0726-small_hybrid_model_1q_measurement

July 26, 2023

[1]:
```
import torch
import torch.nn as nn
import torch.optim as optim
```

[2]:
```
import numpy as np
```

[3]:
```
import sys
sys.path.append('..')

from my_code import functions as f
```

1 Data

[4]:
```
file_path = '../data/energies/Trial/Strings_Energies_4_aa.txt'  # Replace with␣
 ↪the actual path to your 'data.txt' file
string_list, number_list = f.read_data_file(file_path)
score_list = np.array(number_list)/1000
vector_list = np.array([f.string_to_vector(string) for string in string_list])␣
 ↪# one hot encoding
```

[5]:
```
n_aminoacids = len(string_list[0])
```

[6]:
```
X, Y, X_validation, Y_validation = f.create_validating_set(vector_list,␣
 ↪score_list, percentage=0.1)
```

[7]:
```
X = X.reshape(X.shape[0], X.shape[1]*X.shape[2]) # flatten
X_validation = X_validation.reshape(X_validation.shape[0], X_validation.
 ↪shape[1]*X_validation.shape[2]) # flatten
```

[8]:
```
# Define the dataset
input_data = torch.tensor(X, dtype=torch.float32)
target_data = torch.tensor(Y, dtype=torch.float32).view(-1, 1)

# Define the validation set
input_validation = torch.tensor(X_validation, dtype=torch.float32)
target_validation = torch.tensor(Y_validation, dtype=torch.float32).view(-1, 1)
```

2 Quantum node

[9]:
```
import pennylane as qml
```

[10]:
```
def qml_RZZ(params, wires):
    """
    RZZ gate.
    """
    qml.CNOT(wires=wires)
    qml.RZ(params, wires=wires[1])
    qml.CNOT(wires=wires)
```

[11]:
```
n_qubits = n_aminoacids
n_layers_block = 5
n_layers_embedding = 3
dev = qml.device("default.qubit", wires=n_qubits)
```

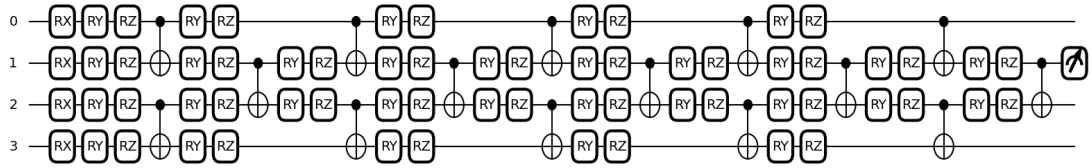
[12]:
```
shape_weights_embedding = (n_layers_embedding, n_qubits, 2)
shape_weights_block_1 = (n_layers_block, n_qubits, 2)
shape_weights_block_2 = (n_layers_block, n_qubits//2, 2)
```

[13]:
```
# size_weights = np.product(shape_weights_embedding) + np.
 ↪product(shape_weights_block_1) + np.product(shape_weights_block_2)
size_weights = np.product(shape_weights_block_1) + np.
 ↪product(shape_weights_block_2)
```

[14]:
```
@qml.qnode(dev)
def qnode(inputs, weights):

    # weights
    # weights_embedding = weights[:np.product(shape_weights_embedding)].
 ↪reshape(shape_weights_embedding)
    # weights_block_1 = weights[np.product(shape_weights_embedding):np.
 ↪product(shape_weights_embedding)+np.product(shape_weights_block_1)].
 ↪reshape(shape_weights_block_1)
    # weights_block_2 = weights[np.product(shape_weights_embedding)+np.
 ↪product(shape_weights_block_1):].reshape(shape_weights_block_2)

    weights_block_1 = weights[:np.product(shape_weights_block_1)].
 ↪reshape(shape_weights_block_1)
    weights_block_2 = weights[np.product(shape_weights_block_1):].
 ↪reshape(shape_weights_block_2)

    # state preparation (we create an embedding with 3 layers, paper: 2001.
 ↪03622)
    # for i in range(n_layers_embedding):
```

```
    #     # angle embedding for each qubit
    #     qml.AngleEmbedding(inputs, wires=range(n_qubits))

    #     # ZZ rotation for neighboring qubits
    #     for x in range(2):
    #         for j in range(x,n_qubits,2):
    #             qml_RZZ(weights_embedding[i,j,0], wires=[j, (j+1)%n_qubits])

    #     # rotations for each qubit
    #     for j in range(n_qubits):
    #         qml.RY(weights_embedding[i,j,1], wires=j)

    #     # last angle embedding
    qml.AngleEmbedding(inputs, wires=range(n_qubits))

    #block
    for i in range(n_layers_block):
        # rotations for each qubit
        for j in range(n_qubits):
            qml.RY(weights_block_1[i,j,0], wires=j)
            qml.RZ(weights_block_1[i,j,1], wires=j)

        # ZZ rotation for neighboring qubits
        for j in range(0,n_qubits,2):
            qml.CNOT(wires=[j, (j+1)])

        # rotations for some qubits
        for j, w in enumerate(range(1, n_qubits, 4)):
            qml.RY(weights_block_2[i,j,0], wires=w)
            qml.RZ(weights_block_2[i,j,1], wires=w)
            qml.RY(weights_block_2[i,j+1,0], wires=w+1)
            qml.RZ(weights_block_2[i,j+1,1], wires=w+1)
            qml.CNOT(wires=[w, (w+1)])

    # measurement
    return [qml.expval(qml.PauliZ(wires=1))]
```

[15]:
```
qml.drawer.use_style("black_white")
fig, ax = qml.draw_mpl(qnode, expansion_strategy="device")([i for i in␣
 ↪range(n_qubits)], np.zeros((size_weights,)))
fig.set_size_inches((16,3))
```



[16]:
```
weight_shapes = {"weights": (size_weights,)}
```

[17]:
```
qlayer = qml.qnn.TorchLayer(qnode, weight_shapes)
```

3 Hybrid model

[18]:
```
input_dim = input_data.size(1)
```

[19]:
```
n_pre_classical_layers = 4
layers_dim = np.linspace(n_qubits, input_dim, 4).astype(int)
```

[20]:
```
layers = []
for i in range(1, len(layers_dim)):
    layers += [nn.Linear(layers_dim[-1*i], layers_dim[-1*(i+1)]), nn.ReLU()]
layers += [nn.Linear(layers_dim[0], layers_dim[0])]
layers += [qlayer]
# layers += [nn.Linear(1, 1)]
# layers += [nn.Linear(2, 4), nn.ReLU()]
# layers += [nn.Linear(4, 1)]


Net = nn.Sequential(*layers)
```

[21]:
```
# Create an instance of the network
model = Net
```

[22]:
```
import time
```

[23]:
```
# time
start_time = time.time()


# Define the loss function and optimizer
criterion = nn.MSELoss()  # Mean Squared Error loss
# optimizer = optim.Adam(model.parameters(), lr=0.1)  # Adam optimizer with␣
 ↪learning rate 0.001
optimizer = optim.SGD(model.parameters(), lr=0.05)
```

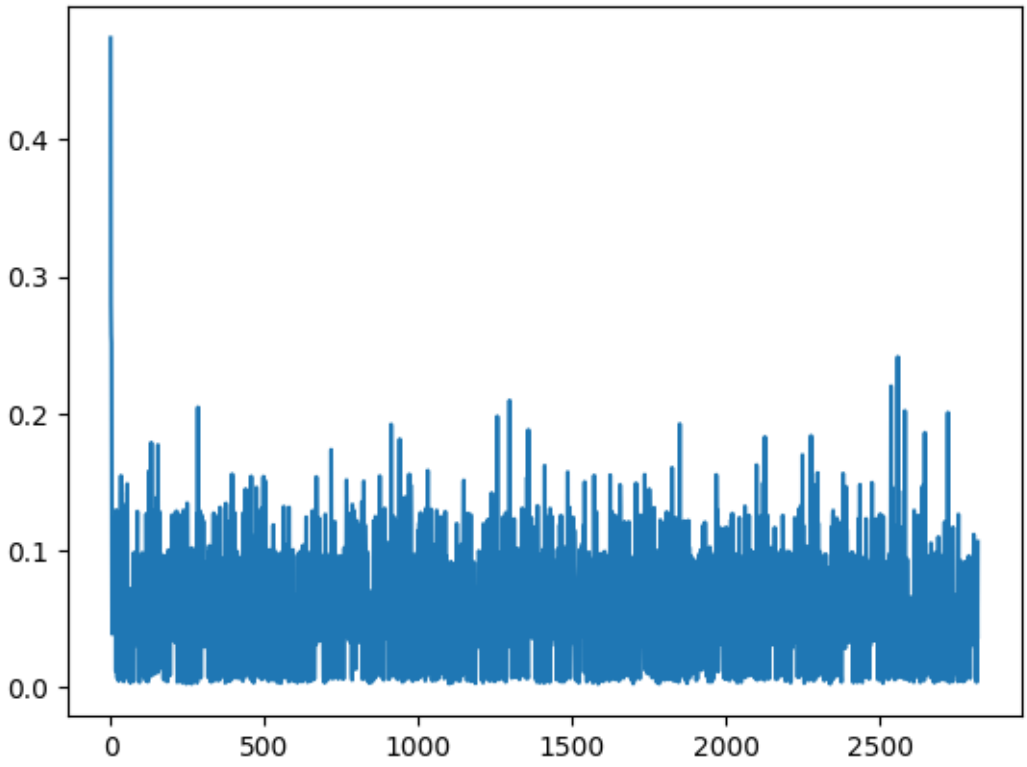
```
# Training loop
num_epochs = 10
batch_size = 32

losses = []
losses_epochs = [0]

losses_epochs[-1] = criterion(model(input_data), target_data).item()
print('Epoch [{}/{}], Loss: {:.4f}'.format(0, num_epochs, losses_epochs[-1]))

for epoch in range(num_epochs):
    # Shuffle the dataset
    indices = torch.randperm(input_data.size(0))
    input_data = input_data[indices]
    target_data = target_data[indices]

    losses_epochs.append(0)

    # Mini-batch training
    for i in range(0, input_data.size(0), batch_size):
        inputs = input_data[i:i+batch_size]
        targets = target_data[i:i+batch_size]

        # Forward pass
        outputs = model(inputs)

        # Compute the loss
        loss = criterion(outputs, targets)

        # Backward pass and optimization
        optimizer.zero_grad()
        loss.backward()
        optimizer.step()

        # Store the loss
        losses.append(loss.item())

        print('- Epoch [{}/{}], i: [{}/{}], Loss: {:.4f}'.format(epoch+1,␣
 ↪num_epochs, i, input_data.size(0), loss.item()), end='\r')

        # add to the epoch loss
        losses_epochs[-1] += loss.item()

    # divide the epoch loss by the number of batches, to get the average loss
    losses_epochs[-1] /= (input_data.size(0)/batch_size)
```

```
    # Validation
    for x, (i, t) in enumerate(zip((input_validation[:3]), target_validation[:
↪3])):
        loss = criterion(model(i), t)
        print('i: {}, \t target: {:.3f}, \t output: {:.3f}, \t loss: {:.3f}'.
↪format(x, t.item(), model(i).item(), loss))

    # time
    # Compute elapsed time and remaining time
    elapsed_time = time.time() - start_time
    avg_time_per_epoch = elapsed_time / (epoch + 1)
    remaining_epochs = num_epochs - (epoch + 1)
    estimated_remaining_time = avg_time_per_epoch * remaining_epochs

    # Convert remaining time to hours, minutes, and seconds for better␣
↪readability
    hours, remainder = divmod(estimated_remaining_time, 3600)
    minutes, seconds = divmod(remainder, 60)

    # Print the loss and remaining time for this epoch
    print('Epoch [{}/{}], Loss: {:.4f}, Time remaining: ~{}h {}m {:.0f}s'.
↪format(
        epoch+1, num_epochs, losses_epochs[-1], hours, minutes, seconds))
```

