..., -0.0378, -0.0172, 0.0138],

[ 0.0085, 0.0349, -0.0330, ..., -0.0319, -0.0260, 0.0339]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Validation loss decreased (0.004249 --> 0.003083). Saving model ...

training: 100%|████████████████████| 55/55 [00:09<00:00, 6.07it/s, loss=0.134]

validation: 100%|█████████████████████| 8/8 [00:01<00:00, 6.78it/s, mse=0.132]

--------------------------------------

Average Train MSE = 0.133595

--------------------------------------

Average Test MSE = 0.131739

--------------------------------------

Epoch no. = 5

--------------------------------------

Generalization error = 0.001856

--------------------------------------

A= tensor([[ 2.4456e-02, 3.4333e-02, 7.2544e-02, ..., -4.0500e-02,

-1.4519e-01, -5.0096e-02],

[-3.9362e-02, 5.1652e-02, -3.4444e-03, ..., 3.6797e-02,

1.7862e-02, -4.4387e-02],

[ 7.2129e-03, -2.8035e-02, 7.3016e-03, ..., 4.0088e-02,

-3.5236e-05, 6.3287e-02],

...,

[ 6.6119e-02, 1.2728e-01, -1.6342e-02, ..., -8.7573e-03,

-3.6810e-02, -1.3903e-02],

[ 5.1528e-02, 1.4842e-01, 1.8867e-02, ..., 6.4752e-03,

-2.1710e-02, 4.6675e-02],

[-3.8884e-02, -8.1907e-02, 5.1284e-02, ..., -6.3037e-02,

-2.0922e-02, 3.3418e-02]], device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[-0.0109, -0.0315, 0.0501, ..., 0.0357, -0.0546, -0.0263],

[-0.0107, 0.0252, -0.0286, ..., -0.0155, -0.0191, -0.0007],

[ 0.0031, -0.0416, 0.0093, ..., 0.0276, -0.0107, 0.0028],

...,

[-0.0082, 0.0360, -0.0364, ..., 0.0318, 0.0030, -0.0094],

[ 0.0117, -0.0486, 0.0267, ..., -0.0398, -0.0202, 0.0132],

[ 0.0090, 0.0361, -0.0311, ..., -0.0294, -0.0263, 0.0316]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Validation loss decreased (0.003083 --> 0.001856). Saving model ...

training: 100%|████████████████████| 55/55 [00:09<00:00, 6.09it/s, loss=0.119]

validation: 100%|██████████████████████| 8/8 [00:01<00:00, 7.03it/s, mse=0.12]

--------------------------------------

Average Train MSE = 0.119364

--------------------------------------

Average Test MSE = 0.119631

--------------------------------------

Epoch no. = 6

--------------------------------------

Generalization error = 0.000267

--------------------------------------

A= tensor([[ 2.4456e-02, 3.4333e-02, 7.2544e-02, ..., -4.0500e-02,

-1.4519e-01, -5.0096e-02],

[-3.9362e-02, 5.1652e-02, -3.4444e-03, ..., 3.6797e-02,

1.7862e-02, -4.4387e-02],

[ 7.2129e-03, -2.8035e-02, 7.3016e-03, ..., 4.0088e-02,

-3.5236e-05, 6.3287e-02],

...,

[ 6.6119e-02, 1.2728e-01, -1.6342e-02, ..., -8.7573e-03,

-3.6810e-02, -1.3903e-02],

[ 5.1528e-02, 1.4842e-01, 1.8867e-02, ..., 6.4752e-03,

-2.1710e-02, 4.6675e-02],

[-3.8884e-02, -8.1907e-02, 5.1284e-02, ..., -6.3037e-02,

-2.0922e-02, 3.3418e-02]], device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[-0.0110, -0.0347, 0.0524, ..., 0.0383, -0.0551, -0.0284],

[-0.0128, 0.0257, -0.0314, ..., -0.0152, -0.0196, -0.0011],

[ 0.0039, -0.0444, 0.0079, ..., 0.0275, -0.0095, 0.0020],

...,

[-0.0098, 0.0377, -0.0386, ..., 0.0307, 0.0055, -0.0105],

[ 0.0135, -0.0518, 0.0290, ..., -0.0418, -0.0233, 0.0122],

[ 0.0093, 0.0364, -0.0293, ..., -0.0269, -0.0272, 0.0303]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Validation loss decreased (0.001856 --> 0.000267). Saving model ...

training: 100%|████████████████████| 55/55 [00:09<00:00, 6.10it/s, loss=0.107]

validation: 100%|█████████████████████| 8/8 [00:01<00:00, 7.02it/s, mse=0.108]

--------------------------------------

Average Train MSE = 0.106709

--------------------------------------

Average Test MSE = 0.108207

--------------------------------------

Epoch no. = 7

--------------------------------------

Generalization error = 0.001499

--------------------------------------

A= tensor([[ 2.4456e-02, 3.4333e-02, 7.2544e-02, ..., -4.0500e-02,

-1.4519e-01, -5.0096e-02],

[-3.9362e-02, 5.1652e-02, -3.4444e-03, ..., 3.6797e-02,

1.7862e-02, -4.4387e-02],

[ 7.2129e-03, -2.8035e-02, 7.3016e-03, ..., 4.0088e-02,

-3.5236e-05, 6.3287e-02],

...,

[ 6.6119e-02, 1.2728e-01, -1.6342e-02, ..., -8.7573e-03,

-3.6810e-02, -1.3903e-02],

[ 5.1528e-02, 1.4842e-01, 1.8867e-02, ..., 6.4752e-03,

-2.1710e-02, 4.6675e-02],

[-3.8884e-02, -8.1907e-02, 5.1284e-02, ..., -6.3037e-02,

-2.0922e-02, 3.3418e-02]], device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[-0.0118, -0.0380, 0.0546, ..., 0.0407, -0.0556, -0.0305],

[-0.0147, 0.0267, -0.0337, ..., -0.0151, -0.0202, -0.0015],

[ 0.0044, -0.0471, 0.0071, ..., 0.0274, -0.0094, 0.0016],

...,

[-0.0110, 0.0389, -0.0407, ..., 0.0293, 0.0076, -0.0118],

[ 0.0154, -0.0548, 0.0311, ..., -0.0434, -0.0262, 0.0111],

[ 0.0098, 0.0366, -0.0274, ..., -0.0249, -0.0278, 0.0287]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Patience used: 1 out of 5

training: 100%|███████████████████| 55/55 [00:09<00:00, 6.08it/s, loss=0.0954]

validation: 100%|████████████████████| 8/8 [00:01<00:00, 6.95it/s, mse=0.0977]

--------------------------------------

Average Train MSE = 0.095403

--------------------------------------

Average Test MSE = 0.097708

--------------------------------------

Epoch no. = 8

--------------------------------------

Generalization error = 0.002305

--------------------------------------

A= tensor([[ 2.4456e-02, 3.4333e-02, 7.2544e-02, ..., -4.0500e-02,

-1.4519e-01, -5.0096e-02],

[-3.9362e-02, 5.1652e-02, -3.4444e-03, ..., 3.6797e-02,

1.7862e-02, -4.4387e-02],

[ 7.2129e-03, -2.8035e-02, 7.3016e-03, ..., 4.0088e-02,

-3.5236e-05, 6.3287e-02],

...,

[ 6.6119e-02, 1.2728e-01, -1.6342e-02, ..., -8.7573e-03,

-3.6810e-02, -1.3903e-02],

[ 5.1528e-02, 1.4842e-01, 1.8867e-02, ..., 6.4752e-03,

-2.1710e-02, 4.6675e-02],

[-3.8884e-02, -8.1907e-02, 5.1284e-02, ..., -6.3037e-02,

-2.0922e-02, 3.3418e-02]], device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[-0.0116, -0.0413, 0.0568, ..., 0.0433, -0.0565, -0.0326],

