0731-small_hybrid_model_1qm_shots_v0

July 31, 2023

[ ]:
```
initial_path = 'peptide-QML/'
# initial_path = '../'
```

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

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

[ ]:
```
import sys
sys.path.append(initial_path)

from my_code import functions as f
```

[ ]:
```
torch.set_default_dtype(torch.float64)
```

1 Data

[ ]:
```
file_path = initial_path + 'data/energies/PET/generated/
 ↪bb14_Strings_Energies_10_000_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
```

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

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

[ ]:
```
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
```

[ ]:
```
# Define the dataset
input_data = torch.tensor(X, dtype=torch.float64)
```

```
target_data = torch.tensor(Y, dtype=torch.float64).view(-1, 1)

# Define the validation set
input_validation = torch.tensor(X_validation, dtype=torch.float64)
target_validation = torch.tensor(Y_validation, dtype=torch.float64).view(-1, 1)
```

2 Quantum node

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

[ ]:
```
n_qubits = n_aminoacids
n_layers_block = 25
n_layers_embedding = 3
n_shots = 1000
# n_shots = None
dev = qml.device("default.qubit.torch", wires=n_qubits, shots=n_shots)
```

[ ]:
```
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)
```

[ ]:
```
# 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)
```

[ ]:
```
@qml.qnode(dev, interface='torch')
def qnode(inputs, weights):

    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)

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

    # # embedding layer
    # for i in range(n_qubits):
    #     qml.RX(inputs[i], wires=i)

    #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)])

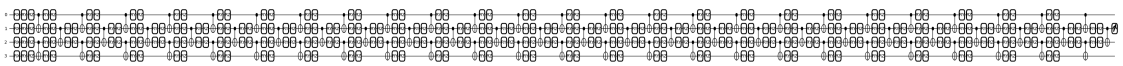
    # measurement
    return [qml.expval(qml.PauliZ(wires=1))]
```

[ ]:
```
qnode([1,2,3,4], np.zeros((size_weights,)))
```

[ ]:
```
[tensor(-0.1880)]
```

[ ]:
```
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((50,3))
```

```
/usr/lib/python3.8/_collections_abc.py:832: MatplotlibDeprecationWarning:
The examples.directory rcparam was deprecated in Matplotlib 3.0 and will be
removed in 3.2. In the future, examples will be found relative to the 'datapath'
directory.
  self[key] = other[key]
/usr/lib/python3.8/_collections_abc.py:832: MatplotlibDeprecationWarning:
The savefig.frameon rcparam was deprecated in Matplotlib 3.1 and will be removed
in 3.3.
  self[key] = other[key]
/usr/lib/python3.8/_collections_abc.py:832: MatplotlibDeprecationWarning:
The text.latex.unicode rcparam was deprecated in Matplotlib 3.0 and will be
removed in 3.2.
  self[key] = other[key]
/usr/lib/python3.8/_collections_abc.py:832: MatplotlibDeprecationWarning:
The verbose.fileo rcparam was deprecated in Matplotlib 3.1 and will be removed
in 3.3.
  self[key] = other[key]
/usr/lib/python3.8/_collections_abc.py:832: MatplotlibDeprecationWarning:
The verbose.level rcparam was deprecated in Matplotlib 3.1 and will be removed
in 3.3.
  self[key] = other[key]
```



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

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

[ ]:
```
class QNodeFunction(torch.autograd.Function):

    @staticmethod
    def forward(ctx, input, qlayer):
        ctx.save_for_backward(input)
        ctx.qlayer = qlayer
        return qlayer(input)

    @staticmethod
    def backward(ctx, grad_output):
        input, = ctx.saved_tensors
        qlayer = ctx.qlayer
        epsilon = 0.01

        # Gradient w.r.t. input
        perturbation_input = (torch.rand_like(input) * 2 - 1) * epsilon
        positive_input = input + perturbation_input
        negative_input = input - perturbation_input

        loss_positive = qlayer(positive_input).sum()
        loss_negative = qlayer(negative_input).sum()

        gradient_input = (loss_positive - loss_negative) / (2 * epsilon) *␣
↪perturbation_input
        gradient_input *= grad_output  # Incorporate grad_output due to chain␣
↪rule

        # Gradient w.r.t. qlayer's parameters
        gradients_weights = []
        for p in qlayer.parameters():
            perturbation_weight = (torch.rand_like(p) * 2 - 1) * epsilon
            p.data += perturbation_weight

            loss_positive = qlayer(input).sum()
            loss_negative = qlayer(input).sum()

            gradient_weight = (loss_positive - loss_negative) / (2 * epsilon) *␣
↪perturbation_weight / epsilon
```

```
            gradients_weights.append(gradient_weight * grad_output.sum())  #␣
 ↪Weighting by grad_output

            p.data -= perturbation_weight  # Reset to original value

        # Update gradients for qlayer's parameters
        for p, grad in zip(qlayer.parameters(), gradients_weights):
            if p.grad is None:
                p.grad = grad.detach()
            else:
                p.grad += grad.detach()

        return gradient_input, None

# Wrapper around the custom autograd function
class CustomQLayer(torch.nn.Module):
    def __init__(self, qlayer):
        super(CustomQLayer, self).__init__()
        self.qlayer = qlayer

    def forward(self, x):
        return QNodeFunction.apply(x, self.qlayer)
```

3 Hybrid model

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

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

[ ]:
```
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 += [CustomQLayer(qlayer)]
# layers += [nn.Linear(1, 1)]
# layers += [nn.Linear(2, 4), nn.ReLU()]
# layers += [nn.Linear(4, 1)]


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

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

[ ]:
```
import time
```

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


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

# Training loop
num_epochs = 25
batch_size = 32

#validation data
i_validation = input_validation[::10] #we take only 10% of the validation data,␣
 ↪to speed up the process
t_validation = target_validation[::10]

losses = []
losses_epochs = [0]
losses_epochs_validation = [0]

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

    # print the loss of 3 strings of the validation data
    for i in range(3):
        prediction = model(i_validation[i])
        target = t_validation[i]
        print('\t Validation string, \t i: {}; \t prediction: {:.4f}, \t target:
↪ {:.4f}, \t loss: {:.4f}'.format(i, prediction.item(), target.item(),␣
↪criterion(prediction, target).item()))

    # 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}, Loss validation: {:.4f}, Time remaining:
↪ ~{}h {}m {:.0f}s'.format(
```

```
        epoch+1, num_epochs, losses_epochs[-1], losses_epochs_validation[-1],␣
↪hours, minutes, seconds))
```

```
Epoch [0/25], Loss: 0.2340, Loss validation: 0.2219

/usr/lib/python3/dist-packages/torch/autograd/__init__.py:147: UserWarning: CUDA
initialization: Unexpected error from cudaGetDeviceCount(). Did you run some
cuda functions before calling NumCudaDevices() that might have already set an
error? Error 804: forward compatibility was attempted on non supported HW
(Triggered internally at  ../c10/cuda/CUDAFunctions.cpp:115.)
  Variable._execution_engine.run_backward(

         Validation string,      i: 0;   prediction: 0.1580,     target:
-0.0754,        loss: 0.0545
         Validation string,      i: 1;   prediction: 0.1660,     target: 0.4133,
loss: 0.0612
         Validation string,      i: 2;   prediction: 0.2180,     target:
-0.0798,        loss: 0.0887
Epoch [1/25], Loss: 0.0555, Loss validation: 0.0356, Time remaining: ~0.0h 35.0m
48s
         Validation string,      i: 0;   prediction: -0.0060,    target:
-0.0754,        loss: 0.0048
         Validation string,      i: 1;   prediction: 0.0100,     target: 0.4133,
loss: 0.1626
         Validation string,      i: 2;   prediction: -0.0440,    target:
-0.0798,        loss: 0.0013
Epoch [2/25], Loss: 0.0340, Loss validation: 0.0147, Time remaining: ~0.0h 32.0m
52s
         Validation string,      i: 0;   prediction: 0.0700,     target:
-0.0754,        loss: 0.0211
         Validation string,      i: 1;   prediction: 0.0640,     target: 0.4133,
loss: 0.1220
         Validation string,      i: 2;   prediction: 0.0300,     target:
-0.0798,        loss: 0.0121
Epoch [3/25], Loss: 0.0606, Loss validation: 0.0178, Time remaining: ~0.0h 30.0m
58s
         Validation string,      i: 0;   prediction: 0.0760,     target:
-0.0754,        loss: 0.0229
         Validation string,      i: 1;   prediction: -0.0420,    target: 0.4133,
loss: 0.2073
         Validation string,      i: 2;   prediction: 0.0140,     target:
-0.0798,        loss: 0.0088
Epoch [4/25], Loss: 0.0316, Loss validation: 0.0178, Time remaining: ~0.0h 29.0m
20s
         Validation string,      i: 0;   prediction: -0.1840,    target:
-0.0754,        loss: 0.0118
         Validation string,      i: 1;   prediction: -0.0800,    target: 0.4133,
loss: 0.2433
         Validation string,      i: 2;   prediction: -0.1740,    target:
```