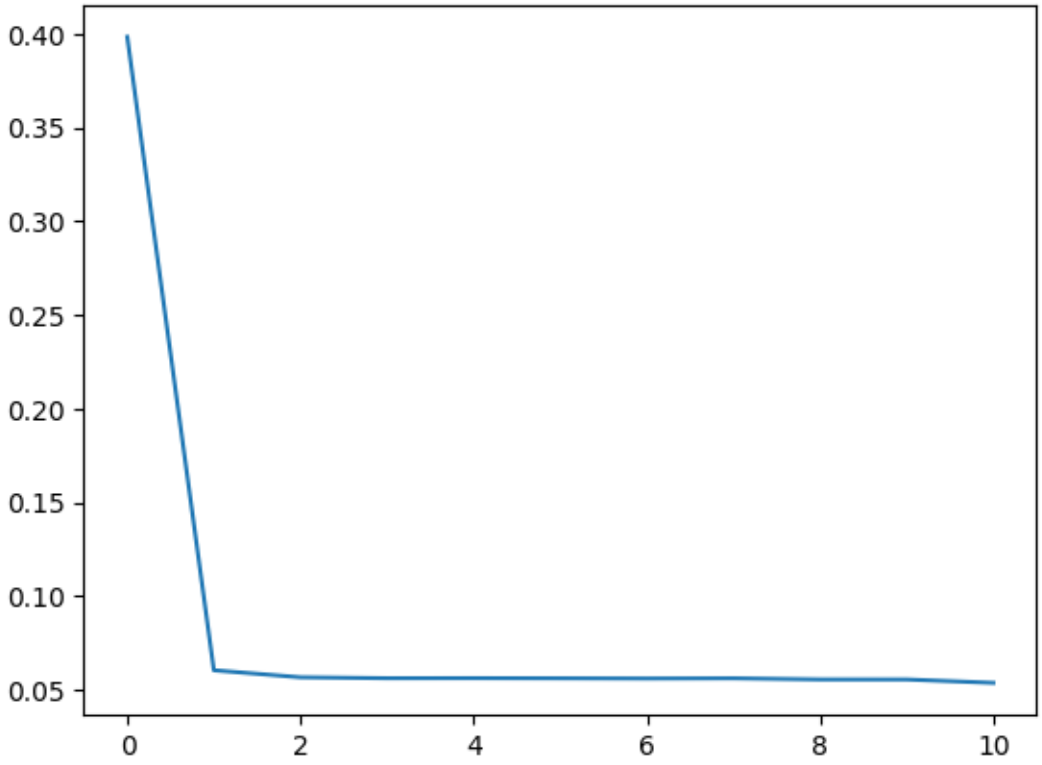
```
Epoch [0/10], Loss: 0.3982
i: 0,    target: -0.047,         output: -0.058,         loss: 0.000
i: 1,    target: -0.140,         output: -0.061,         loss: 0.006
i: 2,    target: -0.151,         output: -0.059,         loss: 0.008
Epoch [1/10], Loss: 0.0604, Time remaining: ~0.0h 6.0m 6s
i: 0,    target: -0.047,         output: -0.021,         loss: 0.001
i: 1,    target: -0.140,         output: -0.025,         loss: 0.013
i: 2,    target: -0.151,         output: -0.022,         loss: 0.016
Epoch [2/10], Loss: 0.0566, Time remaining: ~0.0h 5.0m 26s
i: 0,    target: -0.047,         output: -0.078,         loss: 0.001
i: 1,    target: -0.140,         output: -0.082,         loss: 0.003
i: 2,    target: -0.151,         output: -0.079,         loss: 0.005
Epoch [3/10], Loss: 0.0561, Time remaining: ~0.0h 4.0m 44s
i: 0,    target: -0.047,         output: -0.038,         loss: 0.000
i: 1,    target: -0.140,         output: -0.042,         loss: 0.010
i: 2,    target: -0.151,         output: -0.039,         loss: 0.012
Epoch [4/10], Loss: 0.0562, Time remaining: ~0.0h 3.0m 58s
i: 0,    target: -0.047,         output: -0.063,         loss: 0.000
i: 1,    target: -0.140,         output: -0.068,         loss: 0.005
i: 2,    target: -0.151,         output: -0.065,         loss: 0.007
Epoch [5/10], Loss: 0.0561, Time remaining: ~0.0h 3.0m 15s
i: 0,    target: -0.047,         output: -0.050,         loss: 0.000
i: 1,    target: -0.140,         output: -0.055,         loss: 0.007
```

```
i: 2,    target: -0.151,         output: -0.051,         loss: 0.010
Epoch [6/10], Loss: 0.0560, Time remaining: ~0.0h 2.0m 36s
i: 0,    target: -0.047,         output: -0.007,         loss: 0.002
i: 1,    target: -0.140,         output: -0.013,         loss: 0.016
i: 2,    target: -0.151,         output: -0.009,         loss: 0.020
Epoch [7/10], Loss: 0.0561, Time remaining: ~0.0h 1.0m 55s
i: 0,    target: -0.047,         output: -0.044,         loss: 0.000
i: 1,    target: -0.140,         output: -0.051,         loss: 0.008
i: 2,    target: -0.151,         output: -0.046,         loss: 0.011
Epoch [8/10], Loss: 0.0555, Time remaining: ~0.0h 1.0m 17s
i: 0,    target: -0.047,         output: -0.002,         loss: 0.002
i: 1,    target: -0.140,         output: -0.013,         loss: 0.016
i: 2,    target: -0.151,         output: -0.006,         loss: 0.021
Epoch [9/10], Loss: 0.0555, Time remaining: ~0.0h 0.0m 39s
i: 0,    target: -0.047,         output: -0.037,         loss: 0.000
i: 1,    target: -0.140,         output: -0.056,         loss: 0.007
i: 2,    target: -0.151,         output: -0.044,         loss: 0.011
Epoch [10/10], Loss: 0.0537, Time remaining: ~0.0h 0.0m 0s
```

[24]:
```
#plot the loss
import matplotlib.pyplot as plt
plt.plot(losses)
plt.show()
```



[30]:
```
#plot the loss
import matplotlib.pyplot as plt
plt.plot(losses_epochs)
plt.show()
```