[-0.0163, 0.0275, -0.0362, ..., -0.0149, -0.0204, -0.0020],

[ 0.0043, -0.0500, 0.0058, ..., 0.0274, -0.0084, 0.0009],

...,

[-0.0120, 0.0405, -0.0427, ..., 0.0282, 0.0097, -0.0130],

[ 0.0170, -0.0579, 0.0334, ..., -0.0452, -0.0291, 0.0100],

[ 0.0104, 0.0373, -0.0255, ..., -0.0224, -0.0288, 0.0273]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Patience used: 2 out of 5

training: 100%|███████████████████| 55/55 [00:09<00:00, 6.08it/s, loss=0.0855]

validation: 100%|████████████████████| 8/8 [00:01<00:00, 6.93it/s, mse=0.0888]

--------------------------------------

Average Train MSE = 0.085521

--------------------------------------

Average Test MSE = 0.088848

--------------------------------------

Epoch no. = 9

--------------------------------------

Generalization error = 0.003327

--------------------------------------

A= tensor([[ 2.4456e-02, 3.4333e-02, 7.2544e-02, ..., -4.0500e-02,

-1.4519e-01, -5.0096e-02],

[-3.9362e-02, 5.1652e-02, -3.4444e-03, ..., 3.6797e-02,

1.7862e-02, -4.4387e-02],

[ 7.2129e-03, -2.8035e-02, 7.3016e-03, ..., 4.0088e-02,

-3.5236e-05, 6.3287e-02],

...,

[ 6.6119e-02, 1.2728e-01, -1.6342e-02, ..., -8.7573e-03,

-3.6810e-02, -1.3903e-02],

[ 5.1528e-02, 1.4842e-01, 1.8867e-02, ..., 6.4752e-03,

-2.1710e-02, 4.6675e-02],

[-3.8884e-02, -8.1907e-02, 5.1284e-02, ..., -6.3037e-02,

-2.0922e-02, 3.3418e-02]], device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[-0.0113, -0.0443, 0.0585, ..., 0.0457, -0.0571, -0.0347],

[-0.0179, 0.0284, -0.0382, ..., -0.0151, -0.0209, -0.0021],

[ 0.0047, -0.0523, 0.0047, ..., 0.0269, -0.0081, 0.0004],

...,

[-0.0133, 0.0417, -0.0441, ..., 0.0267, 0.0119, -0.0141],

[ 0.0181, -0.0609, 0.0355, ..., -0.0469, -0.0319, 0.0092],

[ 0.0109, 0.0374, -0.0239, ..., -0.0208, -0.0297, 0.0264]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Patience used: 3 out of 5

training: 100%|███████████████████| 55/55 [00:09<00:00, 6.08it/s, loss=0.0774]

validation: 100%|█████████████████████| 8/8 [00:01<00:00, 7.02it/s, mse=0.082]

--------------------------------------

Average Train MSE = 0.077419

--------------------------------------

Average Test MSE = 0.081980

--------------------------------------

Epoch no. = 10

--------------------------------------

Generalization error = 0.004561

--------------------------------------

A= tensor([[ 2.4456e-02, 3.4333e-02, 7.2544e-02, ..., -4.0500e-02,

-1.4519e-01, -5.0096e-02],

[-3.9362e-02, 5.1652e-02, -3.4444e-03, ..., 3.6797e-02,

1.7862e-02, -4.4387e-02],

[ 7.2129e-03, -2.8035e-02, 7.3016e-03, ..., 4.0088e-02,

-3.5236e-05, 6.3287e-02],

...,

[ 6.6119e-02, 1.2728e-01, -1.6342e-02, ..., -8.7573e-03,

-3.6810e-02, -1.3903e-02],

[ 5.1528e-02, 1.4842e-01, 1.8867e-02, ..., 6.4752e-03,

-2.1710e-02, 4.6675e-02],

[-3.8884e-02, -8.1907e-02, 5.1284e-02, ..., -6.3037e-02,

-2.0922e-02, 3.3418e-02]], device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[-0.0115, -0.0473, 0.0600, ..., 0.0481, -0.0579, -0.0363],

[-0.0194, 0.0289, -0.0400, ..., -0.0151, -0.0211, -0.0023],

[ 0.0050, -0.0550, 0.0043, ..., 0.0267, -0.0077, -0.0001],

...,

[-0.0147, 0.0433, -0.0460, ..., 0.0252, 0.0136, -0.0152],

[ 0.0195, -0.0639, 0.0374, ..., -0.0488, -0.0347, 0.0078],

[ 0.0114, 0.0376, -0.0225, ..., -0.0187, -0.0304, 0.0249]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Patience used: 4 out of 5

training: 100%|███████████████████| 55/55 [00:09<00:00, 6.08it/s, loss=0.0711]

validation: 100%|████████████████████| 8/8 [00:01<00:00, 6.85it/s, mse=0.0766]

--------------------------------------

Average Train MSE = 0.071142

--------------------------------------

Average Test MSE = 0.076570

--------------------------------------

Epoch no. = 11

--------------------------------------

Generalization error = 0.005428

--------------------------------------

A= tensor([[ 2.4456e-02, 3.4333e-02, 7.2544e-02, ..., -4.0500e-02,

-1.4519e-01, -5.0096e-02],

[-3.9362e-02, 5.1652e-02, -3.4444e-03, ..., 3.6797e-02,

1.7862e-02, -4.4387e-02],

[ 7.2129e-03, -2.8035e-02, 7.3016e-03, ..., 4.0088e-02,

-3.5236e-05, 6.3287e-02],

...,

[ 6.6119e-02, 1.2728e-01, -1.6342e-02, ..., -8.7573e-03,

-3.6810e-02, -1.3903e-02],

[ 5.1528e-02, 1.4842e-01, 1.8867e-02, ..., 6.4752e-03,

-2.1710e-02, 4.6675e-02],

[-3.8884e-02, -8.1907e-02, 5.1284e-02, ..., -6.3037e-02,

-2.0922e-02, 3.3418e-02]], device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[-0.0114, -0.0503, 0.0613, ..., 0.0502, -0.0586, -0.0376],

[-0.0203, 0.0295, -0.0418, ..., -0.0150, -0.0219, -0.0027],

[ 0.0052, -0.0573, 0.0034, ..., 0.0261, -0.0075, -0.0005],

...,

[-0.0156, 0.0443, -0.0474, ..., 0.0245, 0.0153, -0.0163],

[ 0.0209, -0.0666, 0.0388, ..., -0.0506, -0.0372, 0.0064],

[ 0.0121, 0.0377, -0.0208, ..., -0.0170, -0.0311, 0.0239]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Patience used: 5 out of 5

**Sigma=0.01, support=10, CS ratio=1/8:**

Model Hyperparameters:

ambient\_dim=4000

measurements=500

redundancy=40000

DECONET\_iterations=10

Step size 1 parameter=0.5

Step size 2 parameter=0.3

Type of initialization=kaiming

Beta parameter a=0.5

Beta parameter b=0.7

DECONET(

(phi): Parameter(40000, 4000)

(first\_activation): TruncationActivation()

(second\_activation): ShrinkageActivation()

)

training: 100%|████████████████████████████████████████████████████████████████| 55/55 [00:09<00:00, 5.97it/s, loss=0.154]

validation: 100%|█████████████████████████████████████████████████████████████████| 8/8 [00:01<00:00, 7.06it/s, mse=0.146]