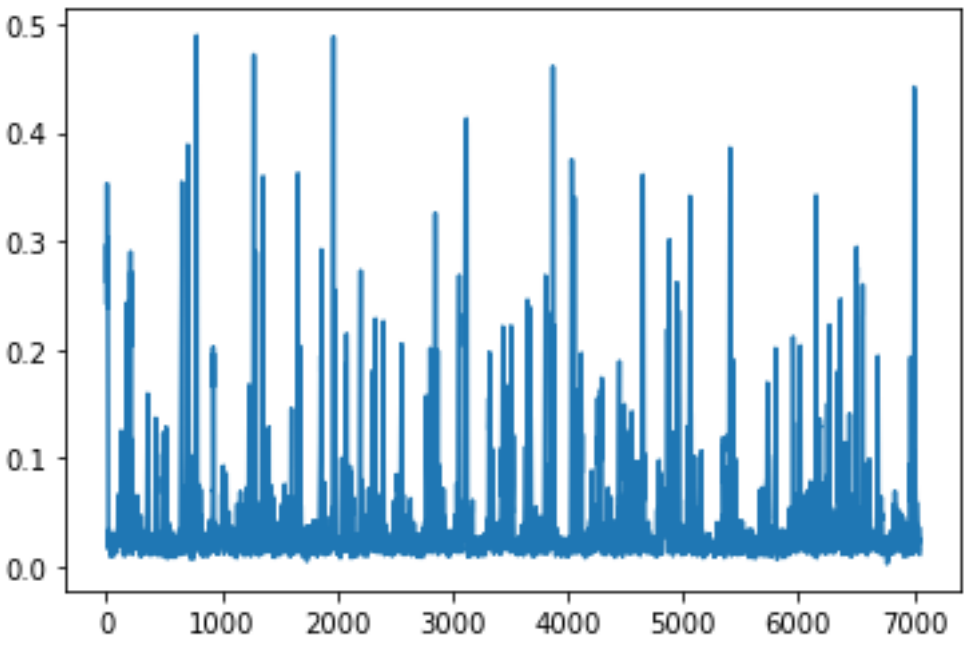
```
-0.0798,        loss: 0.0089
Epoch [5/25], Loss: 0.0554, Loss validation: 0.0477, Time remaining: ~0.0h 27.0m
49s
         Validation string,      i: 0;   prediction: -0.0900,    target:
-0.0754,        loss: 0.0002
         Validation string,      i: 1;   prediction: -0.0700,    target: 0.4133,
loss: 0.2336
         Validation string,      i: 2;   prediction: -0.0460,    target:
-0.0798,        loss: 0.0011
Epoch [6/25], Loss: 0.0408, Loss validation: 0.0210, Time remaining: ~0.0h 26.0m
20s
         Validation string,      i: 0;   prediction: -0.0900,    target:
-0.0754,        loss: 0.0002
         Validation string,      i: 1;   prediction: -0.1000,    target: 0.4133,
loss: 0.2635
         Validation string,      i: 2;   prediction: -0.1180,    target:
-0.0798,        loss: 0.0015
Epoch [7/25], Loss: 0.0393, Loss validation: 0.0304, Time remaining: ~0.0h 24.0m
54s
         Validation string,      i: 0;   prediction: 0.0520,     target:
-0.0754,        loss: 0.0162
         Validation string,      i: 1;   prediction: -0.0540,    target: 0.4133,
loss: 0.2184
         Validation string,      i: 2;   prediction: -0.0040,    target:
-0.0798,        loss: 0.0057
Epoch [8/25], Loss: 0.0457, Loss validation: 0.0177, Time remaining: ~0.0h 23.0m
30s
         Validation string,      i: 0;   prediction: -0.0260,    target:
-0.0754,        loss: 0.0024
         Validation string,      i: 1;   prediction: -0.0220,    target: 0.4133,
loss: 0.1895
         Validation string,      i: 2;   prediction: -0.0320,    target:
-0.0798,        loss: 0.0023
Epoch [9/25], Loss: 0.0416, Loss validation: 0.0187, Time remaining: ~0.0h 22.0m
15s
         Validation string,      i: 0;   prediction: 0.2500,     target:
-0.0754,        loss: 0.1059
         Validation string,      i: 1;   prediction: 0.2720,     target: 0.4133,
loss: 0.0200
         Validation string,      i: 2;   prediction: 0.2380,     target:
-0.0798,        loss: 0.1010
Epoch [10/25], Loss: 0.0394, Loss validation: 0.0639, Time remaining: ~0.0h
20.0m 56s
         Validation string,      i: 0;   prediction: -0.0520,    target:
-0.0754,        loss: 0.0005
         Validation string,      i: 1;   prediction: -0.1800,    target: 0.4133,
loss: 0.3520
         Validation string,      i: 2;   prediction: -0.1600,    target:
```

```
-0.0798,        loss: 0.0064
Epoch [11/25], Loss: 0.0433, Loss validation: 0.0404, Time remaining: ~0.0h
19.0m 37s
         Validation string,      i: 0;   prediction: 0.1140,     target:
-0.0754,        loss: 0.0359
         Validation string,      i: 1;   prediction: 0.1360,     target: 0.4133,
loss: 0.0769
         Validation string,      i: 2;   prediction: 0.1460,     target:
-0.0798,        loss: 0.0510
Epoch [12/25], Loss: 0.0517, Loss validation: 0.0351, Time remaining: ~0.0h
18.0m 16s
         Validation string,      i: 0;   prediction: -0.2860,    target:
-0.0754,        loss: 0.0444
         Validation string,      i: 1;   prediction: -0.3080,    target: 0.4133,
loss: 0.5203
         Validation string,      i: 2;   prediction: -0.3040,    target:
-0.0798,        loss: 0.0503
Epoch [13/25], Loss: 0.0513, Loss validation: 0.1326, Time remaining: ~0.0h
16.0m 54s
         Validation string,      i: 0;   prediction: 0.0440,     target:
-0.0754,        loss: 0.0142
         Validation string,      i: 1;   prediction: 0.0480,     target: 0.4133,
loss: 0.1334
         Validation string,      i: 2;   prediction: 0.0980,     target:
-0.0798,        loss: 0.0316
Epoch [14/25], Loss: 0.0495, Loss validation: 0.0175, Time remaining: ~0.0h
15.0m 31s
         Validation string,      i: 0;   prediction: 0.0120,     target:
-0.0754,        loss: 0.0076
         Validation string,      i: 1;   prediction: -0.0080,    target: 0.4133,
loss: 0.1775
         Validation string,      i: 2;   prediction: -0.0360,    target:
-0.0798,        loss: 0.0019
Epoch [15/25], Loss: 0.0570, Loss validation: 0.0167, Time remaining: ~0.0h
14.0m 8s
         Validation string,      i: 0;   prediction: 0.1120,     target:
-0.0754,        loss: 0.0351
         Validation string,      i: 1;   prediction: 0.1400,     target: 0.4133,
loss: 0.0747
         Validation string,      i: 2;   prediction: 0.1060,     target:
-0.0798,        loss: 0.0345
Epoch [16/25], Loss: 0.0433, Loss validation: 0.0303, Time remaining: ~0.0h
12.0m 43s
         Validation string,      i: 0;   prediction: 0.1380,     target:
-0.0754,        loss: 0.0455
         Validation string,      i: 1;   prediction: 0.0960,     target: 0.4133,
loss: 0.1007
         Validation string,      i: 2;   prediction: 0.0940,     target:
```

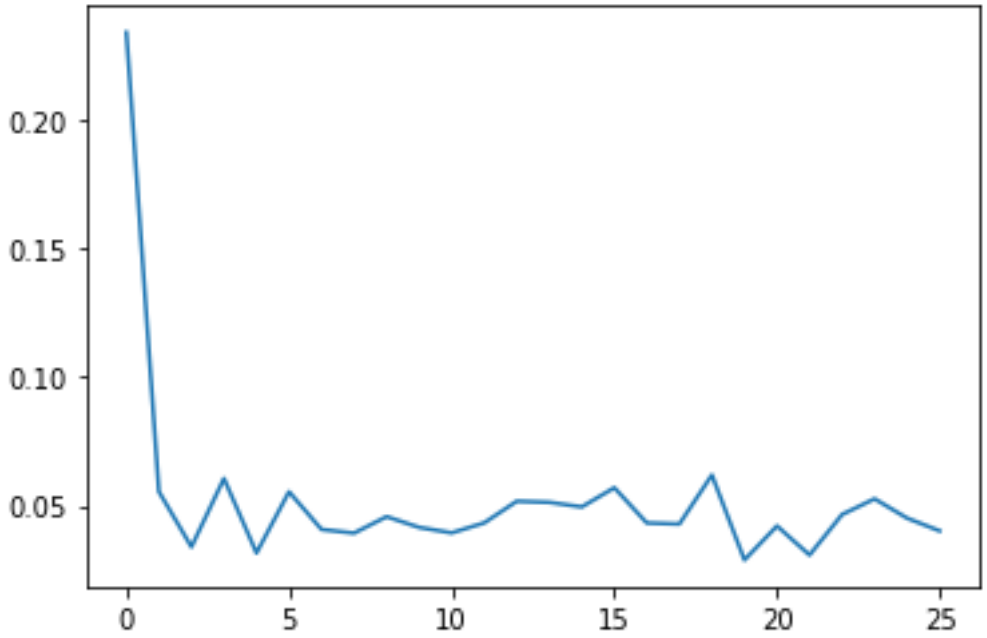
```
-0.0798,        loss: 0.0302
Epoch [17/25], Loss: 0.0429, Loss validation: 0.0233, Time remaining: ~0.0h
11.0m 17s
         Validation string,      i: 0;   prediction: 0.1160,     target:
-0.0754,        loss: 0.0366
         Validation string,      i: 1;   prediction: 0.1060,     target: 0.4133,
loss: 0.0944
         Validation string,      i: 2;   prediction: 0.0240,     target:
-0.0798,        loss: 0.0108
Epoch [18/25], Loss: 0.0619, Loss validation: 0.0209, Time remaining: ~0.0h 9.0m
52s
         Validation string,      i: 0;   prediction: -0.1400,    target:
-0.0754,        loss: 0.0042
         Validation string,      i: 1;   prediction: -0.1260,    target: 0.4133,
loss: 0.2908
         Validation string,      i: 2;   prediction: -0.1160,    target:
-0.0798,        loss: 0.0013
Epoch [19/25], Loss: 0.0289, Loss validation: 0.0302, Time remaining: ~0.0h 8.0m
29s
         Validation string,      i: 0;   prediction: 0.0600,     target:
-0.0754,        loss: 0.0183
         Validation string,      i: 1;   prediction: 0.0640,     target: 0.4133,
loss: 0.1220
         Validation string,      i: 2;   prediction: 0.0400,     target:
-0.0798,        loss: 0.0143
Epoch [20/25], Loss: 0.0421, Loss validation: 0.0158, Time remaining: ~0.0h 7.0m
5s
         Validation string,      i: 0;   prediction: -0.0440,    target:
-0.0754,        loss: 0.0010
         Validation string,      i: 1;   prediction: -0.1300,    target: 0.4133,
loss: 0.2952
         Validation string,      i: 2;   prediction: -0.0520,    target:
-0.0798,        loss: 0.0008
Epoch [21/25], Loss: 0.0308, Loss validation: 0.0192, Time remaining: ~0.0h 5.0m
41s
         Validation string,      i: 0;   prediction: -0.0300,    target:
-0.0754,        loss: 0.0021
         Validation string,      i: 1;   prediction: -0.0920,    target: 0.4133,
loss: 0.2553
         Validation string,      i: 2;   prediction: -0.0620,    target:
-0.0798,        loss: 0.0003
Epoch [22/25], Loss: 0.0465, Loss validation: 0.0233, Time remaining: ~0.0h 4.0m
16s
         Validation string,      i: 0;   prediction: 0.2120,     target:
-0.0754,        loss: 0.0826
         Validation string,      i: 1;   prediction: 0.0940,     target: 0.4133,
loss: 0.1019
         Validation string,      i: 2;   prediction: 0.1800,     target:
```

```
-0.0798,        loss: 0.0675
Epoch [23/25], Loss: 0.0527, Loss validation: 0.0413, Time remaining: ~0.0h 2.0m
51s
         Validation string,      i: 0;   prediction: -0.0740,    target:
-0.0754,        loss: 0.0000
         Validation string,      i: 1;   prediction: -0.0640,    target: 0.4133,
loss: 0.2278
         Validation string,      i: 2;   prediction: 0.0000,     target:
-0.0798,        loss: 0.0064
Epoch [24/25], Loss: 0.0452, Loss validation: 0.0165, Time remaining: ~0.0h 1.0m
26s
         Validation string,      i: 0;   prediction: -0.0740,    target:
-0.0754,        loss: 0.0000
         Validation string,      i: 1;   prediction: -0.0260,    target: 0.4133,
loss: 0.1930
         Validation string,      i: 2;   prediction: -0.0180,    target:
-0.0798,        loss: 0.0038
Epoch [25/25], Loss: 0.0402, Loss validation: 0.0203, Time remaining: ~0.0h 0.0m
0s
```