[31]:
```
avg_loss = 0
for x, (i, t) in enumerate(zip((input_validation), target_validation)):
    loss = criterion(model(i), t)
    avg_loss += loss/len(target_validation)
    print('i: {}, \t target: {:.3f}, \t output: {:.3f}, \t loss: {:.3f}'.
 ↪format(x, t.item(), model(i).item(), loss))

print('Average loss: {:.3f}'.format(avg_loss))
```

```
i: 0,    target: -0.047,         output: -0.037,         loss: 0.000
i: 1,    target: -0.140,         output: -0.056,         loss: 0.007
i: 2,    target: -0.151,         output: -0.044,         loss: 0.011
i: 3,    target: -0.221,         output: -0.020,         loss: 0.041
i: 4,    target: -0.143,         output: -0.040,         loss: 0.011
i: 5,    target: -0.055,         output: -0.025,         loss: 0.001
i: 6,    target: -0.118,         output: -0.069,         loss: 0.002
```

```
i: 7,    target: -0.176,        output: -0.036,        loss: 0.020
i: 8,    target: -0.044,        output: -0.020,        loss: 0.001
i: 9,    target: -0.136,        output: -0.040,        loss: 0.009
i: 10,   target: 0.962,         output: 0.004,         loss: 0.918
i: 11,   target: -0.040,        output: -0.053,        loss: 0.000
i: 12,   target: -0.185,        output: -0.029,        loss: 0.024
i: 13,   target: -0.087,        output: -0.059,        loss: 0.001
i: 14,   target: -0.139,        output: -0.023,        loss: 0.013
i: 15,   target: -0.056,        output: -0.013,        loss: 0.002
i: 16,   target: -0.074,        output: -0.034,        loss: 0.002
i: 17,   target: -0.168,        output: -0.054,        loss: 0.013
i: 18,   target: -0.137,        output: -0.024,        loss: 0.013
i: 19,   target: -0.096,        output: -0.024,        loss: 0.005
i: 20,   target: -0.178,        output: -0.019,        loss: 0.025
i: 21,   target: 0.932,         output: 0.015,         loss: 0.841
i: 22,   target: -0.090,        output: -0.043,        loss: 0.002
i: 23,   target: -0.143,        output: -0.018,        loss: 0.016
i: 24,   target: -0.123,        output: -0.017,        loss: 0.011
i: 25,   target: -0.134,        output: -0.053,        loss: 0.007
i: 26,   target: -0.055,        output: -0.017,        loss: 0.001
i: 27,   target: -0.136,        output: -0.056,        loss: 0.006
i: 28,   target: -0.047,        output: -0.023,        loss: 0.001
i: 29,   target: -0.164,        output: -0.055,        loss: 0.012
i: 30,   target: -0.081,        output: -0.040,        loss: 0.002
i: 31,   target: -0.076,        output: -0.042,        loss: 0.001
i: 32,   target: -0.161,        output: -0.047,        loss: 0.013
i: 33,   target: -0.073,        output: -0.049,        loss: 0.001
i: 34,   target: 0.079,         output: 0.002,         loss: 0.006
i: 35,   target: -0.066,        output: -0.037,        loss: 0.001
i: 36,   target: -0.131,        output: -0.037,        loss: 0.009
i: 37,   target: -0.167,        output: -0.031,        loss: 0.018
i: 38,   target: -0.074,        output: -0.013,        loss: 0.004
i: 39,   target: -0.036,        output: -0.042,        loss: 0.000
i: 40,   target: -0.043,        output: -0.055,        loss: 0.000
i: 41,   target: 0.053,         output: -0.008,        loss: 0.004
i: 42,   target: 0.894,         output: -0.017,        loss: 0.829
i: 43,   target: -0.218,        output: -0.028,        loss: 0.036
i: 44,   target: -0.045,        output: -0.036,        loss: 0.000
i: 45,   target: 0.976,         output: -0.020,        loss: 0.990
i: 46,   target: -0.247,        output: -0.058,        loss: 0.036
i: 47,   target: -0.143,        output: -0.043,        loss: 0.010
i: 48,   target: -0.044,        output: -0.022,        loss: 0.000
i: 49,   target: -0.164,        output: -0.036,        loss: 0.016
i: 50,   target: -0.085,        output: -0.037,        loss: 0.002
i: 51,   target: 0.091,         output: -0.017,        loss: 0.012
i: 52,   target: -0.073,        output: -0.046,        loss: 0.001
i: 53,   target: 0.047,         output: -0.020,        loss: 0.004
i: 54,   target: -0.127,        output: -0.046,        loss: 0.007
```

```
i: 55,   target: -0.118,         output: -0.039,         loss: 0.006
i: 56,   target: -0.120,         output: -0.042,         loss: 0.006
i: 57,   target: -0.089,         output: -0.024,         loss: 0.004
i: 58,   target: -0.062,         output: -0.034,         loss: 0.001
i: 59,   target: -0.099,         output: -0.049,         loss: 0.003
i: 60,   target: -0.137,         output: -0.033,         loss: 0.011
i: 61,   target: -0.101,         output: -0.046,         loss: 0.003
i: 62,   target: -0.125,         output: -0.038,         loss: 0.008
i: 63,   target: -0.044,         output: -0.020,         loss: 0.001
i: 64,   target: -0.103,         output: -0.057,         loss: 0.002
i: 65,   target: -0.126,         output: -0.047,         loss: 0.006
i: 66,   target: -0.061,         output: -0.028,         loss: 0.001
i: 67,   target: -0.048,         output: -0.049,         loss: 0.000
i: 68,   target: -0.080,         output: -0.018,         loss: 0.004
i: 69,   target: -0.061,         output: -0.034,         loss: 0.001
i: 70,   target: -0.119,         output: -0.028,         loss: 0.008
i: 71,   target: -0.081,         output: -0.042,         loss: 0.002
i: 72,   target: -0.044,         output: -0.021,         loss: 0.001
i: 73,   target: -0.134,         output: -0.061,         loss: 0.005
i: 74,   target: -0.196,         output: -0.023,         loss: 0.030
i: 75,   target: -0.093,         output: -0.041,         loss: 0.003
i: 76,   target: -0.194,         output: -0.028,         loss: 0.028
i: 77,   target: -0.052,         output: -0.033,         loss: 0.000
i: 78,   target: -0.055,         output: -0.032,         loss: 0.001
i: 79,   target: -0.093,         output: -0.036,         loss: 0.003
i: 80,   target: -0.017,         output: -0.009,         loss: 0.000
i: 81,   target: -0.032,         output: -0.048,         loss: 0.000
i: 82,   target: -0.131,         output: -0.048,         loss: 0.007
i: 83,   target: 0.081,          output: -0.008,         loss: 0.008
i: 84,   target: -0.079,         output: -0.011,         loss: 0.005
i: 85,   target: -0.010,         output: -0.030,         loss: 0.000
i: 86,   target: -0.058,         output: -0.037,         loss: 0.000
i: 87,   target: -0.023,         output: -0.044,         loss: 0.000
i: 88,   target: -0.064,         output: -0.041,         loss: 0.001
i: 89,   target: -0.101,         output: -0.062,         loss: 0.002
i: 90,   target: -0.073,         output: -0.042,         loss: 0.001
i: 91,   target: -0.108,         output: -0.037,         loss: 0.005
i: 92,   target: -0.014,         output: -0.030,         loss: 0.000
i: 93,   target: -0.107,         output: -0.024,         loss: 0.007
i: 94,   target: -0.118,         output: -0.034,         loss: 0.007
i: 95,   target: -0.156,         output: -0.038,         loss: 0.014
i: 96,   target: 0.030,          output: -0.011,         loss: 0.002
i: 97,   target: -0.152,         output: -0.024,         loss: 0.016
i: 98,   target: -0.074,         output: -0.043,         loss: 0.001
i: 99,   target: -0.091,         output: -0.023,         loss: 0.005
i: 100,          target: -0.117,         output: -0.053,         loss: 0.004
i: 101,          target: -0.063,         output: -0.035,         loss: 0.001
i: 102,          target: -0.020,         output: -0.038,         loss: 0.000
```

```
i: 103,         target: -0.083,         output: -0.044,         loss: 0.001
i: 104,         target: -0.015,         output: -0.029,         loss: 0.000
i: 105,         target: -0.076,         output: -0.026,         loss: 0.002
i: 106,         target: -0.215,         output: -0.034,         loss: 0.033
i: 107,         target: -0.089,         output: -0.043,         loss: 0.002
i: 108,         target: -0.256,         output: -0.039,         loss: 0.047
i: 109,         target: -0.217,         output: -0.037,         loss: 0.033
i: 110,         target: -0.055,         output: -0.030,         loss: 0.001
i: 111,         target: -0.120,         output: -0.034,         loss: 0.007
i: 112,         target: -0.165,         output: -0.051,         loss: 0.013
i: 113,         target: -0.083,         output: -0.016,         loss: 0.004
i: 114,         target: -0.199,         output: -0.057,         loss: 0.020
i: 115,         target: -0.071,         output: -0.055,         loss: 0.000
i: 116,         target: -0.126,         output: -0.059,         loss: 0.005
i: 117,         target: -0.068,         output: -0.014,         loss: 0.003
i: 118,         target: -0.061,         output: -0.040,         loss: 0.000
i: 119,         target: -0.034,         output: -0.045,         loss: 0.000
i: 120,         target: -0.262,         output: -0.029,         loss: 0.054
i: 121,         target: -0.068,         output: -0.056,         loss: 0.000
i: 122,         target: -0.156,         output: -0.023,         loss: 0.018
i: 123,         target: -0.129,         output: -0.046,         loss: 0.007
i: 124,         target: -0.036,         output: -0.048,         loss: 0.000
i: 125,         target: -0.192,         output: -0.048,         loss: 0.021
i: 126,         target: -0.044,         output: -0.037,         loss: 0.000
i: 127,         target: -0.153,         output: -0.044,         loss: 0.012
i: 128,         target: -0.117,         output: -0.053,         loss: 0.004
i: 129,         target: 0.012,          output: -0.038,         loss: 0.002
i: 130,         target: -0.042,         output: -0.005,         loss: 0.001
i: 131,         target: -0.171,         output: -0.047,         loss: 0.015
i: 132,         target: -0.058,         output: -0.019,         loss: 0.002
i: 133,         target: -0.184,         output: -0.025,         loss: 0.025
i: 134,         target: -0.052,         output: -0.034,         loss: 0.000
i: 135,         target: -0.055,         output: -0.037,         loss: 0.000
i: 136,         target: -0.164,         output: -0.059,         loss: 0.011
i: 137,         target: -0.070,         output: -0.030,         loss: 0.002
i: 138,         target: -0.141,         output: -0.007,         loss: 0.018
i: 139,         target: -0.339,         output: -0.020,         loss: 0.102
i: 140,         target: -0.173,         output: -0.042,         loss: 0.017
i: 141,         target: 0.966,          output: 0.008,          loss: 0.918
i: 142,         target: 0.951,          output: 0.005,          loss: 0.894
i: 143,         target: -0.081,         output: -0.025,         loss: 0.003
i: 144,         target: -0.126,         output: -0.034,         loss: 0.008
i: 145,         target: -0.182,         output: -0.060,         loss: 0.015
i: 146,         target: -0.210,         output: -0.001,         loss: 0.044
i: 147,         target: -0.136,         output: -0.030,         loss: 0.011
i: 148,         target: -0.081,         output: -0.022,         loss: 0.003
i: 149,         target: -0.177,         output: -0.036,         loss: 0.020
i: 150,         target: -0.130,         output: -0.048,         loss: 0.007
```

```
i: 151,         target: -0.090,         output: -0.028,         loss: 0.004
i: 152,         target: 0.874,          output: -0.014,         loss: 0.789
i: 153,         target: -0.141,         output: -0.023,         loss: 0.014
i: 154,         target: -0.103,         output: -0.037,         loss: 0.004
i: 155,         target: -0.189,         output: -0.055,         loss: 0.018
i: 156,         target: -0.130,         output: -0.059,         loss: 0.005
i: 157,         target: -0.059,         output: -0.045,         loss: 0.000
i: 158,         target: -0.162,         output: -0.037,         loss: 0.016
i: 159,         target: -0.112,         output: -0.039,         loss: 0.005
i: 160,         target: -0.097,         output: -0.045,         loss: 0.003
i: 161,         target: -0.058,         output: -0.054,         loss: 0.000
i: 162,         target: -0.133,         output: -0.040,         loss: 0.009
i: 163,         target: -0.064,         output: -0.044,         loss: 0.000
i: 164,         target: -0.137,         output: -0.034,         loss: 0.011
i: 165,         target: -0.068,         output: -0.044,         loss: 0.001
i: 166,         target: -0.171,         output: -0.061,         loss: 0.012
i: 167,         target: -0.154,         output: -0.034,         loss: 0.014
i: 168,         target: -0.128,         output: -0.057,         loss: 0.005
i: 169,         target: 0.948,          output: 0.006,          loss: 0.887
i: 170,         target: -0.005,         output: -0.030,         loss: 0.001
i: 171,         target: -0.201,         output: -0.022,         loss: 0.032
i: 172,         target: 0.060,          output: -0.039,         loss: 0.010