--------------------------------------

Average Train MSE = 0.154212

--------------------------------------

Average Test MSE = 0.146004

--------------------------------------

Epoch no. = 0

--------------------------------------

Generalization error = 0.008208

--------------------------------------

A= tensor([[-8.1130e-02, 5.9687e-03, 4.9111e-02, ..., 3.4344e-02,

-3.5823e-02, -7.2584e-02],

[ 5.9535e-02, 7.6900e-02, -6.4636e-02, ..., 3.7920e-02,

9.4714e-02, -2.9295e-03],

[-5.9522e-03, -1.2995e-02, -2.6087e-02, ..., -1.5033e-02,

6.8032e-02, -7.4057e-03],

...,

[-3.7504e-02, 7.3780e-02, -2.1804e-03, ..., -4.3619e-02,

2.7542e-03, -3.4910e-02],

[-1.2939e-02, -2.8528e-04, 1.7902e-02, ..., 4.9834e-02,

1.1974e-02, 6.9082e-05],

[-5.7341e-03, 8.9170e-02, 6.2316e-02, ..., 2.0119e-02,

-4.6723e-02, 2.6717e-03]], device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0401, 0.0286, -0.0202, ..., -0.0061, -0.0061, -0.0056],

[-0.0166, 0.0399, -0.0049, ..., 0.0051, 0.0322, -0.0016],

[ 0.0203, -0.0110, -0.0228, ..., 0.0025, -0.0333, -0.0172],

...,

[ 0.0145, -0.0155, -0.0091, ..., 0.0105, -0.0295, 0.0288],

[-0.0164, -0.0318, -0.0273, ..., 0.0824, -0.0049, 0.0167],

[-0.0398, -0.0052, 0.0257, ..., -0.0170, 0.0192, 0.0295]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Validation loss decreased (inf --> 0.008208). Saving model ...

training: 100%|████████████████████████████████████████████████████████████████| 55/55 [00:08<00:00, 6.14it/s, loss=0.138]

validation: 100%|█████████████████████████████████████████████████████████████████| 8/8 [00:01<00:00, 7.02it/s, mse=0.132]

--------------------------------------

Average Train MSE = 0.138436

--------------------------------------

Average Test MSE = 0.132371

--------------------------------------

Epoch no. = 1

--------------------------------------

Generalization error = 0.006064

--------------------------------------

A= tensor([[-8.1130e-02, 5.9687e-03, 4.9111e-02, ..., 3.4344e-02,

-3.5823e-02, -7.2584e-02],

[ 5.9535e-02, 7.6900e-02, -6.4636e-02, ..., 3.7920e-02,

9.4714e-02, -2.9295e-03],

[-5.9522e-03, -1.2995e-02, -2.6087e-02, ..., -1.5033e-02,

6.8032e-02, -7.4057e-03],

...,

[-3.7504e-02, 7.3780e-02, -2.1804e-03, ..., -4.3619e-02,

2.7542e-03, -3.4910e-02],

[-1.2939e-02, -2.8528e-04, 1.7902e-02, ..., 4.9834e-02,

1.1974e-02, 6.9082e-05],

[-5.7341e-03, 8.9170e-02, 6.2316e-02, ..., 2.0119e-02,

-4.6723e-02, 2.6717e-03]], device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0407, 0.0295, -0.0215, ..., -0.0076, -0.0051, -0.0066],

[-0.0165, 0.0413, -0.0072, ..., 0.0055, 0.0327, -0.0023],

[ 0.0219, -0.0132, -0.0221, ..., 0.0030, -0.0352, -0.0179],

...,

[ 0.0165, -0.0119, -0.0124, ..., 0.0119, -0.0292, 0.0308],

[-0.0187, -0.0358, -0.0304, ..., 0.0844, -0.0033, 0.0175],

[-0.0415, -0.0081, 0.0273, ..., -0.0179, 0.0205, 0.0308]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Validation loss decreased (0.008208 --> 0.006064). Saving model ...

training: 100%|████████████████████████████████████████████████████████████████| 55/55 [00:09<00:00, 6.10it/s, loss=0.125]

validation: 100%|█████████████████████████████████████████████████████████████████| 8/8 [00:01<00:00, 6.87it/s, mse=0.121]

--------------------------------------

Average Train MSE = 0.124509

--------------------------------------

Average Test MSE = 0.120795

--------------------------------------

Epoch no. = 2

--------------------------------------

Generalization error = 0.003714

--------------------------------------

A= tensor([[-8.1130e-02, 5.9687e-03, 4.9111e-02, ..., 3.4344e-02,

-3.5823e-02, -7.2584e-02],

[ 5.9535e-02, 7.6900e-02, -6.4636e-02, ..., 3.7920e-02,

9.4714e-02, -2.9295e-03],

[-5.9522e-03, -1.2995e-02, -2.6087e-02, ..., -1.5033e-02,

6.8032e-02, -7.4057e-03],

...,

[-3.7504e-02, 7.3780e-02, -2.1804e-03, ..., -4.3619e-02,

2.7542e-03, -3.4910e-02],

[-1.2939e-02, -2.8528e-04, 1.7902e-02, ..., 4.9834e-02,

1.1974e-02, 6.9082e-05],

[-5.7341e-03, 8.9170e-02, 6.2316e-02, ..., 2.0119e-02,

-4.6723e-02, 2.6717e-03]], device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0411, 0.0302, -0.0234, ..., -0.0093, -0.0044, -0.0077],

[-0.0172, 0.0427, -0.0093, ..., 0.0059, 0.0333, -0.0034],

[ 0.0234, -0.0151, -0.0214, ..., 0.0040, -0.0369, -0.0194],

...,

[ 0.0175, -0.0086, -0.0152, ..., 0.0131, -0.0285, 0.0326],

[-0.0208, -0.0397, -0.0334, ..., 0.0859, -0.0015, 0.0182],

[-0.0425, -0.0104, 0.0295, ..., -0.0188, 0.0220, 0.0325]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Validation loss decreased (0.006064 --> 0.003714). Saving model ...

training: 100%|████████████████████████████████████████████████████████████████| 55/55 [00:09<00:00, 6.07it/s, loss=0.112]

validation: 100%|█████████████████████████████████████████████████████████████████| 8/8 [00:01<00:00, 6.70it/s, mse=0.111]

--------------------------------------

Average Train MSE = 0.112384

--------------------------------------

Average Test MSE = 0.110795

--------------------------------------

Epoch no. = 3

--------------------------------------

Generalization error = 0.001589

--------------------------------------

A= tensor([[-8.1130e-02, 5.9687e-03, 4.9111e-02, ..., 3.4344e-02,

-3.5823e-02, -7.2584e-02],

[ 5.9535e-02, 7.6900e-02, -6.4636e-02, ..., 3.7920e-02,

9.4714e-02, -2.9295e-03],

[-5.9522e-03, -1.2995e-02, -2.6087e-02, ..., -1.5033e-02,

6.8032e-02, -7.4057e-03],

...,

[-3.7504e-02, 7.3780e-02, -2.1804e-03, ..., -4.3619e-02,

2.7542e-03, -3.4910e-02],

[-1.2939e-02, -2.8528e-04, 1.7902e-02, ..., 4.9834e-02,

1.1974e-02, 6.9082e-05],

[-5.7341e-03, 8.9170e-02, 6.2316e-02, ..., 2.0119e-02,

-4.6723e-02, 2.6717e-03]], device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0421, 0.0305, -0.0253, ..., -0.0108, -0.0034, -0.0079],