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



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



[ ]:
```
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: -0.075,         output: -0.014,         loss: 0.001
i: 1,    target: 0.163,          output: -0.054,         loss: 0.040
i: 2,    target: -0.076,         output: -0.056,         loss: 0.002
i: 3,    target: -0.087,         output: -0.018,         loss: 0.001
i: 4,    target: -0.016,         output: -0.018,         loss: 0.002
i: 5,    target: -0.021,         output: -0.040,         loss: 0.005
i: 6,    target: 0.180,          output: -0.084,         loss: 0.063
i: 7,    target: 0.180,          output: -0.106,         loss: 0.046
i: 8,    target: -0.077,         output: -0.060,         loss: 0.001
i: 9,    target: 0.038,          output: -0.082,         loss: 0.006
i: 10,   target: 0.413,          output: -0.032,         loss: 0.253
i: 11,   target: 0.142,          output: -0.076,         loss: 0.048
```

```
i: 12,   target: -0.066,        output: -0.052,        loss: 0.000
i: 13,   target: -0.081,        output: -0.052,        loss: 0.001
i: 14,   target: 0.087,         output: -0.040,        loss: 0.022
i: 15,   target: 0.044,         output: -0.044,        loss: 0.008
i: 16,   target: -0.031,        output: 0.006,         loss: 0.002
i: 17,   target: 0.040,         output: -0.042,        loss: 0.009
i: 18,   target: 0.073,         output: -0.046,        loss: 0.004
i: 19,   target: -0.092,        output: -0.090,        loss: 0.006
i: 20,   target: -0.080,        output: -0.092,        loss: 0.001
i: 21,   target: -0.032,        output: -0.014,        loss: 0.001
i: 22,   target: -0.045,        output: -0.036,        loss: 0.000
i: 23,   target: -0.077,        output: -0.044,        loss: 0.001
i: 24,   target: -0.080,        output: -0.044,        loss: 0.001
i: 25,   target: -0.061,        output: -0.056,        loss: 0.001
i: 26,   target: 0.063,         output: -0.088,        loss: 0.030
i: 27,   target: -0.067,        output: -0.086,        loss: 0.004
i: 28,   target: -0.112,        output: 0.004,         loss: 0.006
i: 29,   target: -0.009,        output: -0.074,        loss: 0.000
i: 30,   target: -0.004,        output: -0.054,        loss: 0.008
i: 31,   target: -0.058,        output: -0.024,        loss: 0.007
i: 32,   target: -0.050,        output: -0.002,        loss: 0.000
i: 33,   target: 0.181,         output: -0.058,        loss: 0.046
i: 34,   target: 0.004,         output: -0.062,        loss: 0.002
i: 35,   target: -0.077,        output: -0.062,        loss: 0.001
i: 36,   target: 0.183,         output: -0.130,        loss: 0.041
i: 37,   target: 0.142,         output: -0.034,        loss: 0.045
i: 38,   target: -0.066,        output: -0.002,        loss: 0.000
i: 39,   target: -0.104,        output: -0.020,        loss: 0.002
i: 40,   target: 0.063,         output: -0.082,        loss: 0.024
i: 41,   target: -0.063,        output: -0.062,        loss: 0.000
i: 42,   target: 0.095,         output: -0.074,        loss: 0.030
i: 43,   target: -0.039,        output: -0.104,        loss: 0.002
i: 44,   target: -0.071,        output: -0.050,        loss: 0.000
i: 45,   target: 0.222,         output: -0.096,        loss: 0.078
i: 46,   target: -0.079,        output: -0.062,        loss: 0.000
i: 47,   target: 0.063,         output: -0.014,        loss: 0.013
i: 48,   target: -0.095,        output: -0.060,        loss: 0.007
i: 49,   target: -0.038,        output: -0.042,        loss: 0.001
i: 50,   target: 0.151,         output: -0.078,        loss: 0.031
i: 51,   target: 0.191,         output: -0.074,        loss: 0.073
i: 52,   target: -0.017,        output: -0.040,        loss: 0.005
i: 53,   target: 0.228,         output: -0.042,        loss: 0.070
i: 54,   target: -0.073,        output: -0.064,        loss: 0.000
i: 55,   target: -0.047,        output: -0.052,        loss: 0.000
i: 56,   target: -0.075,        output: -0.050,        loss: 0.011
i: 57,   target: -0.052,        output: -0.012,        loss: 0.001
i: 58,   target: -0.053,        output: -0.048,        loss: 0.001
i: 59,   target: -0.037,        output: -0.028,        loss: 0.000
```

```
i: 60,   target: 0.042,          output: -0.008,         loss: 0.003
i: 61,   target: 0.215,          output: -0.046,         loss: 0.095
i: 62,   target: -0.060,         output: -0.092,         loss: 0.000
i: 63,   target: 0.091,          output: -0.038,         loss: 0.034
i: 64,   target: 0.104,          output: -0.012,         loss: 0.029
i: 65,   target: -0.108,         output: -0.056,         loss: 0.004
i: 66,   target: 0.072,          output: -0.120,         loss: 0.012
i: 67,   target: 0.190,          output: -0.018,         loss: 0.042
i: 68,   target: -0.105,         output: -0.064,         loss: 0.003
i: 69,   target: 0.137,          output: -0.074,         loss: 0.035
i: 70,   target: 0.196,          output: -0.060,         loss: 0.046
i: 71,   target: 0.192,          output: -0.034,         loss: 0.071
i: 72,   target: 0.193,          output: -0.080,         loss: 0.058
i: 73,   target: 0.160,          output: -0.036,         loss: 0.060
i: 74,   target: -0.042,         output: -0.030,         loss: 0.001
i: 75,   target: 0.033,          output: -0.028,         loss: 0.005
i: 76,   target: 0.225,          output: -0.070,         loss: 0.104
i: 77,   target: -0.091,         output: -0.100,         loss: 0.001
i: 78,   target: 0.163,          output: -0.078,         loss: 0.067
i: 79,   target: 0.122,          output: -0.028,         loss: 0.029
i: 80,   target: -0.072,         output: -0.032,         loss: 0.002
i: 81,   target: -0.096,         output: -0.086,         loss: 0.000
i: 82,   target: 0.025,          output: -0.022,         loss: 0.018
i: 83,   target: 0.005,          output: -0.024,         loss: 0.005
i: 84,   target: 0.080,          output: -0.062,         loss: 0.022
i: 85,   target: 0.144,          output: -0.002,         loss: 0.050
i: 86,   target: -0.089,         output: -0.086,         loss: 0.019
i: 87,   target: -0.010,         output: -0.086,         loss: 0.005
i: 88,   target: -0.064,         output: -0.156,         loss: 0.003
i: 89,   target: -0.040,         output: -0.044,         loss: 0.000
i: 90,   target: 0.113,          output: -0.058,         loss: 0.032
i: 91,   target: 0.211,          output: -0.106,         loss: 0.068
i: 92,   target: -0.083,         output: -0.082,         loss: 0.000
i: 93,   target: 0.131,          output: -0.038,         loss: 0.041
i: 94,   target: 0.120,          output: -0.020,         loss: 0.019
i: 95,   target: -0.092,         output: -0.052,         loss: 0.000
i: 96,   target: 0.175,          output: -0.002,         loss: 0.060
i: 97,   target: -0.067,         output: -0.076,         loss: 0.000
i: 98,   target: -0.034,         output: -0.078,         loss: 0.001
i: 99,   target: -0.015,         output: -0.044,         loss: 0.005
i: 100,          target: -0.057,         output: -0.042,         loss: 0.000
i: 101,          target: -0.037,         output: -0.040,         loss: 0.000
i: 102,          target: 0.198,          output: -0.060,         loss: 0.054
i: 103,          target: 0.101,          output: -0.060,         loss: 0.043
i: 104,          target: -0.044,         output: -0.030,         loss: 0.000
i: 105,          target: -0.053,         output: -0.052,         loss: 0.000
i: 106,          target: 0.253,          output: -0.050,         loss: 0.100
i: 107,          target: -0.090,         output: -0.066,         loss: 0.003
```

```
i: 108,         target: 0.454,         output: -0.056,         loss: 0.262
i: 109,         target: -0.080,        output: 0.000,          loss: 0.000
i: 110,         target: -0.027,        output: -0.046,         loss: 0.000
i: 111,         target: -0.053,        output: -0.072,         loss: 0.001
i: 112,         target: 0.160,         output: -0.078,         loss: 0.064
i: 113,         target: -0.034,        output: -0.022,         loss: 0.001
i: 114,         target: 0.138,         output: -0.050,         loss: 0.043
i: 115,         target: -0.013,        output: -0.016,         loss: 0.003
i: 116,         target: 0.177,         output: -0.042,         loss: 0.069
i: 117,         target: -0.074,        output: -0.032,         loss: 0.000
i: 118,         target: 0.165,         output: -0.092,         loss: 0.043
i: 119,         target: -0.072,        output: -0.094,         loss: 0.000
i: 120,         target: 0.058,         output: -0.066,         loss: 0.008
i: 121,         target: -0.041,        output: -0.120,         loss: 0.003
i: 122,         target: -0.057,        output: -0.058,         loss: 0.003
i: 123,         target: -0.056,        output: -0.026,         loss: 0.000
i: 124,         target: -0.054,        output: -0.022,         loss: 0.001
i: 125,         target: -0.079,        output: -0.082,         loss: 0.000
i: 126,         target: -0.050,        output: -0.060,         loss: 0.006
i: 127,         target: 0.186,         output: -0.036,         loss: 0.054
i: 128,         target: -0.069,        output: -0.014,         loss: 0.000
i: 129,         target: 0.247,         output: -0.046,         loss: 0.118
i: 130,         target: -0.055,        output: -0.072,         loss: 0.000
i: 131,         target: 0.163,         output: -0.010,         loss: 0.034
i: 132,         target: 0.058,         output: -0.084,         loss: 0.026
i: 133,         target: -0.077,        output: -0.024,         loss: 0.002
i: 134,         target: -0.067,        output: -0.072,         loss: 0.000
i: 135,         target: -0.067,        output: -0.042,         loss: 0.000
i: 136,         target: -0.065,        output: -0.120,         loss: 0.002
i: 137,         target: 0.355,         output: -0.078,         loss: 0.150
i: 138,         target: 0.138,         output: -0.058,         loss: 0.040
i: 139,         target: -0.061,        output: -0.110,         loss: 0.000
i: 140,         target: -0.062,        output: -0.046,         loss: 0.000
i: 141,         target: 0.207,         output: -0.080,         loss: 0.057
i: 142,         target: 0.097,         output: -0.034,         loss: 0.048
i: 143,         target: -0.080,        output: -0.066,         loss: 0.001
i: 144,         target: 0.184,         output: -0.032,         loss: 0.037
i: 145,         target: -0.078,        output: 0.020,          loss: 0.000
i: 146,         target: 0.001,         output: -0.058,         loss: 0.002
i: 147,         target: -0.078,        output: -0.068,         loss: 0.000
i: 148,         target: -0.084,        output: -0.044,         loss: 0.001
i: 149,         target: -0.057,        output: 0.012,          loss: 0.001
i: 150,         target: 0.091,         output: -0.060,         loss: 0.023
i: 151,         target: -0.065,        output: -0.114,         loss: 0.003
i: 152,         target: -0.054,        output: -0.070,         loss: 0.000
i: 153,         target: -0.027,        output: -0.068,         loss: 0.000
i: 154,         target: -0.075,        output: -0.066,         loss: 0.000
i: 155,         target: -0.045,        output: -0.078,         loss: 0.000
```

```
i: 156,         target: -0.091,         output: 0.006,          loss: 0.001
i: 157,         target: 0.005,          output: -0.040,         loss: 0.003
i: 158,         target: -0.079,         output: -0.128,         loss: 0.000
i: 159,         target: 0.013,          output: -0.046,         loss: 0.002
i: 160,         target: -0.040,         output: -0.052,         loss: 0.003
i: 161,         target: 0.118,          output: -0.030,         loss: 0.040
i: 162,         target: 0.308,          output: -0.096,         loss: 0.144
i: 163,         target: 0.012,          output: -0.068,         loss: 0.017
i: 164,         target: -0.055,         output: -0.108,         loss: 0.000
i: 165,         target: -0.094,         output: -0.050,         loss: 0.000
i: 166,         target: -0.024,         output: -0.062,         loss: 0.001
i: 167,         target: -0.088,         output: -0.010,         loss: 0.002
i: 168,         target: -0.043,         output: -0.066,         loss: 0.000
i: 169,         target: -0.067,         output: -0.052,         loss: 0.004
i: 170,         target: 0.195,          output: -0.040,         loss: 0.066
i: 171,         target: 0.138,          output: -0.064,         loss: 0.038
i: 172,         target: 0.392,          output: -0.058,         loss: 0.173
i: 173,         target: -0.074,         output: -0.048,         loss: 0.003
i: 174,         target: 0.042,          output: -0.044,         loss: 0.009
i: 175,         target: -0.067,         output: -0.050,         loss: 0.002
i: 176,         target: -0.032,         output: -0.066,         loss: 0.000
i: 177,         target: -0.032,         output: -0.060,         loss: 0.001
i: 178,         target: 0.213,          output: -0.056,         loss: 0.101
i: 179,         target: 0.227,          output: -0.052,         loss: 0.099
i: 180,         target: -0.069,         output: -0.126,         loss: 0.001
i: 181,         target: -0.078,         output: -0.062,         loss: 0.003
i: 182,         target: -0.045,         output: -0.032,         loss: 0.000
i: 183,         target: -0.035,         output: -0.084,         loss: 0.000
i: 184,         target: 0.203,          output: -0.182,         loss: 0.067
i: 185,         target: 0.240,          output: -0.014,         loss: 0.078
i: 186,         target: -0.044,         output: -0.008,         loss: 0.000
i: 187,         target: 0.061,          output: -0.056,         loss: 0.015
i: 188,         target: -0.083,         output: -0.016,         loss: 0.005
i: 189,         target: 0.256,          output: -0.066,         loss: 0.099
i: 190,         target: -0.082,         output: 0.040,          loss: 0.005
i: 191,         target: 0.157,          output: -0.040,         loss: 0.072
i: 192,         target: 0.192,          output: -0.008,         loss: 0.048
i: 193,         target: 0.199,          output: -0.062,         loss: 0.071
i: 194,         target: 0.214,          output: -0.044,         loss: 0.095
i: 195,         target: 0.177,          output: -0.046,         loss: 0.044
i: 196,         target: -0.093,         output: -0.054,         loss: 0.001
i: 197,         target: -0.009,         output: -0.070,         loss: 0.000
i: 198,         target: 0.199,          output: -0.042,         loss: 0.108
i: 199,         target: -0.054,         output: -0.036,         loss: 0.000
i: 200,         target: 0.179,          output: -0.046,         loss: 0.044
i: 201,         target: 0.197,          output: -0.024,         loss: 0.062
i: 202,         target: -0.042,         output: -0.096,         loss: 0.000
i: 203,         target: 0.187,          output: -0.070,         loss: 0.079
```

```
i: 204,          target: 0.218,          output: -0.076,          loss: 0.076
i: 205,          target: -0.039,         output: -0.068,          loss: 0.001
i: 206,          target: -0.056,         output: -0.066,          loss: 0.000
i: 207,          target: 0.183,          output: -0.050,          loss: 0.060
i: 208,          target: 0.049,          output: -0.066,          loss: 0.009
i: 209,          target: 0.126,          output: -0.034,          loss: 0.023
i: 210,          target: -0.077,         output: -0.046,          loss: 0.002
i: 211,          target: 0.124,          output: -0.056,          loss: 0.023
i: 212,          target: 0.171,          output: -0.034,          loss: 0.055
i: 213,          target: -0.034,         output: -0.040,          loss: 0.000
i: 214,          target: 0.036,          output: -0.128,          loss: 0.002
i: 215,          target: 0.223,          output: -0.086,          loss: 0.080
i: 216,          target: -0.057,         output: 0.022,           loss: 0.000
i: 217,          target: -0.074,         output: -0.042,          loss: 0.000
i: 218,          target: 0.086,          output: -0.036,          loss: 0.013
i: 219,          target: 0.035,          output: -0.042,          loss: 0.012
i: 220,          target: -0.080,         output: -0.070,          loss: 0.000
i: 221,          target: 0.193,          output: -0.100,          loss: 0.065
i: 222,          target: -0.063,         output: -0.022,          loss: 0.000
i: 223,          target: -0.098,         output: -0.052,          loss: 0.005
i: 224,          target: 0.193,          output: -0.058,          loss: 0.077
i: 225,          target: -0.070,         output: -0.062,          loss: 0.001
i: 226,          target: -0.073,         output: -0.042,          loss: 0.000
i: 227,          target: 0.098,          output: -0.044,          loss: 0.012
i: 228,          target: -0.059,         output: -0.096,          loss: 0.003
i: 229,          target: 0.038,          output: -0.042,          loss: 0.021
i: 230,          target: -0.087,         output: -0.096,          loss: 0.001
i: 231,          target: 0.192,          output: -0.038,          loss: 0.039
i: 232,          target: 0.162,          output: -0.032,          loss: 0.073
i: 233,          target: -0.058,         output: -0.108,          loss: 0.000
i: 234,          target: -0.054,         output: -0.100,          loss: 0.001
i: 235,          target: -0.074,         output: 0.000,           loss: 0.000
i: 236,          target: -0.045,         output: -0.046,          loss: 0.002
i: 237,          target: -0.033,         output: -0.062,          loss: 0.003
i: 238,          target: -0.096,         output: 0.034,           loss: 0.001
i: 239,          target: 0.112,          output: -0.118,          loss: 0.026
i: 240,          target: -0.062,         output: -0.058,          loss: 0.003
i: 241,          target: 0.183,          output: -0.080,          loss: 0.047
i: 242,          target: -0.042,         output: -0.084,          loss: 0.002
i: 243,          target: -0.091,         output: 0.012,           loss: 0.000
i: 244,          target: -0.101,         output: -0.068,          loss: 0.010
i: 245,          target: -0.051,         output: -0.072,          loss: 0.000
i: 246,          target: -0.067,         output: -0.002,          loss: 0.000
i: 247,          target: 0.143,          output: -0.050,          loss: 0.059
i: 248,          target: 0.193,          output: -0.014,          loss: 0.065
i: 249,          target: -0.078,         output: -0.056,          loss: 0.004
i: 250,          target: 0.079,          output: -0.104,          loss: 0.012
i: 251,          target: 0.016,          output: -0.034,          loss: 0.002
```

```
i: 252,         target: -0.085,         output: -0.046,         loss: 0.001
i: 253,         target: -0.052,         output: -0.098,         loss: 0.001
i: 254,         target: -0.077,         output: -0.084,         loss: 0.002
i: 255,         target: 0.196,          output: -0.032,         loss: 0.087
i: 256,         target: -0.058,         output: -0.026,         loss: 0.002
i: 257,         target: -0.098,         output: -0.056,         loss: 0.001
i: 258,         target: 0.205,          output: -0.020,         loss: 0.043
i: 259,         target: -0.051,         output: -0.066,         loss: 0.000
i: 260,         target: -0.092,         output: -0.104,         loss: 0.010
i: 261,         target: -0.062,         output: -0.008,         loss: 0.000
i: 262,         target: -0.074,         output: -0.092,         loss: 0.000
i: 263,         target: -0.072,         output: 0.020,          loss: 0.000
i: 264,         target: -0.031,         output: -0.078,         loss: 0.000
i: 265,         target: 0.197,          output: -0.054,         loss: 0.077
i: 266,         target: 0.043,          output: -0.050,         loss: 0.006
i: 267,         target: 0.155,          output: -0.064,         loss: 0.034
i: 268,         target: -0.050,         output: -0.010,         loss: 0.001
i: 269,         target: -0.063,         output: -0.104,         loss: 0.000
i: 270,         target: -0.076,         output: -0.028,         loss: 0.000
i: 271,         target: -0.122,         output: -0.076,         loss: 0.006
i: 272,         target: -0.100,         output: -0.066,         loss: 0.000
i: 273,         target: -0.104,         output: -0.058,         loss: 0.001
i: 274,         target: 0.100,          output: -0.066,         loss: 0.030
i: 275,         target: 0.178,          output: -0.120,         loss: 0.109
i: 276,         target: -0.072,         output: -0.084,         loss: 0.000
i: 277,         target: -0.076,         output: -0.024,         loss: 0.001
i: 278,         target: 0.482,          output: -0.062,         loss: 0.389
i: 279,         target: 0.223,          output: -0.036,         loss: 0.083
i: 280,         target: 0.159,          output: -0.080,         loss: 0.019
i: 281,         target: -0.073,         output: -0.096,         loss: 0.003
i: 282,         target: -0.091,         output: -0.056,         loss: 0.001
i: 283,         target: -0.010,         output: -0.054,         loss: 0.001
i: 284,         target: -0.042,         output: -0.076,         loss: 0.000
i: 285,         target: -0.073,         output: -0.032,         loss: 0.001
i: 286,         target: -0.033,         output: -0.028,         loss: 0.000
i: 287,         target: 0.012,          output: -0.072,         loss: 0.000
i: 288,         target: -0.061,         output: -0.090,         loss: 0.009
i: 289,         target: -0.060,         output: -0.028,         loss: 0.000
i: 290,         target: -0.052,         output: 0.046,          loss: 0.000
i: 291,         target: -0.053,         output: -0.050,         loss: 0.001
i: 292,         target: -0.117,         output: -0.072,         loss: 0.005
i: 293,         target: 0.197,          output: -0.022,         loss: 0.067
i: 294,         target: 0.292,          output: 0.004,          loss: 0.120
i: 295,         target: -0.064,         output: -0.014,         loss: 0.000
i: 296,         target: -0.068,         output: -0.030,         loss: 0.000
i: 297,         target: -0.069,         output: -0.010,         loss: 0.000
i: 298,         target: -0.065,         output: -0.054,         loss: 0.001
i: 299,         target: 0.177,          output: -0.054,         loss: 0.081
```