i: 173,         target: -0.192,         output: -0.021,         loss: 0.029
i: 174,         target: -0.076,         output: -0.038,         loss: 0.001
i: 175,         target: -0.047,         output: -0.019,         loss: 0.001
i: 176,         target: -0.198,         output: -0.064,         loss: 0.018
i: 177,         target: 0.118,          output: -0.032,         loss: 0.022
i: 178,         target: -0.073,         output: -0.041,         loss: 0.001
i: 179,         target: -0.118,         output: -0.049,         loss: 0.005
i: 180,         target: -0.136,         output: -0.022,         loss: 0.013
i: 181,         target: -0.134,         output: -0.045,         loss: 0.008
i: 182,         target: -0.202,         output: -0.040,         loss: 0.026
i: 183,         target: -0.142,         output: -0.050,         loss: 0.008
i: 184,         target: -0.060,         output: -0.032,         loss: 0.001
i: 185,         target: -0.094,         output: -0.018,         loss: 0.006
i: 186,         target: -0.031,         output: -0.036,         loss: 0.000
i: 187,         target: -0.119,         output: -0.033,         loss: 0.007
i: 188,         target: -0.118,         output: -0.015,         loss: 0.011
i: 189,         target: -0.178,         output: -0.043,         loss: 0.018
i: 190,         target: -0.085,         output: -0.033,         loss: 0.003
i: 191,         target: -0.073,         output: -0.030,         loss: 0.002
i: 192,         target: -0.058,         output: -0.004,         loss: 0.003
i: 193,         target: -0.124,         output: -0.042,         loss: 0.007
i: 194,         target: -0.087,         output: -0.010,         loss: 0.006
i: 195,         target: 0.960,          output: 0.018,          loss: 0.887
i: 196,         target: -0.068,         output: -0.035,         loss: 0.001
i: 197,         target: -0.181,         output: -0.025,         loss: 0.024
i: 198,         target: -0.092,         output: -0.041,         loss: 0.003
```

```
i: 199,         target: -0.186,         output: -0.054,         loss: 0.017
i: 200,         target: -0.178,         output: -0.038,         loss: 0.020
i: 201,         target: -0.195,         output: -0.050,         loss: 0.021
i: 202,         target: -0.124,         output: -0.022,         loss: 0.010
i: 203,         target: -0.024,         output: -0.030,         loss: 0.000
i: 204,         target: -0.153,         output: -0.033,         loss: 0.014
i: 205,         target: -0.065,         output: -0.035,         loss: 0.001
i: 206,         target: -0.055,         output: -0.014,         loss: 0.002
i: 207,         target: -0.062,         output: -0.037,         loss: 0.001
i: 208,         target: -0.033,         output: -0.044,         loss: 0.000
i: 209,         target: -0.032,         output: -0.013,         loss: 0.000
i: 210,         target: -0.134,         output: -0.044,         loss: 0.008
i: 211,         target: -0.130,         output: -0.047,         loss: 0.007
i: 212,         target: -0.199,         output: -0.045,         loss: 0.024
i: 213,         target: -0.016,         output: -0.039,         loss: 0.001
i: 214,         target: -0.127,         output: -0.054,         loss: 0.005
i: 215,         target: -0.186,         output: -0.022,         loss: 0.027
i: 216,         target: -0.040,         output: -0.041,         loss: 0.000
i: 217,         target: -0.021,         output: -0.034,         loss: 0.000
i: 218,         target: -0.004,         output: -0.029,         loss: 0.001
i: 219,         target: -0.136,         output: -0.037,         loss: 0.010
i: 220,         target: -0.066,         output: -0.039,         loss: 0.001
i: 221,         target: -0.069,         output: -0.030,         loss: 0.001
i: 222,         target: -0.067,         output: -0.039,         loss: 0.001
i: 223,         target: -0.043,         output: -0.037,         loss: 0.000
i: 224,         target: -0.128,         output: -0.051,         loss: 0.006
i: 225,         target: -0.113,         output: -0.042,         loss: 0.005
i: 226,         target: 0.126,          output: -0.026,         loss: 0.023
i: 227,         target: -0.086,         output: -0.029,         loss: 0.003
i: 228,         target: -0.048,         output: -0.042,         loss: 0.000
i: 229,         target: -0.069,         output: -0.018,         loss: 0.003
i: 230,         target: -0.048,         output: -0.027,         loss: 0.000
i: 231,         target: -0.067,         output: -0.061,         loss: 0.000
i: 232,         target: -0.116,         output: -0.045,         loss: 0.005
i: 233,         target: -0.153,         output: -0.022,         loss: 0.017
i: 234,         target: -0.091,         output: -0.055,         loss: 0.001
i: 235,         target: -0.037,         output: -0.026,         loss: 0.000
i: 236,         target: -0.213,         output: -0.030,         loss: 0.034
i: 237,         target: 0.042,          output: -0.024,         loss: 0.004
i: 238,         target: -0.069,         output: -0.017,         loss: 0.003
i: 239,         target: -0.060,         output: -0.048,         loss: 0.000
i: 240,         target: -0.208,         output: -0.047,         loss: 0.026
i: 241,         target: -0.233,         output: -0.031,         loss: 0.041
i: 242,         target: -0.050,         output: -0.041,         loss: 0.000
i: 243,         target: -0.102,         output: -0.040,         loss: 0.004
i: 244,         target: -0.064,         output: -0.032,         loss: 0.001
i: 245,         target: -0.091,         output: -0.031,         loss: 0.004
i: 246,         target: -0.051,         output: -0.044,         loss: 0.000
```

```
i: 247,         target: -0.119,         output: -0.034,         loss: 0.007
i: 248,         target: -0.151,         output: -0.031,         loss: 0.014
i: 249,         target: -0.172,         output: -0.058,         loss: 0.013
i: 250,         target: -0.081,         output: -0.043,         loss: 0.001
i: 251,         target: -0.092,         output: -0.038,         loss: 0.003
i: 252,         target: -0.070,         output: -0.037,         loss: 0.001
i: 253,         target: -0.141,         output: -0.049,         loss: 0.009
i: 254,         target: 0.915,          output: 0.018,          loss: 0.804
i: 255,         target: -0.105,         output: -0.013,         loss: 0.008
i: 256,         target: 0.818,          output: 0.005,          loss: 0.660
i: 257,         target: -0.066,         output: -0.046,         loss: 0.000
i: 258,         target: -0.129,         output: -0.029,         loss: 0.010
i: 259,         target: -0.156,         output: -0.052,         loss: 0.011
i: 260,         target: -0.135,         output: -0.026,         loss: 0.012
i: 261,         target: -0.050,         output: 0.002,          loss: 0.003
i: 262,         target: -0.077,         output: -0.017,         loss: 0.004
i: 263,         target: -0.111,         output: -0.044,         loss: 0.004
i: 264,         target: -0.074,         output: -0.063,         loss: 0.000
i: 265,         target: -0.283,         output: -0.044,         loss: 0.057
i: 266,         target: -0.093,         output: -0.030,         loss: 0.004
i: 267,         target: -0.048,         output: -0.005,         loss: 0.002
i: 268,         target: -0.074,         output: -0.028,         loss: 0.002
i: 269,         target: -0.088,         output: -0.037,         loss: 0.003
i: 270,         target: -0.082,         output: -0.036,         loss: 0.002
i: 271,         target: -0.110,         output: -0.035,         loss: 0.006
i: 272,         target: 0.898,          output: 0.012,          loss: 0.785
i: 273,         target: -0.116,         output: -0.042,         loss: 0.005
i: 274,         target: -0.060,         output: -0.033,         loss: 0.001
i: 275,         target: -0.145,         output: -0.052,         loss: 0.009
i: 276,         target: -0.157,         output: -0.025,         loss: 0.017
i: 277,         target: -0.237,         output: -0.043,         loss: 0.038
i: 278,         target: -0.018,         output: -0.043,         loss: 0.001
i: 279,         target: -0.062,         output: -0.037,         loss: 0.001
i: 280,         target: -0.019,         output: -0.024,         loss: 0.000
i: 281,         target: -0.037,         output: -0.036,         loss: 0.000
i: 282,         target: -0.059,         output: -0.029,         loss: 0.001
i: 283,         target: -0.140,         output: -0.035,         loss: 0.011
i: 284,         target: -0.222,         output: -0.013,         loss: 0.044
i: 285,         target: -0.046,         output: -0.026,         loss: 0.000
i: 286,         target: -0.046,         output: -0.035,         loss: 0.000
i: 287,         target: -0.103,         output: -0.029,         loss: 0.005
i: 288,         target: -0.094,         output: -0.049,         loss: 0.002
i: 289,         target: -0.022,         output: -0.058,         loss: 0.001
i: 290,         target: -0.112,         output: -0.021,         loss: 0.008
i: 291,         target: -0.219,         output: -0.025,         loss: 0.038
i: 292,         target: -0.070,         output: -0.032,         loss: 0.001
i: 293,         target: -0.098,         output: -0.019,         loss: 0.006
i: 294,         target: -0.069,         output: -0.049,         loss: 0.000
```

```
i: 295,         target: -0.067,         output: -0.025,         loss: 0.002
i: 296,         target: -0.040,         output: -0.032,         loss: 0.000
i: 297,         target: -0.024,         output: -0.021,         loss: 0.000
i: 298,         target: -0.078,         output: -0.046,         loss: 0.001
i: 299,         target: -0.063,         output: -0.060,         loss: 0.000
i: 300,         target: -0.131,         output: -0.033,         loss: 0.010
i: 301,         target: -0.163,         output: -0.062,         loss: 0.010
i: 302,         target: -0.189,         output: -0.058,         loss: 0.017
i: 303,         target: -0.239,         output: -0.029,         loss: 0.044
i: 304,         target: -0.100,         output: -0.056,         loss: 0.002
i: 305,         target: -0.066,         output: -0.035,         loss: 0.001
i: 306,         target: -0.087,         output: -0.017,         loss: 0.005
i: 307,         target: -0.102,         output: -0.029,         loss: 0.005
i: 308,         target: -0.080,         output: -0.045,         loss: 0.001
i: 309,         target: -0.060,         output: -0.032,         loss: 0.001
i: 310,         target: 0.854,          output: 0.012,          loss: 0.709
i: 311,         target: -0.152,         output: -0.042,         loss: 0.012
i: 312,         target: -0.073,         output: -0.027,         loss: 0.002
i: 313,         target: -0.061,         output: -0.032,         loss: 0.001
i: 314,         target: -0.074,         output: -0.023,         loss: 0.003
i: 315,         target: -0.060,         output: -0.043,         loss: 0.000
i: 316,         target: -0.116,         output: -0.047,         loss: 0.005
i: 317,         target: -0.093,         output: -0.039,         loss: 0.003
i: 318,         target: -0.063,         output: -0.020,         loss: 0.002
i: 319,         target: -0.061,         output: -0.006,         loss: 0.003
i: 320,         target: -0.109,         output: -0.060,         loss: 0.002
i: 321,         target: -0.160,         output: -0.029,         loss: 0.017
i: 322,         target: -0.050,         output: -0.036,         loss: 0.000
i: 323,         target: -0.144,         output: -0.034,         loss: 0.012
i: 324,         target: 0.060,          output: -0.028,         loss: 0.008
i: 325,         target: -0.147,         output: -0.033,         loss: 0.013
i: 326,         target: -0.052,         output: -0.039,         loss: 0.000
i: 327,         target: -0.164,         output: -0.037,         loss: 0.016
i: 328,         target: -0.111,         output: -0.041,         loss: 0.005
i: 329,         target: -0.171,         output: -0.018,         loss: 0.023
i: 330,         target: -0.164,         output: -0.053,         loss: 0.012
i: 331,         target: -0.152,         output: -0.019,         loss: 0.018
i: 332,         target: -0.190,         output: -0.051,         loss: 0.019
i: 333,         target: -0.040,         output: -0.035,         loss: 0.000
i: 334,         target: -0.154,         output: -0.056,         loss: 0.010
i: 335,         target: -0.068,         output: -0.042,         loss: 0.001
i: 336,         target: -0.159,         output: -0.051,         loss: 0.012
i: 337,         target: -0.059,         output: -0.028,         loss: 0.001
i: 338,         target: -0.079,         output: -0.023,         loss: 0.003
i: 339,         target: -0.213,         output: -0.024,         loss: 0.036
i: 340,         target: 0.996,          output: 0.002,          loss: 0.988