[-0.0178, 0.0443, -0.0112, ..., 0.0058, 0.0341, -0.0045],

[ 0.0250, -0.0170, -0.0200, ..., 0.0045, -0.0386, -0.0203],

...,

[ 0.0191, -0.0056, -0.0180, ..., 0.0145, -0.0283, 0.0342],

[-0.0232, -0.0430, -0.0360, ..., 0.0873, -0.0004, 0.0186],

[-0.0434, -0.0123, 0.0320, ..., -0.0188, 0.0230, 0.0343]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Validation loss decreased (0.003714 --> 0.001589). Saving model ...

training: 100%|████████████████████████████████████████████████████████████████| 55/55 [00:09<00:00, 6.04it/s, loss=0.102]

validation: 100%|█████████████████████████████████████████████████████████████████| 8/8 [00:01<00:00, 6.41it/s, mse=0.102]

--------------------------------------

Average Train MSE = 0.102251

--------------------------------------

Average Test MSE = 0.102386

--------------------------------------

Epoch no. = 4

--------------------------------------

Generalization error = 0.000135

--------------------------------------

A= tensor([[-8.1130e-02, 5.9687e-03, 4.9111e-02, ..., 3.4344e-02,

-3.5823e-02, -7.2584e-02],

[ 5.9535e-02, 7.6900e-02, -6.4636e-02, ..., 3.7920e-02,

9.4714e-02, -2.9295e-03],

[-5.9522e-03, -1.2995e-02, -2.6087e-02, ..., -1.5033e-02,

6.8032e-02, -7.4057e-03],

...,

[-3.7504e-02, 7.3780e-02, -2.1804e-03, ..., -4.3619e-02,

2.7542e-03, -3.4910e-02],

[-1.2939e-02, -2.8528e-04, 1.7902e-02, ..., 4.9834e-02,

1.1974e-02, 6.9082e-05],

[-5.7341e-03, 8.9170e-02, 6.2316e-02, ..., 2.0119e-02,

-4.6723e-02, 2.6717e-03]], device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0428, 0.0307, -0.0267, ..., -0.0124, -0.0029, -0.0085],

[-0.0183, 0.0461, -0.0130, ..., 0.0059, 0.0343, -0.0053],

[ 0.0267, -0.0184, -0.0182, ..., 0.0056, -0.0402, -0.0218],

...,

[ 0.0201, -0.0023, -0.0207, ..., 0.0166, -0.0273, 0.0354],

[-0.0251, -0.0459, -0.0383, ..., 0.0886, 0.0012, 0.0190],

[-0.0439, -0.0143, 0.0337, ..., -0.0189, 0.0244, 0.0361]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Validation loss decreased (0.001589 --> 0.000135). Saving model ...

training: 100%|███████████████████████████████████████████████████████████████| 55/55 [00:09<00:00, 6.05it/s, loss=0.0934]

validation: 100%|█████████████████████████████████████████████████████████████████| 8/8 [00:01<00:00, 6.69it/s, mse=0.095]

--------------------------------------

Average Train MSE = 0.093448

--------------------------------------

Average Test MSE = 0.095046

--------------------------------------

Epoch no. = 5

--------------------------------------

Generalization error = 0.001597

--------------------------------------

A= tensor([[-8.1130e-02, 5.9687e-03, 4.9111e-02, ..., 3.4344e-02,

-3.5823e-02, -7.2584e-02],

[ 5.9535e-02, 7.6900e-02, -6.4636e-02, ..., 3.7920e-02,

9.4714e-02, -2.9295e-03],

[-5.9522e-03, -1.2995e-02, -2.6087e-02, ..., -1.5033e-02,

6.8032e-02, -7.4057e-03],

...,

[-3.7504e-02, 7.3780e-02, -2.1804e-03, ..., -4.3619e-02,

2.7542e-03, -3.4910e-02],

[-1.2939e-02, -2.8528e-04, 1.7902e-02, ..., 4.9834e-02,

1.1974e-02, 6.9082e-05],

[-5.7341e-03, 8.9170e-02, 6.2316e-02, ..., 2.0119e-02,

-4.6723e-02, 2.6717e-03]], device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0442, 0.0308, -0.0284, ..., -0.0140, -0.0023, -0.0090],

[-0.0187, 0.0476, -0.0151, ..., 0.0064, 0.0347, -0.0058],

[ 0.0283, -0.0197, -0.0175, ..., 0.0063, -0.0410, -0.0231],

...,

[ 0.0218, 0.0009, -0.0233, ..., 0.0176, -0.0263, 0.0368],

[-0.0273, -0.0490, -0.0405, ..., 0.0896, 0.0029, 0.0192],

[-0.0445, -0.0160, 0.0357, ..., -0.0190, 0.0260, 0.0377]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Patience used: 1 out of 5

training: 100%|███████████████████████████████████████████████████████████████| 55/55 [00:09<00:00, 6.07it/s, loss=0.0858]

validation: 100%|████████████████████████████████████████████████████████████████| 8/8 [00:01<00:00, 6.80it/s, mse=0.0884]

--------------------------------------

Average Train MSE = 0.085777

--------------------------------------

Average Test MSE = 0.088401

--------------------------------------

Epoch no. = 6

--------------------------------------

Generalization error = 0.002624

--------------------------------------

A= tensor([[-8.1130e-02, 5.9687e-03, 4.9111e-02, ..., 3.4344e-02,

-3.5823e-02, -7.2584e-02],

[ 5.9535e-02, 7.6900e-02, -6.4636e-02, ..., 3.7920e-02,

9.4714e-02, -2.9295e-03],

[-5.9522e-03, -1.2995e-02, -2.6087e-02, ..., -1.5033e-02,

6.8032e-02, -7.4057e-03],

...,

[-3.7504e-02, 7.3780e-02, -2.1804e-03, ..., -4.3619e-02,

2.7542e-03, -3.4910e-02],

[-1.2939e-02, -2.8528e-04, 1.7902e-02, ..., 4.9834e-02,

1.1974e-02, 6.9082e-05],

[-5.7341e-03, 8.9170e-02, 6.2316e-02, ..., 2.0119e-02,

-4.6723e-02, 2.6717e-03]], device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0453, 0.0309, -0.0299, ..., -0.0154, -0.0016, -0.0093],

[-0.0192, 0.0490, -0.0168, ..., 0.0063, 0.0349, -0.0063],

[ 0.0294, -0.0207, -0.0157, ..., 0.0076, -0.0421, -0.0240],

...,

[ 0.0232, 0.0036, -0.0257, ..., 0.0194, -0.0261, 0.0380],

[-0.0294, -0.0517, -0.0426, ..., 0.0904, 0.0047, 0.0194],

[-0.0445, -0.0172, 0.0380, ..., -0.0185, 0.0271, 0.0397]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Patience used: 2 out of 5

training: 100%|███████████████████████████████████████████████████████████████| 55/55 [00:09<00:00, 6.09it/s, loss=0.0791]

validation: 100%|████████████████████████████████████████████████████████████████| 8/8 [00:01<00:00, 7.00it/s, mse=0.0827]