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i: 300,         target: -0.074,         output: -0.084,         loss: 0.007
i: 301,         target: 0.222,          output: -0.084,         loss: 0.104
i: 302,         target: -0.070,         output: -0.048,         loss: 0.000
i: 303,         target: -0.048,         output: 0.008,          loss: 0.000
i: 304,         target: -0.045,         output: -0.028,         loss: 0.001
i: 305,         target: -0.075,         output: -0.076,         loss: 0.001
i: 306,         target: 0.181,          output: 0.000,          loss: 0.048
i: 307,         target: -0.106,         output: -0.072,         loss: 0.006
i: 308,         target: 0.037,          output: -0.028,         loss: 0.005
i: 309,         target: 0.191,          output: -0.110,         loss: 0.071
i: 310,         target: 0.090,          output: -0.124,         loss: 0.017
i: 311,         target: -0.045,         output: -0.040,         loss: 0.000
i: 312,         target: -0.055,         output: -0.058,         loss: 0.001
i: 313,         target: 0.180,          output: -0.032,         loss: 0.038
i: 314,         target: 0.163,          output: -0.036,         loss: 0.035
i: 315,         target: -0.031,         output: -0.044,         loss: 0.003
i: 316,         target: 0.171,          output: -0.068,         loss: 0.046
i: 317,         target: -0.103,         output: -0.026,         loss: 0.002
i: 318,         target: -0.040,         output: -0.082,         loss: 0.000
i: 319,         target: -0.063,         output: -0.042,         loss: 0.001
i: 320,         target: -0.071,         output: 0.000,          loss: 0.000
i: 321,         target: 0.095,          output: -0.034,         loss: 0.011
i: 322,         target: 0.194,          output: -0.066,         loss: 0.054
i: 323,         target: 0.460,          output: -0.108,         loss: 0.250
i: 324,         target: -0.096,         output: -0.054,         loss: 0.002
i: 325,         target: -0.057,         output: -0.038,         loss: 0.000
i: 326,         target: -0.071,         output: -0.010,         loss: 0.001
i: 327,         target: 0.214,          output: -0.098,         loss: 0.080
i: 328,         target: -0.072,         output: -0.054,         loss: 0.001
i: 329,         target: 0.244,          output: -0.060,         loss: 0.125
i: 330,         target: -0.075,         output: -0.032,         loss: 0.000
i: 331,         target: 0.087,          output: -0.064,         loss: 0.017
i: 332,         target: -0.094,         output: -0.056,         loss: 0.000
i: 333,         target: -0.063,         output: -0.110,         loss: 0.000
i: 334,         target: -0.085,         output: -0.048,         loss: 0.000
i: 335,         target: 0.198,          output: -0.066,         loss: 0.067
i: 336,         target: -0.074,         output: -0.014,         loss: 0.005
i: 337,         target: 0.142,          output: -0.078,         loss: 0.045
i: 338,         target: -0.086,         output: -0.046,         loss: 0.001
i: 339,         target: -0.082,         output: 0.016,          loss: 0.001
i: 340,         target: -0.032,         output: -0.032,         loss: 0.002
i: 341,         target: -0.024,         output: -0.016,         loss: 0.002
i: 342,         target: 0.249,          output: -0.048,         loss: 0.106
i: 343,         target: 0.049,          output: -0.078,         loss: 0.009
i: 344,         target: -0.083,         output: -0.040,         loss: 0.010
i: 345,         target: 0.221,          output: -0.122,         loss: 0.063
i: 346,         target: -0.085,         output: -0.036,         loss: 0.000
i: 347,         target: -0.074,         output: 0.014,          loss: 0.000
```

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i: 348,         target: 0.023,         output: -0.104,         loss: 0.008
i: 349,         target: -0.081,        output: -0.040,         loss: 0.005
i: 350,         target: -0.059,        output: -0.066,         loss: 0.001
i: 351,         target: 0.140,         output: -0.036,         loss: 0.030
i: 352,         target: -0.076,        output: -0.048,         loss: 0.009
i: 353,         target: 0.223,         output: -0.084,         loss: 0.069
i: 354,         target: 0.487,         output: -0.044,         loss: 0.297
i: 355,         target: -0.062,        output: -0.058,         loss: 0.000
i: 356,         target: -0.087,        output: -0.054,         loss: 0.000
i: 357,         target: 0.144,         output: -0.046,         loss: 0.026
i: 358,         target: -0.069,        output: -0.064,         loss: 0.001
i: 359,         target: -0.077,        output: -0.042,         loss: 0.000
i: 360,         target: 0.005,         output: -0.046,         loss: 0.003
i: 361,         target: -0.096,        output: -0.114,         loss: 0.003
i: 362,         target: -0.068,        output: -0.108,         loss: 0.004
i: 363,         target: 0.088,         output: -0.018,         loss: 0.023
i: 364,         target: -0.085,        output: -0.140,         loss: 0.005
i: 365,         target: -0.083,        output: -0.042,         loss: 0.010
i: 366,         target: -0.073,        output: -0.088,         loss: 0.000
i: 367,         target: -0.084,        output: -0.018,         loss: 0.001
i: 368,         target: -0.101,        output: -0.068,         loss: 0.000
i: 369,         target: 0.119,         output: -0.088,         loss: 0.018
i: 370,         target: -0.067,        output: -0.040,         loss: 0.000
i: 371,         target: 0.198,         output: -0.068,         loss: 0.038
i: 372,         target: -0.109,        output: -0.048,         loss: 0.003
i: 373,         target: 0.009,         output: -0.056,         loss: 0.006
i: 374,         target: 0.073,         output: -0.096,         loss: 0.019
i: 375,         target: -0.082,        output: -0.058,         loss: 0.000
i: 376,         target: -0.073,        output: -0.026,         loss: 0.000
i: 377,         target: -0.088,        output: 0.014,          loss: 0.000
i: 378,         target: -0.053,        output: -0.008,         loss: 0.002
i: 379,         target: -0.074,        output: -0.072,         loss: 0.003
i: 380,         target: -0.079,        output: -0.032,         loss: 0.000
i: 381,         target: -0.065,        output: -0.036,         loss: 0.001
i: 382,         target: -0.067,        output: -0.042,         loss: 0.000
i: 383,         target: -0.040,        output: -0.084,         loss: 0.001
i: 384,         target: -0.015,        output: -0.034,         loss: 0.003
i: 385,         target: -0.039,        output: -0.074,         loss: 0.000
i: 386,         target: 0.207,         output: -0.054,         loss: 0.096
i: 387,         target: -0.075,        output: -0.026,         loss: 0.000
i: 388,         target: -0.059,        output: -0.002,         loss: 0.001
i: 389,         target: 0.205,         output: -0.052,         loss: 0.085
i: 390,         target: -0.044,        output: -0.068,         loss: 0.000
i: 391,         target: 0.098,         output: -0.052,         loss: 0.029
i: 392,         target: 0.170,         output: -0.052,         loss: 0.063
i: 393,         target: 0.130,         output: -0.124,         loss: 0.030
i: 394,         target: -0.065,        output: -0.036,         loss: 0.000
i: 395,         target: -0.071,        output: -0.074,         loss: 0.000
```