i: 341,         target: -0.160,         output: -0.028,         loss: 0.017
i: 342,         target: -0.039,         output: -0.018,         loss: 0.000
```

```
i: 343,         target: -0.142,         output: -0.027,         loss: 0.013
i: 344,         target: -0.069,         output: -0.016,         loss: 0.003
i: 345,         target: -0.083,         output: -0.038,         loss: 0.002
i: 346,         target: -0.159,         output: -0.023,         loss: 0.019
i: 347,         target: -0.046,         output: -0.026,         loss: 0.000
i: 348,         target: -0.150,         output: -0.034,         loss: 0.013
i: 349,         target: -0.207,         output: -0.032,         loss: 0.030
i: 350,         target: -0.068,         output: -0.028,         loss: 0.002
i: 351,         target: -0.107,         output: -0.055,         loss: 0.003
i: 352,         target: -0.115,         output: -0.040,         loss: 0.006
i: 353,         target: 0.014,          output: -0.033,         loss: 0.002
i: 354,         target: -0.146,         output: -0.047,         loss: 0.010
i: 355,         target: -0.053,         output: -0.041,         loss: 0.000
i: 356,         target: -0.078,         output: -0.012,         loss: 0.004
i: 357,         target: -0.080,         output: -0.029,         loss: 0.003
i: 358,         target: -0.082,         output: -0.033,         loss: 0.002
i: 359,         target: -0.084,         output: -0.067,         loss: 0.000
i: 360,         target: -0.048,         output: -0.054,         loss: 0.000
i: 361,         target: -0.072,         output: -0.055,         loss: 0.000
i: 362,         target: -0.140,         output: -0.042,         loss: 0.009
i: 363,         target: -0.129,         output: -0.007,         loss: 0.015
i: 364,         target: -0.107,         output: -0.052,         loss: 0.003
i: 365,         target: -0.129,         output: -0.051,         loss: 0.006
i: 366,         target: -0.167,         output: -0.030,         loss: 0.019
i: 367,         target: -0.148,         output: -0.035,         loss: 0.013
i: 368,         target: -0.135,         output: -0.032,         loss: 0.011
i: 369,         target: -0.134,         output: -0.023,         loss: 0.012
i: 370,         target: -0.114,         output: -0.032,         loss: 0.007
i: 371,         target: 0.921,          output: 0.014,          loss: 0.822
i: 372,         target: -0.129,         output: -0.043,         loss: 0.007
i: 373,         target: -0.054,         output: -0.034,         loss: 0.000
i: 374,         target: -0.061,         output: -0.042,         loss: 0.000
i: 375,         target: 0.841,          output: -0.004,         loss: 0.714
i: 376,         target: -0.067,         output: -0.029,         loss: 0.001
i: 377,         target: 0.929,          output: -0.004,         loss: 0.872
i: 378,         target: -0.080,         output: -0.019,         loss: 0.004
i: 379,         target: -0.096,         output: -0.033,         loss: 0.004
i: 380,         target: -0.205,         output: -0.039,         loss: 0.028
i: 381,         target: -0.134,         output: -0.045,         loss: 0.008
i: 382,         target: -0.088,         output: -0.054,         loss: 0.001
i: 383,         target: -0.090,         output: -0.033,         loss: 0.003
i: 384,         target: -0.058,         output: -0.026,         loss: 0.001
i: 385,         target: -0.073,         output: -0.046,         loss: 0.001
i: 386,         target: -0.076,         output: -0.045,         loss: 0.001
i: 387,         target: -0.016,         output: -0.005,         loss: 0.000
i: 388,         target: -0.221,         output: -0.059,         loss: 0.026
i: 389,         target: -0.124,         output: -0.034,         loss: 0.008
i: 390,         target: -0.164,         output: -0.059,         loss: 0.011
```

```
i: 391,         target: -0.047,         output: -0.041,         loss: 0.000
i: 392,         target: 0.030,          output: -0.017,         loss: 0.002
i: 393,         target: -0.102,         output: -0.042,         loss: 0.004
i: 394,         target: 0.062,          output: -0.019,         loss: 0.007
i: 395,         target: -0.145,         output: -0.045,         loss: 0.010
i: 396,         target: -0.272,         output: -0.052,         loss: 0.049
i: 397,         target: -0.168,         output: -0.037,         loss: 0.017
i: 398,         target: -0.179,         output: -0.034,         loss: 0.021
i: 399,         target: -0.047,         output: -0.046,         loss: 0.000
i: 400,         target: -0.034,         output: -0.046,         loss: 0.000
i: 401,         target: -0.073,         output: -0.035,         loss: 0.001
i: 402,         target: -0.098,         output: -0.052,         loss: 0.002
i: 403,         target: -0.082,         output: -0.026,         loss: 0.003
i: 404,         target: -0.129,         output: -0.044,         loss: 0.007
i: 405,         target: 0.061,          output: -0.021,         loss: 0.007
i: 406,         target: -0.152,         output: -0.017,         loss: 0.018
i: 407,         target: -0.210,         output: -0.042,         loss: 0.028
i: 408,         target: -0.097,         output: -0.044,         loss: 0.003
i: 409,         target: -0.200,         output: -0.055,         loss: 0.021
i: 410,         target: -0.128,         output: -0.037,         loss: 0.008
i: 411,         target: 0.051,          output: -0.017,         loss: 0.005
i: 412,         target: -0.079,         output: -0.020,         loss: 0.003
i: 413,         target: -0.076,         output: -0.031,         loss: 0.002
i: 414,         target: -0.137,         output: -0.042,         loss: 0.009
i: 415,         target: -0.074,         output: -0.032,         loss: 0.002
i: 416,         target: -0.137,         output: -0.033,         loss: 0.011
i: 417,         target: -0.120,         output: -0.046,         loss: 0.005
i: 418,         target: -0.046,         output: -0.028,         loss: 0.000
i: 419,         target: -0.054,         output: -0.035,         loss: 0.000
i: 420,         target: -0.093,         output: -0.057,         loss: 0.001
i: 421,         target: -0.056,         output: -0.033,         loss: 0.001
i: 422,         target: -0.105,         output: -0.007,         loss: 0.010
i: 423,         target: -0.160,         output: -0.041,         loss: 0.014
i: 424,         target: -0.187,         output: -0.028,         loss: 0.025
i: 425,         target: -0.129,         output: -0.030,         loss: 0.010
i: 426,         target: -0.109,         output: -0.037,         loss: 0.005
i: 427,         target: -0.060,         output: -0.019,         loss: 0.002
i: 428,         target: -0.124,         output: -0.034,         loss: 0.008
i: 429,         target: -0.135,         output: -0.043,         loss: 0.008
i: 430,         target: 0.948,          output: -0.005,         loss: 0.908
i: 431,         target: -0.129,         output: -0.039,         loss: 0.008
i: 432,         target: -0.116,         output: -0.043,         loss: 0.005
i: 433,         target: -0.092,         output: -0.045,         loss: 0.002
i: 434,         target: -0.054,         output: -0.028,         loss: 0.001
i: 435,         target: -0.206,         output: -0.051,         loss: 0.024
i: 436,         target: -0.043,         output: -0.020,         loss: 0.001
i: 437,         target: -0.151,         output: -0.034,         loss: 0.014
i: 438,         target: -0.243,         output: -0.030,         loss: 0.046
```

```
i: 439,         target: -0.063,         output: -0.022,         loss: 0.002
i: 440,         target: -0.112,         output: -0.045,         loss: 0.005
i: 441,         target: -0.108,         output: -0.035,         loss: 0.005
i: 442,         target: -0.069,         output: -0.016,         loss: 0.003
i: 443,         target: -0.069,         output: -0.053,         loss: 0.000
i: 444,         target: -0.183,         output: -0.036,         loss: 0.022
i: 445,         target: -0.108,         output: -0.038,         loss: 0.005
i: 446,         target: -0.178,         output: -0.043,         loss: 0.018
i: 447,         target: -0.123,         output: -0.051,         loss: 0.005
i: 448,         target: -0.087,         output: -0.036,         loss: 0.003
i: 449,         target: -0.072,         output: -0.047,         loss: 0.001
i: 450,         target: -0.125,         output: -0.050,         loss: 0.006
i: 451,         target: -0.120,         output: -0.069,         loss: 0.003
i: 452,         target: -0.171,         output: -0.050,         loss: 0.015
i: 453,         target: -0.271,         output: -0.044,         loss: 0.052
i: 454,         target: -0.199,         output: -0.028,         loss: 0.029
i: 455,         target: -0.062,         output: -0.037,         loss: 0.001
i: 456,         target: -0.129,         output: -0.029,         loss: 0.010
i: 457,         target: -0.135,         output: -0.015,         loss: 0.014
i: 458,         target: -0.091,         output: -0.043,         loss: 0.002
i: 459,         target: -0.153,         output: -0.042,         loss: 0.012
i: 460,         target: -0.181,         output: -0.056,         loss: 0.015
i: 461,         target: -0.164,         output: -0.056,         loss: 0.012
i: 462,         target: -0.075,         output: -0.029,         loss: 0.002
i: 463,         target: -0.138,         output: -0.022,         loss: 0.013
i: 464,         target: -0.057,         output: -0.032,         loss: 0.001
i: 465,         target: -0.070,         output: -0.015,         loss: 0.003
i: 466,         target: -0.142,         output: -0.043,         loss: 0.010
i: 467,         target: -0.243,         output: -0.059,         loss: 0.034
i: 468,         target: -0.064,         output: -0.034,         loss: 0.001
i: 469,         target: -0.127,         output: -0.065,         loss: 0.004
i: 470,         target: -0.115,         output: -0.050,         loss: 0.004
i: 471,         target: -0.096,         output: -0.030,         loss: 0.004
i: 472,         target: -0.206,         output: -0.063,         loss: 0.021
i: 473,         target: -0.051,         output: -0.049,         loss: 0.000
i: 474,         target: -0.087,         output: -0.022,         loss: 0.004
i: 475,         target: 0.907,          output: 0.008,          loss: 0.807
i: 476,         target: -0.052,         output: -0.029,         loss: 0.001
i: 477,         target: -0.141,         output: -0.029,         loss: 0.013
i: 478,         target: -0.054,         output: -0.053,         loss: 0.000
i: 479,         target: -0.086,         output: -0.043,         loss: 0.002
i: 480,         target: -0.128,         output: -0.054,         loss: 0.005
i: 481,         target: -0.044,         output: -0.053,         loss: 0.000
i: 482,         target: 0.037,          output: -0.017,         loss: 0.003
i: 483,         target: -0.083,         output: -0.025,         loss: 0.003
i: 484,         target: -0.067,         output: -0.026,         loss: 0.002
i: 485,         target: -0.085,         output: -0.043,         loss: 0.002
i: 486,         target: -0.187,         output: -0.027,         loss: 0.025
```

```
i: 487,         target: -0.091,         output: -0.034,         loss: 0.003
i: 488,         target: -0.209,         output: -0.006,         loss: 0.041
i: 489,         target: -0.098,         output: -0.033,         loss: 0.004
i: 490,         target: -0.101,         output: -0.032,         loss: 0.005
i: 491,         target: -0.104,         output: -0.049,         loss: 0.003
i: 492,         target: -0.091,         output: -0.019,         loss: 0.005
i: 493,         target: -0.060,         output: -0.025,         loss: 0.001
i: 494,         target: -0.113,         output: -0.031,         loss: 0.007
i: 495,         target: -0.048,         output: -0.054,         loss: 0.000
i: 496,         target: 0.051,          output: -0.020,         loss: 0.005
i: 497,         target: -0.075,         output: -0.018,         loss: 0.003
i: 498,         target: -0.178,         output: -0.050,         loss: 0.016
i: 499,         target: -0.037,         output: -0.028,         loss: 0.000
i: 500,         target: -0.101,         output: -0.036,         loss: 0.004
i: 501,         target: -0.080,         output: -0.014,         loss: 0.004
i: 502,         target: -0.090,         output: -0.044,         loss: 0.002
i: 503,         target: -0.087,         output: -0.027,         loss: 0.004
i: 504,         target: -0.139,         output: -0.038,         loss: 0.010
i: 505,         target: -0.102,         output: -0.051,         loss: 0.003
i: 506,         target: 0.914,          output: 0.023,          loss: 0.795
i: 507,         target: -0.132,         output: -0.016,         loss: 0.013
i: 508,         target: -0.149,         output: -0.045,         loss: 0.011