--------------------------------------

Average Train MSE = 0.079103

--------------------------------------

Average Test MSE = 0.082709

--------------------------------------

Epoch no. = 7

--------------------------------------

Generalization error = 0.003606

--------------------------------------

A= tensor([[-8.1130e-02, 5.9687e-03, 4.9111e-02, ..., 3.4344e-02,

-3.5823e-02, -7.2584e-02],

[ 5.9535e-02, 7.6900e-02, -6.4636e-02, ..., 3.7920e-02,

9.4714e-02, -2.9295e-03],

[-5.9522e-03, -1.2995e-02, -2.6087e-02, ..., -1.5033e-02,

6.8032e-02, -7.4057e-03],

...,

[-3.7504e-02, 7.3780e-02, -2.1804e-03, ..., -4.3619e-02,

2.7542e-03, -3.4910e-02],

[-1.2939e-02, -2.8528e-04, 1.7902e-02, ..., 4.9834e-02,

1.1974e-02, 6.9082e-05],

[-5.7341e-03, 8.9170e-02, 6.2316e-02, ..., 2.0119e-02,

-4.6723e-02, 2.6717e-03]], device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0466, 0.0307, -0.0312, ..., -0.0162, -0.0012, -0.0104],

[-0.0197, 0.0500, -0.0181, ..., 0.0066, 0.0352, -0.0073],

[ 0.0305, -0.0216, -0.0142, ..., 0.0084, -0.0431, -0.0253],

...,

[ 0.0248, 0.0062, -0.0283, ..., 0.0209, -0.0250, 0.0393],

[-0.0318, -0.0543, -0.0441, ..., 0.0916, 0.0065, 0.0196],

[-0.0446, -0.0182, 0.0397, ..., -0.0184, 0.0281, 0.0413]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Patience used: 3 out of 5

training: 100%|███████████████████████████████████████████████████████████████| 55/55 [00:09<00:00, 6.09it/s, loss=0.0732]

validation: 100%|████████████████████████████████████████████████████████████████| 8/8 [00:01<00:00, 6.99it/s, mse=0.0779]

--------------------------------------

Average Train MSE = 0.073234

--------------------------------------

Average Test MSE = 0.077886

--------------------------------------

Epoch no. = 8

--------------------------------------

Generalization error = 0.004652

--------------------------------------

A= tensor([[-8.1130e-02, 5.9687e-03, 4.9111e-02, ..., 3.4344e-02,

-3.5823e-02, -7.2584e-02],

[ 5.9535e-02, 7.6900e-02, -6.4636e-02, ..., 3.7920e-02,

9.4714e-02, -2.9295e-03],

[-5.9522e-03, -1.2995e-02, -2.6087e-02, ..., -1.5033e-02,

6.8032e-02, -7.4057e-03],

...,

[-3.7504e-02, 7.3780e-02, -2.1804e-03, ..., -4.3619e-02,

2.7542e-03, -3.4910e-02],

[-1.2939e-02, -2.8528e-04, 1.7902e-02, ..., 4.9834e-02,

1.1974e-02, 6.9082e-05],

[-5.7341e-03, 8.9170e-02, 6.2316e-02, ..., 2.0119e-02,

-4.6723e-02, 2.6717e-03]], device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0477, 0.0314, -0.0324, ..., -0.0171, -0.0009, -0.0110],

[-0.0205, 0.0512, -0.0199, ..., 0.0065, 0.0352, -0.0073],

[ 0.0321, -0.0228, -0.0129, ..., 0.0092, -0.0438, -0.0261],

...,

[ 0.0261, 0.0089, -0.0303, ..., 0.0224, -0.0242, 0.0401],

[-0.0341, -0.0565, -0.0456, ..., 0.0923, 0.0084, 0.0199],

[-0.0447, -0.0193, 0.0414, ..., -0.0184, 0.0292, 0.0429]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Patience used: 4 out of 5

training: 100%|████████████████████████████████████████████████████████████████| 55/55 [00:09<00:00, 6.08it/s, loss=0.068]

validation: 100%|████████████████████████████████████████████████████████████████| 8/8 [00:01<00:00, 7.02it/s, mse=0.0732]

--------------------------------------

Average Train MSE = 0.068035

--------------------------------------

Average Test MSE = 0.073249

--------------------------------------

Epoch no. = 9

--------------------------------------

Generalization error = 0.005214

--------------------------------------

A= tensor([[-8.1130e-02, 5.9687e-03, 4.9111e-02, ..., 3.4344e-02,

-3.5823e-02, -7.2584e-02],

[ 5.9535e-02, 7.6900e-02, -6.4636e-02, ..., 3.7920e-02,

9.4714e-02, -2.9295e-03],

[-5.9522e-03, -1.2995e-02, -2.6087e-02, ..., -1.5033e-02,

6.8032e-02, -7.4057e-03],

...,

[-3.7504e-02, 7.3780e-02, -2.1804e-03, ..., -4.3619e-02,

2.7542e-03, -3.4910e-02],

[-1.2939e-02, -2.8528e-04, 1.7902e-02, ..., 4.9834e-02,

1.1974e-02, 6.9082e-05],

[-5.7341e-03, 8.9170e-02, 6.2316e-02, ..., 2.0119e-02,

-4.6723e-02, 2.6717e-03]], device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0493, 0.0316, -0.0337, ..., -0.0177, -0.0007, -0.0116],

[-0.0208, 0.0520, -0.0212, ..., 0.0069, 0.0353, -0.0081],

[ 0.0336, -0.0235, -0.0116, ..., 0.0101, -0.0444, -0.0270],

...,

[ 0.0274, 0.0114, -0.0324, ..., 0.0237, -0.0235, 0.0412],

[-0.0359, -0.0586, -0.0468, ..., 0.0934, 0.0103, 0.0204],

[-0.0450, -0.0205, 0.0433, ..., -0.0181, 0.0302, 0.0441]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Patience used: 5 out of 5

**Sigma=0.01, support=10, CS ratio=1/2:**

Model Hyperparameters:

ambient\_dim=4000

measurements=2000

redundancy=40000

DECONET\_iterations=10

Step size 1 parameter=0.5

Step size 2 parameter=0.3

Type of initialization=kaiming

Beta parameter a=0.5

Beta parameter b=0.7

DECONET(

(phi): Parameter(40000, 4000)

(first\_activation): TruncationActivation()

(second\_activation): ShrinkageActivation()

)

training: 100%|███████████████████████████████████████████████████████████████| 55/55 [00:09<00:00, 5.74it/s, loss=0.0455]

validation: 100%|████████████████████████████████████████████████████████████████| 8/8 [00:01<00:00, 6.72it/s, mse=0.0431]

--------------------------------------

Average Train MSE = 0.045460

--------------------------------------

Average Test MSE = 0.043125

--------------------------------------

Epoch no. = 0

--------------------------------------

Generalization error = 0.002334

--------------------------------------

A= tensor([[-0.0064, 0.0057, 0.0145, ..., 0.0194, -0.0174, -0.0194],

[-0.0293, -0.0127, 0.0120, ..., -0.0183, 0.0035, 0.0204],

[-0.0354, 0.0234, -0.0011, ..., 0.0109, -0.0171, -0.0115],

...,

[-0.0419, -0.0224, 0.0347, ..., -0.0015, 0.0425, 0.0214],

[-0.0128, 0.0261, -0.0429, ..., 0.0024, -0.0289, 0.0047],

[-0.0103, 0.0192, -0.0433, ..., -0.0366, 0.0204, 0.0187]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0233, 0.0097, 0.0401, ..., 0.0123, 0.0010, 0.0279],

[ 0.0018, -0.0283, -0.0067, ..., 0.0153, -0.0182, 0.0503],

[ 0.0119, -0.0236, 0.0007, ..., -0.0007, -0.0313, 0.0054],

...,

[ 0.0374, 0.0078, -0.0277, ..., -0.0068, 0.0088, 0.0265],

[ 0.0187, -0.0016, -0.0194, ..., -0.0109, -0.0027, -0.0060],

[-0.0196, 0.0085, 0.0177, ..., -0.0042, 0.0089, 0.0067]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Validation loss decreased (inf --> 0.002334). Saving model ...