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i: 396,         target: 0.177,         output: -0.056,         loss: 0.093
i: 397,         target: -0.061,        output: -0.054,         loss: 0.001
i: 398,         target: 0.195,         output: -0.050,         loss: 0.063
i: 399,         target: 0.215,         output: -0.066,         loss: 0.081
i: 400,         target: -0.053,        output: -0.068,         loss: 0.001
i: 401,         target: -0.072,        output: -0.046,         loss: 0.000
i: 402,         target: -0.100,        output: -0.072,         loss: 0.001
i: 403,         target: -0.087,        output: -0.006,         loss: 0.000
i: 404,         target: -0.104,        output: -0.054,         loss: 0.002
i: 405,         target: 0.031,         output: -0.068,         loss: 0.005
i: 406,         target: 0.145,         output: -0.028,         loss: 0.037
i: 407,         target: -0.077,        output: -0.032,         loss: 0.007
i: 408,         target: -0.039,        output: -0.064,         loss: 0.000
i: 409,         target: -0.052,        output: -0.024,         loss: 0.000
i: 410,         target: -0.037,        output: -0.046,         loss: 0.000
i: 411,         target: -0.070,        output: -0.052,         loss: 0.002
i: 412,         target: -0.073,        output: -0.064,         loss: 0.000
i: 413,         target: 0.179,         output: -0.112,         loss: 0.035
i: 414,         target: -0.030,        output: -0.042,         loss: 0.000
i: 415,         target: -0.101,        output: -0.078,         loss: 0.000
i: 416,         target: 0.191,         output: -0.038,         loss: 0.059
i: 417,         target: 0.146,         output: -0.138,         loss: 0.056
i: 418,         target: -0.084,        output: 0.002,          loss: 0.000
i: 419,         target: 0.194,         output: -0.034,         loss: 0.093
i: 420,         target: -0.086,        output: -0.032,         loss: 0.001
i: 421,         target: -0.088,        output: -0.074,         loss: 0.005
i: 422,         target: -0.076,        output: -0.052,         loss: 0.002
i: 423,         target: 0.218,         output: -0.054,         loss: 0.051
i: 424,         target: 0.143,         output: -0.080,         loss: 0.022
i: 425,         target: 0.112,         output: -0.066,         loss: 0.025
i: 426,         target: -0.065,        output: -0.036,         loss: 0.001
i: 427,         target: 0.153,         output: -0.096,         loss: 0.038
i: 428,         target: -0.093,        output: -0.072,         loss: 0.012
i: 429,         target: -0.064,        output: -0.064,         loss: 0.000
i: 430,         target: -0.058,        output: -0.048,         loss: 0.003
i: 431,         target: 0.442,         output: -0.072,         loss: 0.240
i: 432,         target: -0.075,        output: -0.058,         loss: 0.001
i: 433,         target: 0.293,         output: -0.090,         loss: 0.138
i: 434,         target: -0.009,        output: -0.042,         loss: 0.010
i: 435,         target: -0.100,        output: -0.042,         loss: 0.007
i: 436,         target: 0.107,         output: -0.034,         loss: 0.024
i: 437,         target: -0.063,        output: -0.044,         loss: 0.001
i: 438,         target: -0.072,        output: -0.094,         loss: 0.002
i: 439,         target: -0.076,        output: -0.048,         loss: 0.000
i: 440,         target: -0.028,        output: -0.052,         loss: 0.001
i: 441,         target: -0.084,        output: -0.098,         loss: 0.000
i: 442,         target: -0.054,        output: -0.078,         loss: 0.000
i: 443,         target: 0.086,         output: -0.042,         loss: 0.020
```

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i: 444,         target: -0.055,         output: -0.080,         loss: 0.004
i: 445,         target: 0.038,          output: -0.088,         loss: 0.012
i: 446,         target: -0.061,         output: -0.010,         loss: 0.003
i: 447,         target: -0.039,         output: -0.040,         loss: 0.002
i: 448,         target: -0.073,         output: -0.020,         loss: 0.002
i: 449,         target: -0.061,         output: -0.070,         loss: 0.000
i: 450,         target: -0.067,         output: -0.014,         loss: 0.000
i: 451,         target: 0.125,          output: 0.018,          loss: 0.062
i: 452,         target: 0.233,          output: -0.078,         loss: 0.098
i: 453,         target: -0.054,         output: -0.032,         loss: 0.004
i: 454,         target: -0.069,         output: 0.002,          loss: 0.003
i: 455,         target: -0.034,         output: -0.080,         loss: 0.000
i: 456,         target: -0.073,         output: -0.038,         loss: 0.002
i: 457,         target: 0.143,          output: -0.054,         loss: 0.041
i: 458,         target: 0.200,          output: -0.096,         loss: 0.044
i: 459,         target: 0.181,          output: -0.050,         loss: 0.044
i: 460,         target: 0.207,          output: -0.026,         loss: 0.075
i: 461,         target: -0.071,         output: -0.040,         loss: 0.000
i: 462,         target: -0.072,         output: -0.062,         loss: 0.000
i: 463,         target: 0.134,          output: -0.068,         loss: 0.060
i: 464,         target: 0.019,          output: -0.038,         loss: 0.004
i: 465,         target: 0.180,          output: -0.016,         loss: 0.048
i: 466,         target: -0.034,         output: -0.044,         loss: 0.002
i: 467,         target: -0.067,         output: -0.024,         loss: 0.000
i: 468,         target: 0.056,          output: -0.114,         loss: 0.012
i: 469,         target: -0.091,         output: -0.040,         loss: 0.002
i: 470,         target: 0.185,          output: -0.102,         loss: 0.052
i: 471,         target: -0.072,         output: -0.086,         loss: 0.000
i: 472,         target: 0.072,          output: -0.062,         loss: 0.021
i: 473,         target: 0.132,          output: -0.052,         loss: 0.051
i: 474,         target: -0.052,         output: -0.128,         loss: 0.003
i: 475,         target: -0.028,         output: -0.016,         loss: 0.001
i: 476,         target: -0.106,         output: -0.048,         loss: 0.005
i: 477,         target: 0.018,          output: -0.054,         loss: 0.003
i: 478,         target: -0.098,         output: -0.060,         loss: 0.001
i: 479,         target: -0.055,         output: -0.070,         loss: 0.000
i: 480,         target: -0.076,         output: -0.082,         loss: 0.000
i: 481,         target: 0.169,          output: -0.042,         loss: 0.031
i: 482,         target: -0.039,         output: -0.078,         loss: 0.000
i: 483,         target: -0.110,         output: 0.032,          loss: 0.007
i: 484,         target: -0.073,         output: -0.152,         loss: 0.007
i: 485,         target: 0.174,          output: -0.078,         loss: 0.064
i: 486,         target: 0.139,          output: -0.076,         loss: 0.063
i: 487,         target: 0.302,          output: -0.042,         loss: 0.137
i: 488,         target: 0.200,          output: -0.064,         loss: 0.069
i: 489,         target: -0.055,         output: -0.026,         loss: 0.002
i: 490,         target: 0.095,          output: -0.004,         loss: 0.022
i: 491,         target: -0.077,         output: -0.076,         loss: 0.000
```