i: 509,         target: -0.111,         output: -0.031,         loss: 0.006
i: 510,         target: -0.210,         output: -0.040,         loss: 0.029
i: 511,         target: -0.246,         output: -0.056,         loss: 0.036
i: 512,         target: 0.948,          output: 0.006,          loss: 0.887
i: 513,         target: -0.147,         output: -0.043,         loss: 0.011
i: 514,         target: -0.179,         output: -0.064,         loss: 0.013
i: 515,         target: -0.223,         output: -0.029,         loss: 0.037
i: 516,         target: -0.089,         output: -0.015,         loss: 0.006
i: 517,         target: 0.968,          output: 0.011,          loss: 0.915
i: 518,         target: -0.099,         output: -0.026,         loss: 0.005
i: 519,         target: -0.144,         output: -0.034,         loss: 0.012
i: 520,         target: -0.134,         output: -0.054,         loss: 0.006
i: 521,         target: -0.137,         output: -0.052,         loss: 0.007
i: 522,         target: -0.108,         output: -0.028,         loss: 0.006
i: 523,         target: -0.131,         output: -0.051,         loss: 0.006
i: 524,         target: -0.044,         output: -0.035,         loss: 0.000
i: 525,         target: -0.136,         output: -0.049,         loss: 0.008
i: 526,         target: -0.113,         output: -0.048,         loss: 0.004
i: 527,         target: -0.060,         output: -0.015,         loss: 0.002
i: 528,         target: -0.158,         output: -0.036,         loss: 0.015
i: 529,         target: 0.937,          output: 0.018,          loss: 0.845
i: 530,         target: -0.049,         output: -0.044,         loss: 0.000
i: 531,         target: -0.178,         output: -0.053,         loss: 0.016
i: 532,         target: -0.097,         output: -0.040,         loss: 0.003
i: 533,         target: -0.189,         output: -0.073,         loss: 0.014
i: 534,         target: -0.044,         output: -0.012,         loss: 0.001
```

```
i: 535,         target: -0.106,         output: -0.021,         loss: 0.007
i: 536,         target: -0.040,         output: -0.020,         loss: 0.000
i: 537,         target: -0.082,         output: -0.031,         loss: 0.003
i: 538,         target: -0.085,         output: -0.043,         loss: 0.002
i: 539,         target: -0.089,         output: -0.023,         loss: 0.004
i: 540,         target: -0.140,         output: 0.008,          loss: 0.022
i: 541,         target: -0.061,         output: -0.051,         loss: 0.000
i: 542,         target: -0.001,         output: -0.033,         loss: 0.001
i: 543,         target: -0.100,         output: -0.056,         loss: 0.002
i: 544,         target: -0.071,         output: -0.028,         loss: 0.002
i: 545,         target: -0.124,         output: -0.030,         loss: 0.009
i: 546,         target: -0.136,         output: -0.025,         loss: 0.012
i: 547,         target: -0.144,         output: -0.041,         loss: 0.011
i: 548,         target: -0.012,         output: -0.028,         loss: 0.000
i: 549,         target: -0.138,         output: -0.051,         loss: 0.008
i: 550,         target: -0.100,         output: -0.052,         loss: 0.002
i: 551,         target: -0.155,         output: -0.060,         loss: 0.009
i: 552,         target: -0.089,         output: -0.036,         loss: 0.003
i: 553,         target: -0.141,         output: -0.039,         loss: 0.010
i: 554,         target: -0.060,         output: -0.057,         loss: 0.000
i: 555,         target: -0.270,         output: -0.039,         loss: 0.053
i: 556,         target: -0.042,         output: -0.039,         loss: 0.000
i: 557,         target: -0.042,         output: -0.023,         loss: 0.000
i: 558,         target: -0.057,         output: -0.025,         loss: 0.001
i: 559,         target: -0.036,         output: -0.029,         loss: 0.000
i: 560,         target: -0.117,         output: -0.027,         loss: 0.008
i: 561,         target: -0.078,         output: -0.043,         loss: 0.001
i: 562,         target: -0.032,         output: -0.017,         loss: 0.000
i: 563,         target: -0.110,         output: -0.045,         loss: 0.004
i: 564,         target: -0.071,         output: -0.040,         loss: 0.001
i: 565,         target: -0.108,         output: -0.015,         loss: 0.009
i: 566,         target: -0.062,         output: -0.038,         loss: 0.001
i: 567,         target: -0.086,         output: -0.047,         loss: 0.002
i: 568,         target: -0.048,         output: -0.009,         loss: 0.002
i: 569,         target: 0.961,          output: 0.017,          loss: 0.892
i: 570,         target: -0.131,         output: -0.021,         loss: 0.012
i: 571,         target: -0.070,         output: -0.056,         loss: 0.000
i: 572,         target: -0.113,         output: -0.032,         loss: 0.007
i: 573,         target: -0.124,         output: -0.021,         loss: 0.011
i: 574,         target: -0.114,         output: -0.045,         loss: 0.005
i: 575,         target: -0.049,         output: -0.043,         loss: 0.000
i: 576,         target: -0.140,         output: -0.029,         loss: 0.012
i: 577,         target: 0.091,          output: -0.028,         loss: 0.014
i: 578,         target: -0.048,         output: -0.029,         loss: 0.000
i: 579,         target: -0.094,         output: -0.045,         loss: 0.002
i: 580,         target: 0.944,          output: -0.001,         loss: 0.893
i: 581,         target: -0.083,         output: -0.025,         loss: 0.003
i: 582,         target: -0.085,         output: -0.052,         loss: 0.001
```

```
i: 583,         target: 0.972,         output: 0.017,         loss: 0.911
i: 584,         target: -0.066,        output: -0.026,        loss: 0.002
i: 585,         target: -0.052,        output: -0.003,        loss: 0.002
i: 586,         target: -0.036,        output: -0.062,        loss: 0.001
i: 587,         target: -0.131,        output: -0.060,        loss: 0.005
i: 588,         target: -0.206,        output: -0.023,        loss: 0.033
i: 589,         target: -0.043,        output: -0.033,        loss: 0.000
i: 590,         target: -0.196,        output: -0.050,        loss: 0.021
i: 591,         target: -0.131,        output: -0.032,        loss: 0.010
i: 592,         target: -0.112,        output: -0.052,        loss: 0.004
i: 593,         target: -0.125,        output: -0.043,        loss: 0.007
i: 594,         target: -0.049,        output: -0.023,        loss: 0.001
i: 595,         target: -0.068,        output: -0.058,        loss: 0.000
i: 596,         target: -0.212,        output: -0.060,        loss: 0.023
i: 597,         target: -0.204,        output: -0.052,        loss: 0.023
i: 598,         target: -0.129,        output: -0.039,        loss: 0.008
i: 599,         target: -0.126,        output: -0.040,        loss: 0.007
i: 600,         target: -0.134,        output: -0.035,        loss: 0.010
i: 601,         target: -0.065,        output: -0.040,        loss: 0.001
i: 602,         target: -0.056,        output: -0.042,        loss: 0.000
i: 603,         target: 0.888,         output: -0.006,        loss: 0.799
i: 604,         target: -0.062,        output: -0.021,        loss: 0.002
i: 605,         target: -0.094,        output: -0.038,        loss: 0.003
i: 606,         target: -0.074,        output: -0.046,        loss: 0.001
i: 607,         target: -0.122,        output: -0.037,        loss: 0.007
i: 608,         target: 0.966,         output: -0.000,        loss: 0.934
i: 609,         target: -0.171,        output: -0.038,        loss: 0.017
i: 610,         target: -0.070,        output: -0.020,        loss: 0.002
i: 611,         target: -0.101,        output: -0.063,        loss: 0.001
i: 612,         target: -0.207,        output: -0.032,        loss: 0.031
i: 613,         target: -0.127,        output: -0.019,        loss: 0.012
i: 614,         target: -0.073,        output: -0.027,        loss: 0.002
i: 615,         target: -0.160,        output: -0.039,        loss: 0.015
i: 616,         target: -0.177,        output: -0.035,        loss: 0.020
i: 617,         target: -0.169,        output: -0.048,        loss: 0.014
i: 618,         target: 0.921,         output: -0.005,        loss: 0.859
i: 619,         target: -0.094,        output: -0.009,        loss: 0.007
i: 620,         target: -0.049,        output: -0.035,        loss: 0.000
i: 621,         target: -0.137,        output: -0.043,        loss: 0.009
i: 622,         target: -0.214,        output: -0.059,        loss: 0.024
i: 623,         target: -0.051,        output: -0.053,        loss: 0.000
i: 624,         target: -0.027,        output: -0.020,        loss: 0.000
i: 625,         target: 0.048,         output: -0.028,        loss: 0.006
i: 626,         target: -0.072,        output: -0.020,        loss: 0.003
i: 627,         target: -0.134,        output: -0.022,        loss: 0.013
i: 628,         target: -0.083,        output: -0.051,        loss: 0.001
i: 629,         target: -0.048,        output: -0.030,        loss: 0.000
i: 630,         target: -0.137,        output: -0.029,        loss: 0.012
```

```
i: 631,         target: -0.157,         output: -0.021,         loss: 0.018
i: 632,         target: -0.048,         output: -0.025,         loss: 0.001
i: 633,         target: -0.089,         output: -0.030,         loss: 0.003
i: 634,         target: -0.116,         output: -0.036,         loss: 0.007
i: 635,         target: 0.920,          output: 0.002,          loss: 0.843
i: 636,         target: -0.065,         output: -0.058,         loss: 0.000
i: 637,         target: -0.135,         output: -0.043,         loss: 0.008
i: 638,         target: -0.085,         output: -0.055,         loss: 0.001
i: 639,         target: -0.081,         output: -0.013,         loss: 0.005
i: 640,         target: -0.062,         output: -0.020,         loss: 0.002
i: 641,         target: 0.952,          output: 0.016,          loss: 0.876
i: 642,         target: -0.088,         output: -0.037,         loss: 0.003
i: 643,         target: -0.023,         output: -0.010,         loss: 0.000
i: 644,         target: -0.150,         output: -0.053,         loss: 0.009
i: 645,         target: -0.109,         output: -0.047,         loss: 0.004
i: 646,         target: -0.129,         output: -0.020,         loss: 0.012
i: 647,         target: 0.974,          output: -0.001,         loss: 0.951
i: 648,         target: -0.048,         output: -0.028,         loss: 0.000
i: 649,         target: -0.058,         output: -0.024,         loss: 0.001
i: 650,         target: -0.126,         output: -0.039,         loss: 0.008
i: 651,         target: 0.880,          output: 0.007,          loss: 0.762
i: 652,         target: -0.152,         output: -0.049,         loss: 0.011
i: 653,         target: 0.095,          output: -0.023,         loss: 0.014
i: 654,         target: -0.186,         output: -0.061,         loss: 0.015
i: 655,         target: -0.026,         output: -0.013,         loss: 0.000
i: 656,         target: -0.133,         output: -0.035,         loss: 0.010
i: 657,         target: -0.089,         output: -0.063,         loss: 0.001
i: 658,         target: -0.055,         output: -0.042,         loss: 0.000
i: 659,         target: -0.194,         output: -0.061,         loss: 0.018
i: 660,         target: -0.074,         output: -0.039,         loss: 0.001
i: 661,         target: -0.087,         output: -0.019,         loss: 0.005
i: 662,         target: -0.070,         output: -0.043,         loss: 0.001
i: 663,         target: -0.037,         output: -0.032,         loss: 0.000
i: 664,         target: -0.178,         output: -0.034,         loss: 0.021
i: 665,         target: -0.154,         output: -0.037,         loss: 0.014
i: 666,         target: -0.050,         output: -0.045,         loss: 0.000
i: 667,         target: -0.047,         output: -0.035,         loss: 0.000
i: 668,         target: -0.091,         output: -0.027,         loss: 0.004
i: 669,         target: -0.044,         output: -0.034,         loss: 0.000
i: 670,         target: -0.084,         output: -0.042,         loss: 0.002
i: 671,         target: -0.154,         output: -0.043,         loss: 0.012
i: 672,         target: -0.150,         output: -0.045,         loss: 0.011
i: 673,         target: -0.070,         output: -0.018,         loss: 0.003
i: 674,         target: -0.122,         output: -0.044,         loss: 0.006
i: 675,         target: -0.057,         output: -0.051,         loss: 0.000
i: 676,         target: -0.115,         output: -0.043,         loss: 0.005
i: 677,         target: -0.077,         output: -0.045,         loss: 0.001