training: 100%|███████████████████████████████████████████████████████████████| 55/55 [00:09<00:00, 5.93it/s, loss=0.0405]

validation: 100%|████████████████████████████████████████████████████████████████| 8/8 [00:01<00:00, 6.50it/s, mse=0.0394]

--------------------------------------

Average Train MSE = 0.040456

--------------------------------------

Average Test MSE = 0.039409

--------------------------------------

Epoch no. = 1

--------------------------------------

Generalization error = 0.001048

--------------------------------------

A= tensor([[-0.0064, 0.0057, 0.0145, ..., 0.0194, -0.0174, -0.0194],

[-0.0293, -0.0127, 0.0120, ..., -0.0183, 0.0035, 0.0204],

[-0.0354, 0.0234, -0.0011, ..., 0.0109, -0.0171, -0.0115],

...,

[-0.0419, -0.0224, 0.0347, ..., -0.0015, 0.0425, 0.0214],

[-0.0128, 0.0261, -0.0429, ..., 0.0024, -0.0289, 0.0047],

[-0.0103, 0.0192, -0.0433, ..., -0.0366, 0.0204, 0.0187]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0233, 0.0107, 0.0403, ..., 0.0116, 0.0005, 0.0278],

[ 0.0010, -0.0296, -0.0067, ..., 0.0135, -0.0193, 0.0518],

[ 0.0110, -0.0227, -0.0011, ..., -0.0004, -0.0328, 0.0055],

...,

[ 0.0369, 0.0073, -0.0288, ..., -0.0056, 0.0070, 0.0265],

[ 0.0176, -0.0021, -0.0211, ..., -0.0085, -0.0021, -0.0061],

[-0.0205, 0.0071, 0.0198, ..., -0.0033, 0.0098, 0.0068]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Validation loss decreased (0.002334 --> 0.001048). Saving model ...

training: 100%|███████████████████████████████████████████████████████████████| 55/55 [00:09<00:00, 5.92it/s, loss=0.0366]

validation: 100%|████████████████████████████████████████████████████████████████| 8/8 [00:01<00:00, 6.73it/s, mse=0.0365]

--------------------------------------

Average Train MSE = 0.036564

--------------------------------------

Average Test MSE = 0.036544

--------------------------------------

Epoch no. = 2

--------------------------------------

Generalization error = 0.000019

--------------------------------------

A= tensor([[-0.0064, 0.0057, 0.0145, ..., 0.0194, -0.0174, -0.0194],

[-0.0293, -0.0127, 0.0120, ..., -0.0183, 0.0035, 0.0204],

[-0.0354, 0.0234, -0.0011, ..., 0.0109, -0.0171, -0.0115],

...,

[-0.0419, -0.0224, 0.0347, ..., -0.0015, 0.0425, 0.0214],

[-0.0128, 0.0261, -0.0429, ..., 0.0024, -0.0289, 0.0047],

[-0.0103, 0.0192, -0.0433, ..., -0.0366, 0.0204, 0.0187]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 2.3737e-02, 1.1665e-02, 4.0428e-02, ..., 1.0962e-02,

-2.7153e-04, 2.7981e-02],

[ 7.0925e-05, -3.0339e-02, -6.5201e-03, ..., 1.2361e-02,

-2.0100e-02, 5.2786e-02],

[ 1.0396e-02, -2.2277e-02, -3.0905e-03, ..., -3.4692e-04,

-3.4366e-02, 5.4527e-03],

...,

[ 3.6023e-02, 6.9652e-03, -2.9406e-02, ..., -4.2498e-03,

5.6285e-03, 2.6551e-02],

[ 1.6666e-02, -2.5343e-03, -2.3072e-02, ..., -6.2593e-03,

-2.0651e-03, -6.1299e-03],

[-2.1129e-02, 6.1069e-03, 2.1966e-02, ..., -2.2489e-03,

1.1062e-02, 7.1982e-03]], device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Validation loss decreased (0.001048 --> 0.000019). Saving model ...

training: 100%|███████████████████████████████████████████████████████████████| 55/55 [00:09<00:00, 5.92it/s, loss=0.0335]

validation: 100%|████████████████████████████████████████████████████████████████| 8/8 [00:01<00:00, 6.70it/s, mse=0.0344]

--------------------------------------

Average Train MSE = 0.033545

--------------------------------------

Average Test MSE = 0.034356

--------------------------------------

Epoch no. = 3

--------------------------------------

Generalization error = 0.000811

--------------------------------------

A= tensor([[-0.0064, 0.0057, 0.0145, ..., 0.0194, -0.0174, -0.0194],

[-0.0293, -0.0127, 0.0120, ..., -0.0183, 0.0035, 0.0204],

[-0.0354, 0.0234, -0.0011, ..., 0.0109, -0.0171, -0.0115],

...,

[-0.0419, -0.0224, 0.0347, ..., -0.0015, 0.0425, 0.0214],

[-0.0128, 0.0261, -0.0429, ..., 0.0024, -0.0289, 0.0047],

[-0.0103, 0.0192, -0.0433, ..., -0.0366, 0.0204, 0.0187]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0238, 0.0125, 0.0410, ..., 0.0099, -0.0006, 0.0280],

[-0.0007, -0.0308, -0.0065, ..., 0.0114, -0.0209, 0.0538],

[ 0.0096, -0.0216, -0.0048, ..., -0.0002, -0.0355, 0.0054],

...,

[ 0.0354, 0.0070, -0.0299, ..., -0.0031, 0.0041, 0.0263],

[ 0.0158, -0.0030, -0.0242, ..., -0.0040, -0.0018, -0.0063],

[-0.0217, 0.0050, 0.0237, ..., -0.0015, 0.0119, 0.0073]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Patience used: 1 out of 5

training: 100%|███████████████████████████████████████████████████████████████| 55/55 [00:09<00:00, 5.91it/s, loss=0.0312]

validation: 100%|████████████████████████████████████████████████████████████████| 8/8 [00:01<00:00, 6.78it/s, mse=0.0327]

--------------------------------------

Average Train MSE = 0.031206

--------------------------------------

Average Test MSE = 0.032688

--------------------------------------

Epoch no. = 4

--------------------------------------

Generalization error = 0.001481

--------------------------------------

A= tensor([[-0.0064, 0.0057, 0.0145, ..., 0.0194, -0.0174, -0.0194],

[-0.0293, -0.0127, 0.0120, ..., -0.0183, 0.0035, 0.0204],

[-0.0354, 0.0234, -0.0011, ..., 0.0109, -0.0171, -0.0115],

...,

[-0.0419, -0.0224, 0.0347, ..., -0.0015, 0.0425, 0.0214],

[-0.0128, 0.0261, -0.0429, ..., 0.0024, -0.0289, 0.0047],

[-0.0103, 0.0192, -0.0433, ..., -0.0366, 0.0204, 0.0187]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0244, 0.0132, 0.0412, ..., 0.0095, -0.0009, 0.0282],