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i: 492,         target: -0.028,         output: -0.028,         loss: 0.001
i: 493,         target: 0.028,          output: -0.068,         loss: 0.009
i: 494,         target: -0.051,         output: -0.024,         loss: 0.000
i: 495,         target: 0.152,          output: -0.090,         loss: 0.043
i: 496,         target: 0.238,          output: -0.064,         loss: 0.080
i: 497,         target: 0.174,          output: -0.048,         loss: 0.055
i: 498,         target: 0.115,          output: -0.006,         loss: 0.045
i: 499,         target: -0.086,         output: -0.050,         loss: 0.002
i: 500,         target: 0.174,          output: -0.050,         loss: 0.061
i: 501,         target: -0.106,         output: -0.060,         loss: 0.001
i: 502,         target: -0.086,         output: -0.054,         loss: 0.004
i: 503,         target: 0.107,          output: -0.028,         loss: 0.035
i: 504,         target: -0.051,         output: -0.048,         loss: 0.000
i: 505,         target: -0.040,         output: -0.060,         loss: 0.000
i: 506,         target: -0.073,         output: -0.028,         loss: 0.001
i: 507,         target: 0.076,          output: -0.048,         loss: 0.035
i: 508,         target: 0.192,          output: 0.016,          loss: 0.065
i: 509,         target: -0.002,         output: -0.062,         loss: 0.003
i: 510,         target: 0.058,          output: -0.024,         loss: 0.008
i: 511,         target: 0.354,          output: -0.110,         loss: 0.196
i: 512,         target: -0.059,         output: -0.066,         loss: 0.001
i: 513,         target: -0.069,         output: -0.018,         loss: 0.000
i: 514,         target: -0.081,         output: -0.048,         loss: 0.001
i: 515,         target: -0.088,         output: -0.088,         loss: 0.000
i: 516,         target: 0.220,          output: -0.080,         loss: 0.064
i: 517,         target: -0.038,         output: 0.010,          loss: 0.001
i: 518,         target: 0.190,          output: -0.068,         loss: 0.071
i: 519,         target: 0.164,          output: -0.078,         loss: 0.060
i: 520,         target: 0.219,          output: -0.026,         loss: 0.062
i: 521,         target: -0.050,         output: -0.066,         loss: 0.000
i: 522,         target: -0.055,         output: -0.086,         loss: 0.000
i: 523,         target: -0.050,         output: -0.080,         loss: 0.000
i: 524,         target: -0.055,         output: -0.080,         loss: 0.000
i: 525,         target: 0.036,          output: -0.088,         loss: 0.010
i: 526,         target: 0.112,          output: -0.028,         loss: 0.026
i: 527,         target: 0.164,          output: -0.052,         loss: 0.052
i: 528,         target: -0.083,         output: -0.100,         loss: 0.000
i: 529,         target: 0.065,          output: -0.106,         loss: 0.021
i: 530,         target: -0.010,         output: -0.044,         loss: 0.008
i: 531,         target: 0.022,          output: -0.038,         loss: 0.005
i: 532,         target: -0.047,         output: -0.062,         loss: 0.005
i: 533,         target: 0.097,          output: -0.038,         loss: 0.031
i: 534,         target: -0.049,         output: -0.104,         loss: 0.003
i: 535,         target: -0.034,         output: -0.082,         loss: 0.001
i: 536,         target: 0.137,          output: -0.062,         loss: 0.056
i: 537,         target: 0.177,          output: -0.094,         loss: 0.051
i: 538,         target: -0.104,         output: 0.002,          loss: 0.001
i: 539,         target: -0.065,         output: -0.100,         loss: 0.000
```

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i: 540,         target: -0.091,         output: -0.064,         loss: 0.002
i: 541,         target: -0.048,         output: -0.090,         loss: 0.004
i: 542,         target: -0.072,         output: -0.060,         loss: 0.001
i: 543,         target: 0.028,          output: -0.084,         loss: 0.004
i: 544,         target: -0.083,         output: -0.046,         loss: 0.002
i: 545,         target: -0.071,         output: -0.036,         loss: 0.000
i: 546,         target: 0.043,          output: -0.090,         loss: 0.015
i: 547,         target: 0.193,          output: -0.026,         loss: 0.048
i: 548,         target: -0.079,         output: -0.076,         loss: 0.005
i: 549,         target: -0.021,         output: -0.062,         loss: 0.003
i: 550,         target: 0.028,          output: -0.044,         loss: 0.006
i: 551,         target: -0.055,         output: -0.032,         loss: 0.001
i: 552,         target: -0.078,         output: -0.072,         loss: 0.002
i: 553,         target: -0.074,         output: -0.032,         loss: 0.001
i: 554,         target: 0.090,          output: -0.098,         loss: 0.032
i: 555,         target: -0.077,         output: -0.060,         loss: 0.001
i: 556,         target: 0.094,          output: -0.030,         loss: 0.010
i: 557,         target: -0.052,         output: -0.046,         loss: 0.000
i: 558,         target: -0.087,         output: -0.036,         loss: 0.000
i: 559,         target: 0.132,          output: -0.012,         loss: 0.031
i: 560,         target: 0.190,          output: -0.092,         loss: 0.080
i: 561,         target: -0.088,         output: -0.102,         loss: 0.001
i: 562,         target: -0.075,         output: -0.124,         loss: 0.005
i: 563,         target: -0.085,         output: -0.014,         loss: 0.003
i: 564,         target: -0.067,         output: -0.090,         loss: 0.000
i: 565,         target: 0.460,          output: -0.042,         loss: 0.298
i: 566,         target: 0.015,          output: -0.132,         loss: 0.002
i: 567,         target: 0.193,          output: -0.094,         loss: 0.077
i: 568,         target: -0.065,         output: -0.028,         loss: 0.001
i: 569,         target: -0.050,         output: -0.008,         loss: 0.000
i: 570,         target: 0.499,          output: -0.054,         loss: 0.310
i: 571,         target: 0.191,          output: -0.098,         loss: 0.067
i: 572,         target: -0.062,         output: -0.006,         loss: 0.000
i: 573,         target: -0.065,         output: -0.054,         loss: 0.001
i: 574,         target: -0.034,         output: -0.060,         loss: 0.010
i: 575,         target: -0.056,         output: -0.062,         loss: 0.000
i: 576,         target: 0.142,          output: -0.066,         loss: 0.038
i: 577,         target: 0.090,          output: -0.012,         loss: 0.013
i: 578,         target: -0.056,         output: -0.072,         loss: 0.001
i: 579,         target: 0.138,          output: -0.034,         loss: 0.033
i: 580,         target: -0.096,         output: -0.108,         loss: 0.006
i: 581,         target: -0.092,         output: -0.088,         loss: 0.001
i: 582,         target: 0.118,          output: -0.090,         loss: 0.016
i: 583,         target: 0.181,          output: -0.006,         loss: 0.044
i: 584,         target: -0.049,         output: -0.040,         loss: 0.000
i: 585,         target: 0.396,          output: -0.046,         loss: 0.212
i: 586,         target: -0.060,         output: -0.052,         loss: 0.006
i: 587,         target: -0.112,         output: -0.004,         loss: 0.006
```

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i: 588,         target: 0.015,         output: -0.064,         loss: 0.003
i: 589,         target: 0.170,         output: -0.064,         loss: 0.061
i: 590,         target: 0.022,         output: -0.056,         loss: 0.000
i: 591,         target: -0.074,        output: -0.064,         loss: 0.003
i: 592,         target: 0.195,         output: -0.044,         loss: 0.028
i: 593,         target: -0.069,        output: -0.144,         loss: 0.001
i: 594,         target: -0.073,        output: -0.078,         loss: 0.002
i: 595,         target: -0.083,        output: -0.084,         loss: 0.002
i: 596,         target: -0.019,        output: -0.144,         loss: 0.001
i: 597,         target: 0.070,         output: -0.064,         loss: 0.005
i: 598,         target: -0.053,        output: -0.048,         loss: 0.000
i: 599,         target: 0.224,         output: -0.036,         loss: 0.054
i: 600,         target: -0.017,        output: -0.036,         loss: 0.001
i: 601,         target: 0.023,         output: -0.016,         loss: 0.006
i: 602,         target: -0.081,        output: -0.038,         loss: 0.002
i: 603,         target: -0.055,        output: -0.048,         loss: 0.002
i: 604,         target: -0.050,        output: -0.094,         loss: 0.002
i: 605,         target: -0.039,        output: -0.042,         loss: 0.002
i: 606,         target: 0.180,         output: -0.064,         loss: 0.056
i: 607,         target: -0.053,        output: -0.110,         loss: 0.000
i: 608,         target: -0.069,        output: -0.054,         loss: 0.000
i: 609,         target: -0.037,        output: 0.008,          loss: 0.000
i: 610,         target: -0.053,        output: -0.064,         loss: 0.002
i: 611,         target: -0.086,        output: -0.096,         loss: 0.001
i: 612,         target: -0.096,        output: -0.012,         loss: 0.009
i: 613,         target: -0.074,        output: -0.050,         loss: 0.001
i: 614,         target: 0.108,         output: -0.082,         loss: 0.037
i: 615,         target: -0.069,        output: -0.082,         loss: 0.000
i: 616,         target: -0.065,        output: -0.050,         loss: 0.006
i: 617,         target: -0.072,        output: -0.010,         loss: 0.000
i: 618,         target: 0.169,         output: -0.044,         loss: 0.041
i: 619,         target: -0.012,        output: -0.058,         loss: 0.000
i: 620,         target: -0.046,        output: -0.046,         loss: 0.000
i: 621,         target: 0.125,         output: -0.056,         loss: 0.018
i: 622,         target: -0.055,        output: -0.008,         loss: 0.001
i: 623,         target: -0.079,        output: -0.096,         loss: 0.002
i: 624,         target: 0.119,         output: -0.074,         loss: 0.045
i: 625,         target: -0.065,        output: -0.050,         loss: 0.000
i: 626,         target: 0.018,         output: -0.076,         loss: 0.011
i: 627,         target: -0.079,        output: 0.010,          loss: 0.007
i: 628,         target: -0.058,        output: -0.026,         loss: 0.000
i: 629,         target: -0.041,        output: -0.080,         loss: 0.000
i: 630,         target: -0.090,        output: -0.062,         loss: 0.000
i: 631,         target: -0.010,        output: -0.082,         loss: 0.000
i: 632,         target: -0.000,        output: 0.002,          loss: 0.009
i: 633,         target: -0.048,        output: -0.030,         loss: 0.000
i: 634,         target: 0.192,         output: -0.102,         loss: 0.041
i: 635,         target: -0.098,        output: -0.042,         loss: 0.010
```

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i: 636,         target: -0.052,         output: -0.016,         loss: 0.000
i: 637,         target: 0.195,          output: -0.032,         loss: 0.092
i: 638,         target: 0.491,          output: -0.072,         loss: 0.253
i: 639,         target: 0.063,          output: -0.054,         loss: 0.031
i: 640,         target: -0.102,         output: -0.110,         loss: 0.005
i: 641,         target: -0.049,         output: -0.066,         loss: 0.000
i: 642,         target: -0.069,         output: -0.018,         loss: 0.000
i: 643,         target: 0.267,          output: -0.064,         loss: 0.111
i: 644,         target: -0.085,         output: -0.084,         loss: 0.006
i: 645,         target: 0.032,          output: -0.066,         loss: 0.008
i: 646,         target: 0.102,          output: -0.118,         loss: 0.012
i: 647,         target: 0.129,          output: -0.072,         loss: 0.018
i: 648,         target: -0.029,         output: -0.086,         loss: 0.000
i: 649,         target: -0.084,         output: -0.086,         loss: 0.005
i: 650,         target: -0.063,         output: -0.038,         loss: 0.002
i: 651,         target: -0.047,         output: -0.026,         loss: 0.001
i: 652,         target: -0.055,         output: -0.040,         loss: 0.000
i: 653,         target: -0.045,         output: -0.032,         loss: 0.000
i: 654,         target: -0.055,         output: -0.078,         loss: 0.000
i: 655,         target: -0.085,         output: -0.102,         loss: 0.000
i: 656,         target: 0.165,          output: 0.008,          loss: 0.045
i: 657,         target: 0.174,          output: -0.086,         loss: 0.024
i: 658,         target: -0.063,         output: -0.056,         loss: 0.001
i: 659,         target: 0.164,          output: -0.120,         loss: 0.059
i: 660,         target: -0.073,         output: -0.034,         loss: 0.000
i: 661,         target: 0.116,          output: -0.088,         loss: 0.046
i: 662,         target: 0.199,          output: -0.036,         loss: 0.043
i: 663,         target: 0.142,          output: -0.060,         loss: 0.024
i: 664,         target: 0.192,          output: -0.022,         loss: 0.070
i: 665,         target: -0.091,         output: -0.114,         loss: 0.001
i: 666,         target: -0.073,         output: -0.072,         loss: 0.001
i: 667,         target: -0.069,         output: 0.002,          loss: 0.000
i: 668,         target: 0.189,          output: -0.084,         loss: 0.038
i: 669,         target: -0.063,         output: -0.034,         loss: 0.006
i: 670,         target: -0.032,         output: -0.074,         loss: 0.001
i: 671,         target: 0.145,          output: -0.082,         loss: 0.047
i: 672,         target: -0.076,         output: -0.042,         loss: 0.001
i: 673,         target: -0.078,         output: -0.050,         loss: 0.000
i: 674,         target: -0.002,         output: 0.006,          loss: 0.004
i: 675,         target: 0.112,          output: -0.050,         loss: 0.020
i: 676,         target: 0.014,          output: -0.002,         loss: 0.005
i: 677,         target: 0.013,          output: -0.070,         loss: 0.013
i: 678,         target: -0.084,         output: -0.012,         loss: 0.000
i: 679,         target: 0.113,          output: -0.056,         loss: 0.032
i: 680,         target: -0.073,         output: -0.084,         loss: 0.001
i: 681,         target: 0.102,          output: -0.032,         loss: 0.021
i: 682,         target: 0.136,          output: -0.048,         loss: 0.029
i: 683,         target: 0.119,          output: -0.030,         loss: 0.029
```