i: 678,         target: -0.145,         output: -0.036,         loss: 0.012
```

```
i: 679,         target: -0.128,         output: -0.038,         loss: 0.008
i: 680,         target: -0.047,         output: -0.020,         loss: 0.001
i: 681,         target: -0.188,         output: -0.025,         loss: 0.027
i: 682,         target: -0.192,         output: -0.042,         loss: 0.022
i: 683,         target: -0.027,         output: -0.009,         loss: 0.000
i: 684,         target: -0.110,         output: -0.034,         loss: 0.006
i: 685,         target: -0.060,         output: -0.015,         loss: 0.002
i: 686,         target: 0.044,          output: -0.022,         loss: 0.004
i: 687,         target: -0.023,         output: -0.029,         loss: 0.000
i: 688,         target: 0.113,          output: -0.021,         loss: 0.018
i: 689,         target: -0.064,         output: -0.022,         loss: 0.002
i: 690,         target: -0.129,         output: -0.042,         loss: 0.008
i: 691,         target: -0.221,         output: -0.035,         loss: 0.035
i: 692,         target: 0.868,          output: -0.005,         loss: 0.762
i: 693,         target: 0.071,          output: -0.004,         loss: 0.006
i: 694,         target: -0.075,         output: -0.029,         loss: 0.002
i: 695,         target: -0.060,         output: -0.045,         loss: 0.000
i: 696,         target: -0.070,         output: -0.030,         loss: 0.002
i: 697,         target: -0.061,         output: -0.038,         loss: 0.001
i: 698,         target: -0.025,         output: -0.024,         loss: 0.000
i: 699,         target: -0.131,         output: -0.042,         loss: 0.008
i: 700,         target: -0.089,         output: -0.043,         loss: 0.002
i: 701,         target: -0.008,         output: -0.046,         loss: 0.001
i: 702,         target: -0.191,         output: -0.018,         loss: 0.030
i: 703,         target: -0.034,         output: -0.041,         loss: 0.000
i: 704,         target: -0.113,         output: -0.027,         loss: 0.007
i: 705,         target: -0.045,         output: -0.040,         loss: 0.000
i: 706,         target: -0.128,         output: -0.013,         loss: 0.013
i: 707,         target: -0.197,         output: -0.032,         loss: 0.028
i: 708,         target: -0.116,         output: -0.037,         loss: 0.006
i: 709,         target: -0.213,         output: -0.037,         loss: 0.031
i: 710,         target: -0.085,         output: -0.024,         loss: 0.004
i: 711,         target: -0.063,         output: -0.021,         loss: 0.002
i: 712,         target: -0.133,         output: -0.056,         loss: 0.006
i: 713,         target: -0.094,         output: -0.033,         loss: 0.004
i: 714,         target: -0.090,         output: -0.025,         loss: 0.004
i: 715,         target: 0.935,          output: 0.006,          loss: 0.863
i: 716,         target: -0.197,         output: -0.052,         loss: 0.021
i: 717,         target: -0.087,         output: -0.042,         loss: 0.002
i: 718,         target: -0.201,         output: -0.014,         loss: 0.035
i: 719,         target: -0.047,         output: -0.028,         loss: 0.000
i: 720,         target: -0.115,         output: -0.029,         loss: 0.007
i: 721,         target: 0.870,          output: -0.003,         loss: 0.762
i: 722,         target: -0.107,         output: -0.016,         loss: 0.008
i: 723,         target: -0.076,         output: -0.019,         loss: 0.003
i: 724,         target: -0.062,         output: -0.055,         loss: 0.000
i: 725,         target: -0.058,         output: -0.012,         loss: 0.002
i: 726,         target: -0.161,         output: -0.024,         loss: 0.019
```

```
i: 727,         target: -0.119,         output: -0.044,         loss: 0.006
i: 728,         target: -0.151,         output: -0.057,         loss: 0.009
i: 729,         target: -0.075,         output: -0.043,         loss: 0.001
i: 730,         target: -0.196,         output: -0.054,         loss: 0.020
i: 731,         target: -0.066,         output: -0.041,         loss: 0.001
i: 732,         target: -0.206,         output: -0.042,         loss: 0.027
i: 733,         target: -0.200,         output: -0.022,         loss: 0.032
i: 734,         target: -0.126,         output: -0.020,         loss: 0.011
i: 735,         target: -0.092,         output: -0.035,         loss: 0.003
i: 736,         target: -0.083,         output: -0.039,         loss: 0.002
i: 737,         target: -0.154,         output: -0.037,         loss: 0.014
i: 738,         target: -0.096,         output: -0.023,         loss: 0.005
i: 739,         target: -0.034,         output: -0.015,         loss: 0.000
i: 740,         target: -0.070,         output: -0.040,         loss: 0.001
i: 741,         target: -0.184,         output: -0.007,         loss: 0.031
i: 742,         target: -0.156,         output: -0.043,         loss: 0.013
i: 743,         target: -0.066,         output: -0.027,         loss: 0.002
i: 744,         target: -0.146,         output: -0.057,         loss: 0.008
i: 745,         target: -0.126,         output: -0.021,         loss: 0.011
i: 746,         target: -0.183,         output: -0.029,         loss: 0.024
i: 747,         target: -0.173,         output: -0.019,         loss: 0.024
i: 748,         target: -0.070,         output: -0.033,         loss: 0.001
i: 749,         target: -0.169,         output: -0.026,         loss: 0.020
i: 750,         target: -0.053,         output: -0.042,         loss: 0.000
i: 751,         target: -0.092,         output: -0.040,         loss: 0.003
i: 752,         target: -0.129,         output: -0.014,         loss: 0.013
i: 753,         target: 0.060,          output: -0.023,         loss: 0.007
i: 754,         target: -0.072,         output: -0.047,         loss: 0.001
i: 755,         target: -0.041,         output: -0.068,         loss: 0.001
i: 756,         target: 0.946,          output: 0.014,          loss: 0.870
i: 757,         target: -0.132,         output: -0.050,         loss: 0.007
i: 758,         target: -0.013,         output: -0.020,         loss: 0.000
i: 759,         target: -0.101,         output: -0.062,         loss: 0.002
i: 760,         target: -0.075,         output: -0.051,         loss: 0.001
i: 761,         target: -0.085,         output: -0.051,         loss: 0.001
i: 762,         target: -0.096,         output: -0.051,         loss: 0.002
i: 763,         target: -0.066,         output: -0.024,         loss: 0.002
i: 764,         target: -0.060,         output: -0.040,         loss: 0.000
i: 765,         target: -0.028,         output: -0.018,         loss: 0.000
i: 766,         target: -0.173,         output: -0.046,         loss: 0.016
i: 767,         target: -0.166,         output: -0.043,         loss: 0.015
i: 768,         target: -0.074,         output: -0.009,         loss: 0.004
i: 769,         target: -0.077,         output: -0.036,         loss: 0.002
i: 770,         target: -0.139,         output: -0.025,         loss: 0.013
i: 771,         target: -0.076,         output: -0.047,         loss: 0.001
i: 772,         target: -0.049,         output: -0.029,         loss: 0.000
i: 773,         target: -0.085,         output: -0.031,         loss: 0.003
i: 774,         target: -0.044,         output: -0.030,         loss: 0.000
```

```
i: 775,         target: -0.120,         output: -0.017,         loss: 0.011
i: 776,         target: 0.958,          output: 0.013,          loss: 0.894
i: 777,         target: -0.030,         output: -0.029,         loss: 0.000
i: 778,         target: -0.048,         output: -0.017,         loss: 0.001
i: 779,         target: 0.007,          output: -0.022,         loss: 0.001
i: 780,         target: -0.114,         output: -0.036,         loss: 0.006
i: 781,         target: -0.136,         output: -0.033,         loss: 0.011
i: 782,         target: -0.063,         output: -0.028,         loss: 0.001
i: 783,         target: -0.050,         output: -0.040,         loss: 0.000
i: 784,         target: -0.072,         output: -0.051,         loss: 0.000
i: 785,         target: -0.113,         output: -0.034,         loss: 0.006
i: 786,         target: -0.074,         output: -0.041,         loss: 0.001
i: 787,         target: 0.065,          output: 0.003,          loss: 0.004
i: 788,         target: -0.147,         output: -0.031,         loss: 0.013
i: 789,         target: -0.027,         output: -0.016,         loss: 0.000
i: 790,         target: -0.079,         output: -0.040,         loss: 0.002
i: 791,         target: -0.056,         output: -0.023,         loss: 0.001
i: 792,         target: -0.081,         output: -0.057,         loss: 0.001
i: 793,         target: -0.120,         output: -0.033,         loss: 0.008
i: 794,         target: -0.135,         output: -0.049,         loss: 0.007
i: 795,         target: -0.181,         output: -0.050,         loss: 0.017
i: 796,         target: -0.108,         output: -0.024,         loss: 0.007
i: 797,         target: -0.065,         output: -0.031,         loss: 0.001
i: 798,         target: -0.063,         output: -0.004,         loss: 0.003
i: 799,         target: -0.079,         output: -0.022,         loss: 0.003
i: 800,         target: -0.080,         output: -0.045,         loss: 0.001
i: 801,         target: -0.078,         output: -0.036,         loss: 0.002
i: 802,         target: -0.232,         output: -0.023,         loss: 0.043
i: 803,         target: -0.146,         output: -0.056,         loss: 0.008
i: 804,         target: -0.099,         output: -0.023,         loss: 0.006
i: 805,         target: 0.024,          output: -0.027,         loss: 0.003
i: 806,         target: -0.046,         output: -0.057,         loss: 0.000
i: 807,         target: -0.070,         output: -0.023,         loss: 0.002
i: 808,         target: -0.065,         output: -0.049,         loss: 0.000
i: 809,         target: -0.066,         output: -0.017,         loss: 0.002
i: 810,         target: -0.164,         output: -0.036,         loss: 0.016
i: 811,         target: -0.262,         output: -0.019,         loss: 0.059
i: 812,         target: -0.193,         output: -0.036,         loss: 0.025
i: 813,         target: 0.017,          output: -0.038,         loss: 0.003
i: 814,         target: -0.066,         output: -0.009,         loss: 0.003
i: 815,         target: -0.116,         output: -0.055,         loss: 0.004
i: 816,         target: -0.044,         output: -0.025,         loss: 0.000
i: 817,         target: -0.211,         output: -0.036,         loss: 0.031
i: 818,         target: -0.101,         output: -0.051,         loss: 0.002
i: 819,         target: -0.143,         output: -0.049,         loss: 0.009
i: 820,         target: -0.206,         output: -0.053,         loss: 0.023
i: 821,         target: -0.175,         output: -0.043,         loss: 0.017
i: 822,         target: -0.069,         output: -0.018,         loss: 0.003
```

```
i: 823,         target: -0.051,         output: -0.049,         loss: 0.000
i: 824,         target: 0.060,          output: -0.016,         loss: 0.006
i: 825,         target: -0.123,         output: -0.052,         loss: 0.005
i: 826,         target: -0.067,         output: -0.023,         loss: 0.002
i: 827,         target: 0.829,          output: 0.008,          loss: 0.675
i: 828,         target: -0.204,         output: -0.037,         loss: 0.028
i: 829,         target: -0.083,         output: -0.007,         loss: 0.006
i: 830,         target: 0.047,          output: -0.017,         loss: 0.004
i: 831,         target: -0.142,         output: -0.048,         loss: 0.009
i: 832,         target: -0.022,         output: -0.024,         loss: 0.000
i: 833,         target: -0.146,         output: -0.041,         loss: 0.011
i: 834,         target: 0.023,          output: -0.041,         loss: 0.004
i: 835,         target: -0.112,         output: -0.047,         loss: 0.004
i: 836,         target: -0.047,         output: -0.045,         loss: 0.000
i: 837,         target: -0.200,         output: -0.032,         loss: 0.028
i: 838,         target: -0.126,         output: -0.051,         loss: 0.006
i: 839,         target: -0.070,         output: -0.031,         loss: 0.002
i: 840,         target: -0.173,         output: -0.049,         loss: 0.016
i: 841,         target: -0.099,         output: -0.033,         loss: 0.004
i: 842,         target: -0.079,         output: -0.048,         loss: 0.001
i: 843,         target: -0.178,         output: -0.047,         loss: 0.017
i: 844,         target: -0.066,         output: -0.053,         loss: 0.000