[-0.0014, -0.0317, -0.0063, ..., 0.0107, -0.0218, 0.0550],

[ 0.0091, -0.0210, -0.0064, ..., 0.0005, -0.0361, 0.0050],

...,

[ 0.0350, 0.0067, -0.0303, ..., -0.0019, 0.0025, 0.0265],

[ 0.0150, -0.0030, -0.0257, ..., -0.0021, -0.0017, -0.0068],

[-0.0219, 0.0041, 0.0253, ..., -0.0003, 0.0125, 0.0080]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Patience used: 2 out of 5

training: 100%|███████████████████████████████████████████████████████████████| 55/55 [00:09<00:00, 5.89it/s, loss=0.0294]

validation: 100%|████████████████████████████████████████████████████████████████| 8/8 [00:01<00:00, 6.72it/s, mse=0.0314]

--------------------------------------

Average Train MSE = 0.029361

--------------------------------------

Average Test MSE = 0.031386

--------------------------------------

Epoch no. = 5

--------------------------------------

Generalization error = 0.002025

--------------------------------------

A= tensor([[-0.0064, 0.0057, 0.0145, ..., 0.0194, -0.0174, -0.0194],

[-0.0293, -0.0127, 0.0120, ..., -0.0183, 0.0035, 0.0204],

[-0.0354, 0.0234, -0.0011, ..., 0.0109, -0.0171, -0.0115],

...,

[-0.0419, -0.0224, 0.0347, ..., -0.0015, 0.0425, 0.0214],

[-0.0128, 0.0261, -0.0429, ..., 0.0024, -0.0289, 0.0047],

[-0.0103, 0.0192, -0.0433, ..., -0.0366, 0.0204, 0.0187]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0244, 0.0136, 0.0413, ..., 0.0088, -0.0019, 0.0282],

[-0.0018, -0.0322, -0.0064, ..., 0.0101, -0.0224, 0.0554],

[ 0.0086, -0.0207, -0.0075, ..., 0.0005, -0.0375, 0.0047],

...,

[ 0.0346, 0.0063, -0.0308, ..., -0.0013, 0.0010, 0.0260],

[ 0.0138, -0.0030, -0.0261, ..., -0.0003, -0.0018, -0.0070],

[-0.0222, 0.0031, 0.0262, ..., 0.0006, 0.0132, 0.0080]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Patience used: 3 out of 5

training: 100%|███████████████████████████████████████████████████████████████| 55/55 [00:09<00:00, 5.91it/s, loss=0.0279]

validation: 100%|████████████████████████████████████████████████████████████████| 8/8 [00:01<00:00, 6.71it/s, mse=0.0304]

--------------------------------------

Average Train MSE = 0.027885

--------------------------------------

Average Test MSE = 0.030361

--------------------------------------

Epoch no. = 6

--------------------------------------

Generalization error = 0.002476

--------------------------------------

A= tensor([[-0.0064, 0.0057, 0.0145, ..., 0.0194, -0.0174, -0.0194],

[-0.0293, -0.0127, 0.0120, ..., -0.0183, 0.0035, 0.0204],

[-0.0354, 0.0234, -0.0011, ..., 0.0109, -0.0171, -0.0115],

...,

[-0.0419, -0.0224, 0.0347, ..., -0.0015, 0.0425, 0.0214],

[-0.0128, 0.0261, -0.0429, ..., 0.0024, -0.0289, 0.0047],

[-0.0103, 0.0192, -0.0433, ..., -0.0366, 0.0204, 0.0187]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0242, 0.0138, 0.0414, ..., 0.0083, -0.0019, 0.0279],

[-0.0022, -0.0329, -0.0065, ..., 0.0099, -0.0234, 0.0560],

[ 0.0081, -0.0200, -0.0087, ..., 0.0010, -0.0385, 0.0043],

...,

[ 0.0344, 0.0061, -0.0311, ..., -0.0003, -0.0004, 0.0259],

[ 0.0130, -0.0029, -0.0271, ..., 0.0011, -0.0019, -0.0071],

[-0.0222, 0.0023, 0.0276, ..., 0.0010, 0.0138, 0.0081]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Patience used: 4 out of 5

training: 100%|███████████████████████████████████████████████████████████████| 55/55 [00:09<00:00, 5.90it/s, loss=0.0267]

validation: 100%|████████████████████████████████████████████████████████████████| 8/8 [00:01<00:00, 6.36it/s, mse=0.0295]

--------------------------------------

Average Train MSE = 0.026682

--------------------------------------

Average Test MSE = 0.029537

--------------------------------------

Epoch no. = 7

--------------------------------------

Generalization error = 0.002855

--------------------------------------

A= tensor([[-0.0064, 0.0057, 0.0145, ..., 0.0194, -0.0174, -0.0194],

[-0.0293, -0.0127, 0.0120, ..., -0.0183, 0.0035, 0.0204],

[-0.0354, 0.0234, -0.0011, ..., 0.0109, -0.0171, -0.0115],

...,

[-0.0419, -0.0224, 0.0347, ..., -0.0015, 0.0425, 0.0214],

[-0.0128, 0.0261, -0.0429, ..., 0.0024, -0.0289, 0.0047],

[-0.0103, 0.0192, -0.0433, ..., -0.0366, 0.0204, 0.0187]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0244, 0.0139, 0.0415, ..., 0.0078, -0.0019, 0.0282],

[-0.0027, -0.0332, -0.0068, ..., 0.0094, -0.0238, 0.0567],

[ 0.0080, -0.0199, -0.0100, ..., 0.0014, -0.0393, 0.0039],

...,

[ 0.0340, 0.0053, -0.0312, ..., 0.0005, -0.0016, 0.0256],

[ 0.0120, -0.0029, -0.0272, ..., 0.0027, -0.0018, -0.0077],

[-0.0226, 0.0019, 0.0284, ..., 0.0018, 0.0144, 0.0085]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Patience used: 5 out of 5

**Sigma=0.01, supp=10, k\_sparse=5%, m=1/128n**

alpha= 0.5

--------------------------------------

beta= 0.3

Patience used: 3 out of 5

training: 100%|████████████████████████████████████████████████████████████████████████████████| 55/55 [00:08<00:00, 6.13it/s, loss=0.0461]

validation: 100%|█████████████████████████████████████████████████████████████████████████████████| 8/8 [00:01<00:00, 6.95it/s, mse=0.0467]

--------------------------------------

Average Train MSE = 0.046102

--------------------------------------

Average Test MSE = 0.046680

--------------------------------------

Epoch no. = 11

--------------------------------------

Generalization error = 0.000578

--------------------------------------

A= tensor([[ 0.1126, 0.1099, 0.2686, ..., 0.1617, 0.0626, -0.1162],

[-0.0820, -0.0926, -0.4462, ..., 0.1251, 0.1329, 0.1027],

[ 0.1408, -0.0669, -0.0008, ..., -0.0345, 0.1588, -0.1221],

...,

[-0.0355, -0.3215, -0.1932, ..., -0.0044, -0.0056, 0.2349],

[ 0.1502, -0.4096, -0.2356, ..., -0.0485, 0.2415, -0.2565],

[ 0.0378, 0.1900, -0.0130, ..., 0.2492, -0.1466, -0.1047]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0195, -0.0027, -0.0290, ..., 0.0526, -0.0015, 0.0209],

[-0.0160, -0.0052, -0.0183, ..., -0.0174, 0.0189, 0.0067],

[-0.0146, -0.0252, 0.0122, ..., -0.0008, 0.0218, -0.0008],

...,

[-0.0381, 0.0040, -0.0024, ..., 0.0325, 0.0276, -0.0562],

[-0.0017, -0.0435, -0.0224, ..., -0.0117, -0.0277, 0.0514],

[-0.0151, -0.0089, -0.0285, ..., 0.0230, -0.0118, 0.0162]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Patience used: 4 out of 5

training: 100%|████████████████████████████████████████████████████████████████████████████████| 55/55 [00:08<00:00, 6.14it/s, loss=0.0456]

validation: 100%|█████████████████████████████████████████████████████████████████████████████████| 8/8 [00:01<00:00, 6.93it/s, mse=0.0463]