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i: 684,         target: -0.076,         output: -0.036,         loss: 0.001
i: 685,         target: 0.134,          output: -0.082,         loss: 0.038
i: 686,         target: -0.043,         output: -0.064,         loss: 0.002
i: 687,         target: 0.186,          output: -0.020,         loss: 0.070
i: 688,         target: 0.251,          output: -0.042,         loss: 0.104
i: 689,         target: -0.017,         output: -0.032,         loss: 0.001
i: 690,         target: 0.173,          output: -0.030,         loss: 0.054
i: 691,         target: 0.143,          output: -0.070,         loss: 0.050
i: 692,         target: 0.055,          output: -0.020,         loss: 0.011
i: 693,         target: 0.195,          output: 0.000,          loss: 0.059
i: 694,         target: 0.046,          output: -0.074,         loss: 0.001
i: 695,         target: 0.039,          output: -0.104,         loss: 0.010
i: 696,         target: -0.051,         output: -0.062,         loss: 0.002
i: 697,         target: 0.205,          output: -0.060,         loss: 0.066
i: 698,         target: -0.074,         output: -0.066,         loss: 0.000
i: 699,         target: -0.080,         output: -0.048,         loss: 0.001
i: 700,         target: -0.087,         output: -0.002,         loss: 0.004
i: 701,         target: 0.083,          output: -0.096,         loss: 0.008
i: 702,         target: -0.083,         output: -0.070,         loss: 0.001
i: 703,         target: -0.033,         output: -0.070,         loss: 0.001
i: 704,         target: -0.062,         output: -0.044,         loss: 0.003
i: 705,         target: -0.073,         output: -0.020,         loss: 0.002
i: 706,         target: 0.081,          output: -0.062,         loss: 0.012
i: 707,         target: 0.149,          output: -0.108,         loss: 0.055
i: 708,         target: -0.076,         output: -0.036,         loss: 0.004
i: 709,         target: 0.112,          output: -0.082,         loss: 0.038
i: 710,         target: -0.072,         output: -0.012,         loss: 0.000
i: 711,         target: -0.102,         output: 0.024,          loss: 0.006
i: 712,         target: -0.063,         output: -0.076,         loss: 0.000
i: 713,         target: -0.045,         output: -0.026,         loss: 0.002
i: 714,         target: -0.064,         output: -0.064,         loss: 0.000
i: 715,         target: -0.095,         output: -0.096,         loss: 0.000
i: 716,         target: 0.206,          output: -0.044,         loss: 0.052
i: 717,         target: -0.074,         output: -0.082,         loss: 0.000
i: 718,         target: -0.079,         output: -0.042,         loss: 0.004
i: 719,         target: -0.057,         output: -0.046,         loss: 0.001
i: 720,         target: 0.242,          output: -0.038,         loss: 0.092
i: 721,         target: 0.038,          output: -0.068,         loss: 0.001
i: 722,         target: 0.091,          output: -0.084,         loss: 0.023
i: 723,         target: 0.059,          output: -0.090,         loss: 0.012
i: 724,         target: -0.050,         output: 0.006,          loss: 0.000
i: 725,         target: -0.085,         output: -0.014,         loss: 0.002
i: 726,         target: 0.197,          output: -0.100,         loss: 0.066
i: 727,         target: 0.026,          output: -0.028,         loss: 0.002
i: 728,         target: 0.229,          output: -0.044,         loss: 0.085
i: 729,         target: -0.061,         output: -0.008,         loss: 0.003
i: 730,         target: 0.010,          output: -0.024,         loss: 0.001
i: 731,         target: 0.221,          output: -0.032,         loss: 0.068
```

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i: 732,         target: 0.027,         output: -0.020,         loss: 0.016
i: 733,         target: 0.208,         output: -0.106,         loss: 0.056
i: 734,         target: 0.314,         output: -0.034,         loss: 0.192
i: 735,         target: -0.074,        output: -0.020,         loss: 0.002
i: 736,         target: -0.052,        output: -0.072,         loss: 0.005
i: 737,         target: -0.059,        output: -0.024,         loss: 0.000
i: 738,         target: 0.113,         output: -0.038,         loss: 0.018
i: 739,         target: 0.124,         output: -0.072,         loss: 0.024
i: 740,         target: -0.044,        output: -0.026,         loss: 0.000
i: 741,         target: 0.128,         output: -0.020,         loss: 0.035
i: 742,         target: -0.086,        output: -0.060,         loss: 0.002
i: 743,         target: -0.094,        output: -0.042,         loss: 0.005
i: 744,         target: -0.087,        output: -0.068,         loss: 0.002
i: 745,         target: 0.120,         output: 0.002,          loss: 0.052
i: 746,         target: -0.085,        output: -0.018,         loss: 0.000
i: 747,         target: 0.055,         output: -0.032,         loss: 0.019
i: 748,         target: 0.175,         output: -0.088,         loss: 0.039
i: 749,         target: -0.105,        output: -0.038,         loss: 0.003
i: 750,         target: -0.021,        output: -0.054,         loss: 0.010
i: 751,         target: 0.023,         output: -0.052,         loss: 0.001
i: 752,         target: -0.104,        output: -0.068,         loss: 0.004
i: 753,         target: 0.163,         output: -0.028,         loss: 0.050
i: 754,         target: 0.184,         output: -0.088,         loss: 0.032
i: 755,         target: -0.079,        output: -0.078,         loss: 0.001
i: 756,         target: 0.154,         output: -0.070,         loss: 0.057
i: 757,         target: -0.039,        output: -0.070,         loss: 0.001
i: 758,         target: -0.096,        output: -0.038,         loss: 0.001
i: 759,         target: 0.120,         output: -0.080,         loss: 0.017
i: 760,         target: 0.038,         output: -0.052,         loss: 0.017
i: 761,         target: -0.042,        output: -0.092,         loss: 0.003
i: 762,         target: 0.140,         output: 0.004,          loss: 0.028
i: 763,         target: 0.186,         output: -0.036,         loss: 0.061
i: 764,         target: -0.044,        output: -0.128,         loss: 0.000
i: 765,         target: -0.059,        output: -0.112,         loss: 0.000
i: 766,         target: -0.069,        output: -0.072,         loss: 0.001
i: 767,         target: -0.035,        output: -0.068,         loss: 0.001
i: 768,         target: -0.108,        output: -0.068,         loss: 0.003
i: 769,         target: -0.088,        output: -0.026,         loss: 0.000
i: 770,         target: -0.074,        output: -0.034,         loss: 0.001
i: 771,         target: -0.077,        output: -0.044,         loss: 0.004
i: 772,         target: -0.071,        output: -0.054,         loss: 0.001
i: 773,         target: 0.008,         output: -0.048,         loss: 0.000
i: 774,         target: 0.485,         output: -0.076,         loss: 0.259
i: 775,         target: -0.064,        output: -0.050,         loss: 0.001
i: 776,         target: -0.087,        output: 0.002,          loss: 0.007
i: 777,         target: -0.055,        output: -0.026,         loss: 0.001
i: 778,         target: -0.081,        output: -0.092,         loss: 0.005
i: 779,         target: -0.052,        output: -0.068,         loss: 0.003
```