i: 845,         target: 0.004,          output: -0.028,         loss: 0.001
i: 846,         target: -0.167,         output: -0.059,         loss: 0.012
i: 847,         target: -0.078,         output: -0.007,         loss: 0.005
i: 848,         target: -0.060,         output: -0.027,         loss: 0.001
i: 849,         target: -0.076,         output: -0.060,         loss: 0.000
i: 850,         target: -0.066,         output: -0.036,         loss: 0.001
i: 851,         target: -0.102,         output: -0.011,         loss: 0.008
i: 852,         target: -0.160,         output: -0.042,         loss: 0.014
i: 853,         target: -0.073,         output: -0.028,         loss: 0.002
i: 854,         target: 0.045,          output: -0.058,         loss: 0.011
i: 855,         target: -0.089,         output: -0.036,         loss: 0.003
i: 856,         target: -0.049,         output: -0.029,         loss: 0.000
i: 857,         target: -0.133,         output: -0.072,         loss: 0.004
i: 858,         target: -0.017,         output: -0.029,         loss: 0.000
i: 859,         target: -0.120,         output: -0.041,         loss: 0.006
i: 860,         target: -0.090,         output: -0.050,         loss: 0.002
i: 861,         target: -0.057,         output: -0.032,         loss: 0.001
i: 862,         target: -0.102,         output: -0.028,         loss: 0.005
i: 863,         target: -0.044,         output: -0.026,         loss: 0.000
i: 864,         target: -0.046,         output: 0.004,          loss: 0.002
i: 865,         target: -0.135,         output: -0.051,         loss: 0.007
i: 866,         target: -0.035,         output: -0.030,         loss: 0.000
i: 867,         target: -0.038,         output: -0.023,         loss: 0.000
i: 868,         target: -0.195,         output: -0.026,         loss: 0.028
i: 869,         target: -0.061,         output: -0.033,         loss: 0.001
i: 870,         target: -0.045,         output: -0.027,         loss: 0.000
```

```
i: 871,         target: 0.033,         output: -0.044,         loss: 0.006
i: 872,         target: -0.066,        output: -0.034,         loss: 0.001
i: 873,         target: -0.129,        output: 0.002,          loss: 0.017
i: 874,         target: -0.034,        output: -0.063,         loss: 0.001
i: 875,         target: -0.106,        output: -0.037,         loss: 0.005
i: 876,         target: -0.114,        output: -0.037,         loss: 0.006
i: 877,         target: -0.066,        output: -0.042,         loss: 0.001
i: 878,         target: -0.021,        output: -0.028,         loss: 0.000
i: 879,         target: -0.109,        output: -0.049,         loss: 0.004
i: 880,         target: -0.210,        output: -0.049,         loss: 0.026
i: 881,         target: -0.079,        output: -0.046,         loss: 0.001
i: 882,         target: -0.112,        output: -0.027,         loss: 0.007
i: 883,         target: -0.099,        output: -0.014,         loss: 0.007
i: 884,         target: -0.190,        output: -0.027,         loss: 0.027
i: 885,         target: -0.063,        output: -0.042,         loss: 0.000
i: 886,         target: -0.082,        output: -0.020,         loss: 0.004
i: 887,         target: -0.119,        output: -0.053,         loss: 0.004
i: 888,         target: -0.168,        output: 0.009,          loss: 0.031
i: 889,         target: -0.191,        output: -0.025,         loss: 0.028
i: 890,         target: -0.056,        output: -0.038,         loss: 0.000
i: 891,         target: -0.195,        output: -0.051,         loss: 0.021
i: 892,         target: -0.070,        output: -0.022,         loss: 0.002
i: 893,         target: -0.065,        output: -0.032,         loss: 0.001
i: 894,         target: -0.060,        output: -0.024,         loss: 0.001
i: 895,         target: -0.155,        output: -0.049,         loss: 0.011
i: 896,         target: 0.039,         output: -0.022,         loss: 0.004
i: 897,         target: -0.129,        output: -0.006,         loss: 0.015
i: 898,         target: -0.223,        output: -0.052,         loss: 0.029
i: 899,         target: -0.058,        output: -0.018,         loss: 0.002
i: 900,         target: -0.149,        output: -0.032,         loss: 0.014
i: 901,         target: -0.087,        output: -0.040,         loss: 0.002
i: 902,         target: 0.963,         output: -0.002,         loss: 0.930
i: 903,         target: -0.192,        output: -0.067,         loss: 0.016
i: 904,         target: -0.104,        output: -0.035,         loss: 0.005
i: 905,         target: -0.048,        output: -0.029,         loss: 0.000
i: 906,         target: -0.082,        output: -0.020,         loss: 0.004
i: 907,         target: -0.101,        output: -0.042,         loss: 0.003
i: 908,         target: -0.135,        output: -0.040,         loss: 0.009
i: 909,         target: -0.154,        output: -0.037,         loss: 0.014
i: 910,         target: -0.169,        output: -0.059,         loss: 0.012
i: 911,         target: -0.060,        output: -0.020,         loss: 0.002
i: 912,         target: -0.045,        output: -0.054,         loss: 0.000
i: 913,         target: -0.184,        output: -0.054,         loss: 0.017
i: 914,         target: -0.063,        output: -0.042,         loss: 0.000
i: 915,         target: -0.069,        output: -0.035,         loss: 0.001
i: 916,         target: -0.078,        output: -0.028,         loss: 0.002
i: 917,         target: -0.100,        output: -0.036,         loss: 0.004
i: 918,         target: -0.147,        output: -0.022,         loss: 0.015
```

```
i: 919,         target: -0.059,         output: 0.000,          loss: 0.004
i: 920,         target: -0.163,         output: -0.062,         loss: 0.010
i: 921,         target: -0.194,         output: -0.049,         loss: 0.021
i: 922,         target: -0.067,         output: -0.043,         loss: 0.001
i: 923,         target: -0.056,         output: -0.027,         loss: 0.001
i: 924,         target: -0.148,         output: -0.035,         loss: 0.013
i: 925,         target: -0.090,         output: -0.017,         loss: 0.005
i: 926,         target: -0.036,         output: -0.019,         loss: 0.000
i: 927,         target: 0.050,          output: -0.030,         loss: 0.006
i: 928,         target: -0.154,         output: -0.049,         loss: 0.011
i: 929,         target: 0.070,          output: -0.015,         loss: 0.007
i: 930,         target: -0.042,         output: -0.024,         loss: 0.000
i: 931,         target: -0.166,         output: -0.036,         loss: 0.017
i: 932,         target: -0.126,         output: -0.036,         loss: 0.008
i: 933,         target: -0.087,         output: -0.038,         loss: 0.002
i: 934,         target: 0.990,          output: -0.003,         loss: 0.986
i: 935,         target: -0.033,         output: -0.027,         loss: 0.000
i: 936,         target: -0.131,         output: -0.049,         loss: 0.007
i: 937,         target: -0.211,         output: -0.047,         loss: 0.027
i: 938,         target: -0.199,         output: -0.057,         loss: 0.020
i: 939,         target: 0.976,          output: 0.006,          loss: 0.941
i: 940,         target: -0.092,         output: -0.059,         loss: 0.001
i: 941,         target: -0.078,         output: -0.036,         loss: 0.002
i: 942,         target: -0.073,         output: -0.041,         loss: 0.001
i: 943,         target: -0.168,         output: -0.043,         loss: 0.016
i: 944,         target: -0.140,         output: -0.041,         loss: 0.010
i: 945,         target: -0.048,         output: -0.035,         loss: 0.000
i: 946,         target: -0.120,         output: -0.015,         loss: 0.011
i: 947,         target: -0.104,         output: -0.032,         loss: 0.005
i: 948,         target: -0.068,         output: -0.011,         loss: 0.003
i: 949,         target: -0.055,         output: -0.034,         loss: 0.000
i: 950,         target: -0.056,         output: -0.028,         loss: 0.001
i: 951,         target: 0.765,          output: -0.009,         loss: 0.599
i: 952,         target: -0.112,         output: -0.035,         loss: 0.006
i: 953,         target: -0.073,         output: -0.041,         loss: 0.001
i: 954,         target: -0.074,         output: -0.040,         loss: 0.001
i: 955,         target: -0.055,         output: -0.029,         loss: 0.001
i: 956,         target: -0.120,         output: -0.018,         loss: 0.010
i: 957,         target: -0.107,         output: -0.050,         loss: 0.003
i: 958,         target: -0.063,         output: -0.034,         loss: 0.001
i: 959,         target: -0.121,         output: -0.060,         loss: 0.004
i: 960,         target: -0.068,         output: -0.038,         loss: 0.001
i: 961,         target: -0.139,         output: -0.048,         loss: 0.008
i: 962,         target: -0.062,         output: -0.038,         loss: 0.001
i: 963,         target: -0.128,         output: -0.031,         loss: 0.009
i: 964,         target: -0.086,         output: -0.037,         loss: 0.002
i: 965,         target: -0.102,         output: -0.039,         loss: 0.004
i: 966,         target: -0.115,         output: -0.044,         loss: 0.005
```

```
i: 967,          target: -0.061,         output: -0.041,         loss: 0.000
i: 968,          target: -0.037,         output: -0.023,         loss: 0.000
i: 969,          target: -0.124,         output: -0.034,         loss: 0.008
i: 970,          target: -0.205,         output: -0.051,         loss: 0.024
i: 971,          target: -0.135,         output: -0.041,         loss: 0.009
i: 972,          target: -0.113,         output: -0.020,         loss: 0.009
i: 973,          target: -0.198,         output: -0.025,         loss: 0.030
i: 974,          target: -0.071,         output: -0.040,         loss: 0.001
i: 975,          target: -0.089,         output: -0.042,         loss: 0.002
i: 976,          target: -0.072,         output: -0.034,         loss: 0.001
i: 977,          target: -0.146,         output: -0.039,         loss: 0.011
i: 978,          target: -0.120,         output: -0.042,         loss: 0.006
i: 979,          target: -0.047,         output: -0.028,         loss: 0.000
i: 980,          target: -0.130,         output: -0.049,         loss: 0.007
i: 981,          target: 0.069,          output: -0.019,         loss: 0.008
i: 982,          target: -0.113,         output: -0.044,         loss: 0.005
i: 983,          target: -0.041,         output: -0.014,         loss: 0.001
i: 984,          target: -0.130,         output: -0.044,         loss: 0.008
i: 985,          target: -0.064,         output: -0.022,         loss: 0.002
i: 986,          target: -0.053,         output: -0.046,         loss: 0.000
i: 987,          target: -0.048,         output: -0.048,         loss: 0.000
i: 988,          target: -0.038,         output: -0.054,         loss: 0.000
i: 989,          target: -0.185,         output: -0.016,         loss: 0.029
i: 990,          target: -0.057,         output: -0.031,         loss: 0.001
i: 991,          target: -0.170,         output: -0.046,         loss: 0.015
i: 992,          target: 0.007,          output: -0.051,         loss: 0.003
i: 993,          target: -0.121,         output: -0.034,         loss: 0.008
i: 994,          target: -0.044,         output: -0.030,         loss: 0.000
i: 995,          target: -0.128,         output: -0.045,         loss: 0.007
i: 996,          target: -0.047,         output: -0.033,         loss: 0.000
i: 997,          target: 0.020,          output: -0.028,         loss: 0.002
i: 998,          target: -0.054,         output: -0.017,         loss: 0.001
i: 999,          target: -0.178,         output: -0.021,         loss: 0.025
Average loss: 0.044
```

4 Save the Notebook as a PDF

[ ]:
```python
# SAVE THE NOTEBOOK

from IPython.display import Javascript

# Define the function to save the notebook
def save_notebook():
    display(Javascript('IPython.notebook.save_notebook()'))

# Call the save_notebook function to save the notebook
save_notebook()
```

```
<IPython.core.display.Javascript object>
```

[ ]:
```
import subprocess
import os

name_notebook = "0726-small_hybrid_model_1q_measurement.ipynb"

output_filename = "results/"+ name_notebook[:4] +"/" + name_notebook[:-6] + "_0.
 ↪pdf"

#check if the output file already exists
while os.path.exists(output_filename):
    print("The file {} already exists".format(output_filename))
    output_filename = output_filename[:-5] + str(int(output_filename[-5]) + 1)␣
 ↪+ ".pdf"
    print("Trying to save the file as {}".format(output_filename))


subprocess.run(["jupyter", "nbconvert", "--to", "pdf", "--output",␣
 ↪output_filename, name_notebook])
```