--------------------------------------

Average Train MSE = 0.045644

--------------------------------------

Average Test MSE = 0.046322

--------------------------------------

Epoch no. = 12

--------------------------------------

Generalization error = 0.000678

--------------------------------------

A= tensor([[ 0.1126, 0.1099, 0.2686, ..., 0.1617, 0.0626, -0.1162],

[-0.0820, -0.0926, -0.4462, ..., 0.1251, 0.1329, 0.1027],

[ 0.1408, -0.0669, -0.0008, ..., -0.0345, 0.1588, -0.1221],

...,

[-0.0355, -0.3215, -0.1932, ..., -0.0044, -0.0056, 0.2349],

[ 0.1502, -0.4096, -0.2356, ..., -0.0485, 0.2415, -0.2565],

[ 0.0378, 0.1900, -0.0130, ..., 0.2492, -0.1466, -0.1047]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0196, -0.0034, -0.0283, ..., 0.0527, -0.0007, 0.0217],

[-0.0160, -0.0052, -0.0179, ..., -0.0172, 0.0200, 0.0067],

[-0.0149, -0.0257, 0.0129, ..., -0.0008, 0.0225, -0.0015],

...,

[-0.0385, 0.0038, -0.0024, ..., 0.0332, 0.0273, -0.0564],

[-0.0019, -0.0433, -0.0221, ..., -0.0123, -0.0270, 0.0505],

[-0.0142, -0.0096, -0.0285, ..., 0.0228, -0.0126, 0.0161]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Patience used: 5 out of 5

**Sigma=0.01, supp=10, k\_sparse=5%, m=1/400n**

alpha= 0.5

--------------------------------------

beta= 0.3

Patience used: 3 out of 5

training: 100%|█████████████████████████████████████████████████████████████████████████████████| 55/55 [00:08<00:00, 6.18it/s, loss=0.782]

validation: 100%|██████████████████████████████████████████████████████████████████████████████████| 8/8 [00:01<00:00, 7.00it/s, mse=0.775]

--------------------------------------

Average Train MSE = 0.781847

--------------------------------------

Average Test MSE = 0.774761

--------------------------------------

Epoch no. = 6

--------------------------------------

Generalization error = 0.007085

--------------------------------------

A= tensor([[ 0.1115, -0.4244, 0.2667, ..., 0.3092, 0.2370, 0.1867],

[-0.1005, 0.2667, 0.0603, ..., 0.2399, 0.2256, 0.4046],

[ 0.3025, 0.6610, -0.4832, ..., 0.2052, 0.2369, 0.4091],

...,

[ 0.7663, -0.0782, 0.1803, ..., -0.2135, 0.2544, -0.0740],

[-0.1491, 0.1381, 0.4621, ..., 0.1096, 0.2326, -0.2247],

[-0.0058, -0.0359, 0.2599, ..., -0.2775, -0.1839, 0.1359]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 1.8924e-02, -6.4724e-05, 1.2280e-02, ..., -3.5637e-02,

8.0340e-03, -7.4409e-03],

[-4.0843e-02, -2.6751e-02, -1.6100e-02, ..., 2.8555e-02,

-3.7291e-02, -5.0497e-02],

[ 6.0710e-03, 2.8127e-03, -4.9893e-03, ..., 3.3737e-02,

1.7730e-02, -1.9237e-02],

...,

[ 1.8642e-02, 2.1934e-02, -3.1103e-02, ..., 3.0125e-02,

5.0030e-02, -5.3894e-02],

[ 2.2883e-02, -1.4720e-02, 9.0904e-03, ..., 6.2762e-02,

2.0455e-02, 4.1121e-02],

[-1.4879e-02, 1.3178e-03, -1.8518e-03, ..., 1.2775e-02,

-2.8032e-02, -3.8691e-02]], device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Patience used: 4 out of 5

training: 100%|█████████████████████████████████████████████████████████████████████████████████| 55/55 [00:08<00:00, 6.16it/s, loss=0.781]

validation: 100%|██████████████████████████████████████████████████████████████████████████████████| 8/8 [00:01<00:00, 6.93it/s, mse=0.772]

--------------------------------------

Average Train MSE = 0.781374

--------------------------------------

Average Test MSE = 0.771525

--------------------------------------

Epoch no. = 7

--------------------------------------

Generalization error = 0.009850

--------------------------------------

A= tensor([[ 0.1115, -0.4244, 0.2667, ..., 0.3092, 0.2370, 0.1867],

[-0.1005, 0.2667, 0.0603, ..., 0.2399, 0.2256, 0.4046],

[ 0.3025, 0.6610, -0.4832, ..., 0.2052, 0.2369, 0.4091],

...,

[ 0.7663, -0.0782, 0.1803, ..., -0.2135, 0.2544, -0.0740],

[-0.1491, 0.1381, 0.4621, ..., 0.1096, 0.2326, -0.2247],

[-0.0058, -0.0359, 0.2599, ..., -0.2775, -0.1839, 0.1359]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[ 0.0238, -0.0002, 0.0146, ..., -0.0337, 0.0090, -0.0058],

[-0.0450, -0.0255, -0.0160, ..., 0.0249, -0.0402, -0.0536],

[ 0.0084, 0.0036, -0.0059, ..., 0.0370, 0.0167, -0.0224],

...,

[ 0.0201, 0.0229, -0.0327, ..., 0.0338, 0.0488, -0.0569],

[ 0.0274, -0.0153, 0.0086, ..., 0.0671, 0.0228, 0.0435],

[-0.0176, 0.0039, -0.0024, ..., 0.0149, -0.0311, -0.0421]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Patience used: 5 out of 5

**MAE, sigma=0.01, support=10, m=0.25n**

Average Train MSE = 0.169272

--------------------------------------

Average Test MSE = 0.178309

--------------------------------------

Epoch no. = 7

--------------------------------------

Generalization error = 0.009037

--------------------------------------

A= tensor([[-0.0043, -0.0046, -0.0280, ..., -0.0010, 0.0226, 0.0209],

[-0.0300, -0.0290, -0.0277, ..., -0.0267, -0.0081, -0.0180],

[ 0.0478, -0.0186, -0.0046, ..., 0.0219, -0.0242, 0.0669],

...,

[ 0.0390, 0.0754, -0.0068, ..., -0.0314, -0.0395, -0.0249],

[ 0.0386, -0.0070, 0.0229, ..., 0.0061, 0.0158, 0.0308],

[ 0.0087, 0.0287, 0.0055, ..., 0.0087, 0.0082, 0.0338]],

device='cuda:0')

--------------------------------------

PHI= Parameter containing:

tensor([[-0.0314, 0.0234, 0.0234, ..., -0.0102, -0.0045, 0.0149],

[ 0.0138, -0.0074, 0.0295, ..., -0.0017, -0.0086, -0.0093],

[ 0.0014, 0.0035, -0.0171, ..., 0.0148, 0.0089, 0.0308],

...,

[ 0.0003, -0.0136, -0.0066, ..., -0.0035, 0.0258, 0.0173],

[-0.0208, -0.0278, 0.0156, ..., -0.0137, 0.0486, 0.0064],

[-0.0414, -0.0091, -0.0186, ..., -0.0132, 0.0025, 0.0311]],

device='cuda:0', requires\_grad=True)

--------------------------------------

alpha= 0.5

--------------------------------------

beta= 0.3

Patience used: 5 out of 5