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i: 780,         target: 0.222,         output: -0.068,         loss: 0.061
i: 781,         target: 0.014,         output: -0.036,         loss: 0.006
i: 782,         target: 0.022,         output: -0.018,         loss: 0.005
i: 783,         target: -0.038,        output: -0.058,         loss: 0.001
i: 784,         target: 0.155,         output: -0.040,         loss: 0.029
i: 785,         target: -0.099,        output: -0.056,         loss: 0.002
i: 786,         target: -0.093,        output: -0.050,         loss: 0.004
i: 787,         target: 0.239,         output: -0.076,         loss: 0.084
i: 788,         target: -0.077,        output: -0.086,         loss: 0.001
i: 789,         target: -0.053,        output: -0.034,         loss: 0.000
i: 790,         target: 0.233,         output: -0.076,         loss: 0.102
i: 791,         target: -0.052,        output: -0.014,         loss: 0.003
i: 792,         target: 0.062,         output: -0.020,         loss: 0.019
i: 793,         target: -0.080,        output: 0.008,          loss: 0.002
i: 794,         target: 0.025,         output: -0.026,         loss: 0.014
i: 795,         target: 0.036,         output: -0.062,         loss: 0.018
i: 796,         target: 0.058,         output: -0.080,         loss: 0.024
i: 797,         target: -0.073,        output: -0.116,         loss: 0.000
i: 798,         target: 0.396,         output: -0.100,         loss: 0.204
i: 799,         target: 0.202,         output: 0.030,          loss: 0.054
i: 800,         target: -0.081,        output: -0.040,         loss: 0.009
i: 801,         target: 0.232,         output: -0.034,         loss: 0.076
i: 802,         target: 0.189,         output: -0.046,         loss: 0.063
i: 803,         target: -0.066,        output: -0.062,         loss: 0.000
i: 804,         target: 0.200,         output: -0.080,         loss: 0.075
i: 805,         target: 0.175,         output: -0.012,         loss: 0.069
i: 806,         target: -0.095,        output: -0.016,         loss: 0.013
i: 807,         target: -0.078,        output: -0.036,         loss: 0.000
i: 808,         target: 0.119,         output: -0.038,         loss: 0.013
i: 809,         target: -0.083,        output: -0.044,         loss: 0.000
i: 810,         target: 0.178,         output: -0.046,         loss: 0.072
i: 811,         target: -0.077,        output: -0.062,         loss: 0.002
i: 812,         target: -0.068,        output: -0.074,         loss: 0.000
i: 813,         target: -0.084,        output: -0.062,         loss: 0.003
i: 814,         target: -0.081,        output: -0.016,         loss: 0.001
i: 815,         target: 0.227,         output: -0.006,         loss: 0.072
i: 816,         target: 0.302,         output: -0.032,         loss: 0.180
i: 817,         target: -0.080,        output: -0.050,         loss: 0.001
i: 818,         target: -0.075,        output: -0.010,         loss: 0.000
i: 819,         target: -0.060,        output: -0.098,         loss: 0.000
i: 820,         target: -0.104,        output: -0.072,         loss: 0.004
i: 821,         target: 0.144,         output: -0.052,         loss: 0.038
i: 822,         target: -0.072,        output: 0.002,          loss: 0.000
i: 823,         target: -0.094,        output: -0.072,         loss: 0.006
i: 824,         target: 0.188,         output: 0.002,          loss: 0.037
i: 825,         target: -0.041,        output: -0.064,         loss: 0.003
i: 826,         target: 0.100,         output: -0.064,         loss: 0.041
i: 827,         target: -0.035,        output: -0.078,         loss: 0.001
```

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i: 828,         target: 0.110,         output: -0.054,         loss: 0.017
i: 829,         target: 0.148,         output: -0.032,         loss: 0.043
i: 830,         target: -0.016,        output: -0.036,         loss: 0.000
i: 831,         target: 0.198,         output: -0.084,         loss: 0.058
i: 832,         target: 0.073,         output: -0.038,         loss: 0.015
i: 833,         target: -0.079,        output: -0.114,         loss: 0.008
i: 834,         target: -0.104,        output: -0.094,         loss: 0.000
i: 835,         target: -0.077,        output: -0.034,         loss: 0.000
i: 836,         target: 0.137,         output: 0.008,          loss: 0.024
i: 837,         target: 0.097,         output: -0.084,         loss: 0.016
i: 838,         target: -0.062,        output: -0.090,         loss: 0.001
i: 839,         target: -0.066,        output: -0.106,         loss: 0.000
i: 840,         target: 0.203,         output: -0.112,         loss: 0.078
i: 841,         target: -0.050,        output: 0.012,          loss: 0.000
i: 842,         target: 0.213,         output: -0.066,         loss: 0.074
i: 843,         target: 0.144,         output: -0.034,         loss: 0.030
i: 844,         target: -0.053,        output: -0.056,         loss: 0.000
i: 845,         target: -0.057,        output: -0.026,         loss: 0.001
i: 846,         target: 0.140,         output: -0.054,         loss: 0.044
i: 847,         target: 0.096,         output: -0.036,         loss: 0.026
i: 848,         target: -0.094,        output: -0.026,         loss: 0.001
i: 849,         target: -0.052,        output: -0.018,         loss: 0.000
i: 850,         target: -0.040,        output: -0.070,         loss: 0.000
i: 851,         target: -0.077,        output: -0.076,         loss: 0.001
i: 852,         target: -0.053,        output: -0.066,         loss: 0.004
i: 853,         target: 0.223,         output: -0.064,         loss: 0.061
i: 854,         target: -0.077,        output: -0.012,         loss: 0.000
i: 855,         target: -0.042,        output: -0.026,         loss: 0.000
i: 856,         target: 0.157,         output: -0.076,         loss: 0.035
i: 857,         target: -0.076,        output: -0.046,         loss: 0.001
i: 858,         target: -0.018,        output: -0.032,         loss: 0.000
i: 859,         target: -0.081,        output: -0.012,         loss: 0.000
i: 860,         target: 0.144,         output: -0.080,         loss: 0.027
i: 861,         target: 0.009,         output: -0.078,         loss: 0.004
i: 862,         target: 0.103,         output: -0.046,         loss: 0.012
i: 863,         target: -0.073,        output: -0.060,         loss: 0.002
i: 864,         target: 0.198,         output: 0.014,          loss: 0.060
i: 865,         target: 0.192,         output: -0.030,         loss: 0.063
i: 866,         target: -0.061,        output: -0.068,         loss: 0.000
i: 867,         target: -0.094,        output: -0.032,         loss: 0.010
i: 868,         target: 0.182,         output: -0.068,         loss: 0.048
i: 869,         target: 0.003,         output: -0.044,         loss: 0.002
i: 870,         target: -0.075,        output: -0.054,         loss: 0.000
i: 871,         target: -0.100,        output: -0.042,         loss: 0.000
i: 872,         target: -0.050,        output: -0.024,         loss: 0.000
i: 873,         target: -0.058,        output: -0.082,         loss: 0.000
i: 874,         target: -0.055,        output: -0.064,         loss: 0.000
i: 875,         target: -0.028,        output: -0.058,         loss: 0.000
```

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i: 876,         target: -0.095,         output: -0.044,         loss: 0.000
i: 877,         target: -0.065,         output: -0.016,         loss: 0.001
i: 878,         target: 0.138,          output: -0.064,         loss: 0.026
i: 879,         target: -0.040,         output: -0.024,         loss: 0.001
i: 880,         target: 0.022,          output: -0.046,         loss: 0.005
i: 881,         target: -0.074,         output: -0.094,         loss: 0.003
i: 882,         target: 0.025,          output: -0.084,         loss: 0.002
i: 883,         target: 0.040,          output: -0.052,         loss: 0.004
i: 884,         target: 0.210,          output: -0.014,         loss: 0.054
i: 885,         target: 0.327,          output: -0.036,         loss: 0.158
i: 886,         target: 0.128,          output: -0.108,         loss: 0.029
i: 887,         target: -0.076,         output: -0.052,         loss: 0.001
i: 888,         target: -0.057,         output: -0.018,         loss: 0.001
i: 889,         target: 0.007,          output: -0.050,         loss: 0.001
i: 890,         target: -0.049,         output: -0.068,         loss: 0.001
i: 891,         target: -0.021,         output: -0.102,         loss: 0.000
i: 892,         target: -0.076,         output: -0.036,         loss: 0.000
i: 893,         target: -0.023,         output: -0.058,         loss: 0.000
i: 894,         target: -0.079,         output: -0.048,         loss: 0.000
i: 895,         target: -0.078,         output: -0.026,         loss: 0.000
i: 896,         target: 0.070,          output: -0.098,         loss: 0.006
i: 897,         target: 0.196,          output: -0.064,         loss: 0.059
i: 898,         target: 0.065,          output: -0.050,         loss: 0.010
i: 899,         target: -0.032,         output: -0.058,         loss: 0.002
i: 900,         target: -0.098,         output: -0.020,         loss: 0.001
i: 901,         target: 0.054,          output: -0.058,         loss: 0.025
i: 902,         target: 0.141,          output: -0.106,         loss: 0.029
i: 903,         target: -0.066,         output: -0.044,         loss: 0.002
i: 904,         target: -0.027,         output: -0.046,         loss: 0.001
i: 905,         target: 0.047,          output: -0.150,         loss: 0.022
i: 906,         target: 0.210,          output: -0.024,         loss: 0.079
i: 907,         target: -0.100,         output: -0.052,         loss: 0.000
i: 908,         target: -0.055,         output: -0.060,         loss: 0.000
i: 909,         target: -0.083,         output: -0.094,         loss: 0.000
i: 910,         target: 0.135,          output: -0.062,         loss: 0.044
i: 911,         target: 0.180,          output: -0.008,         loss: 0.091
i: 912,         target: -0.080,         output: -0.020,         loss: 0.004
i: 913,         target: -0.035,         output: -0.030,         loss: 0.002
i: 914,         target: -0.106,         output: -0.038,         loss: 0.001
i: 915,         target: -0.057,         output: -0.084,         loss: 0.001
i: 916,         target: 0.192,          output: -0.082,         loss: 0.068
i: 917,         target: -0.042,         output: -0.042,         loss: 0.001
i: 918,         target: 0.051,          output: -0.016,         loss: 0.018
i: 919,         target: -0.087,         output: -0.008,         loss: 0.002
i: 920,         target: 0.018,          output: -0.074,         loss: 0.001
i: 921,         target: -0.082,         output: -0.072,         loss: 0.000
i: 922,         target: 0.009,          output: -0.014,         loss: 0.005
i: 923,         target: -0.074,         output: 0.008,          loss: 0.002
```

```
i: 924,         target: -0.084,         output: -0.014,         loss: 0.002
i: 925,         target: 0.139,          output: -0.050,         loss: 0.031
i: 926,         target: -0.076,         output: -0.058,         loss: 0.000
i: 927,         target: -0.040,         output: -0.086,         loss: 0.003
i: 928,         target: -0.037,         output: -0.048,         loss: 0.001
i: 929,         target: 0.161,          output: -0.054,         loss: 0.061
i: 930,         target: -0.052,         output: 0.018,          loss: 0.001
i: 931,         target: -0.037,         output: -0.004,         loss: 0.000
i: 932,         target: -0.044,         output: -0.032,         loss: 0.000
i: 933,         target: 0.146,          output: -0.030,         loss: 0.058
i: 934,         target: -0.073,         output: -0.008,         loss: 0.000
i: 935,         target: 0.047,          output: -0.078,         loss: 0.009
i: 936,         target: -0.031,         output: -0.066,         loss: 0.009
i: 937,         target: 0.083,          output: -0.050,         loss: 0.020
i: 938,         target: -0.072,         output: -0.098,         loss: 0.003
i: 939,         target: 0.182,          output: -0.042,         loss: 0.037
i: 940,         target: 0.167,          output: -0.022,         loss: 0.052
i: 941,         target: 0.026,          output: -0.110,         loss: 0.006
i: 942,         target: -0.035,         output: -0.096,         loss: 0.002
i: 943,         target: -0.051,         output: -0.032,         loss: 0.000
i: 944,         target: 0.235,          output: -0.016,         loss: 0.105
i: 945,         target: -0.030,         output: -0.080,         loss: 0.002
i: 946,         target: -0.078,         output: -0.022,         loss: 0.001
i: 947,         target: 0.044,          output: -0.060,         loss: 0.009
i: 948,         target: 0.104,          output: -0.044,         loss: 0.022
i: 949,         target: -0.068,         output: -0.036,         loss: 0.000
i: 950,         target: -0.084,         output: -0.004,         loss: 0.000
i: 951,         target: -0.036,         output: -0.100,         loss: 0.000
i: 952,         target: -0.060,         output: -0.042,         loss: 0.000
i: 953,         target: -0.083,         output: -0.054,         loss: 0.001
i: 954,         target: -0.076,         output: -0.096,         loss: 0.008
i: 955,         target: -0.087,         output: -0.044,         loss: 0.001
i: 956,         target: -0.020,         output: -0.056,         loss: 0.000
i: 957,         target: 0.018,          output: -0.054,         loss: 0.006
i: 958,         target: -0.025,         output: -0.098,         loss: 0.000
i: 959,         target: -0.085,         output: 0.004,          loss: 0.003
i: 960,         target: -0.086,         output: -0.050,         loss: 0.000
i: 961,         target: 0.144,          output: -0.058,         loss: 0.043
i: 962,         target: 0.009,          output: -0.046,         loss: 0.007
i: 963,         target: 0.170,          output: -0.084,         loss: 0.032
i: 964,         target: 0.043,          output: -0.052,         loss: 0.010
i: 965,         target: 0.227,          output: -0.018,         loss: 0.061
i: 966,         target: -0.091,         output: -0.054,         loss: 0.003
i: 967,         target: -0.084,         output: -0.050,         loss: 0.002
i: 968,         target: -0.075,         output: -0.010,         loss: 0.000
i: 969,         target: 0.095,          output: -0.010,         loss: 0.031
i: 970,         target: 0.197,          output: -0.054,         loss: 0.068
i: 971,         target: -0.056,         output: -0.048,         loss: 0.001
```

```
i: 972,          target: -0.065,         output: -0.074,         loss: 0.000
i: 973,          target: 0.390,          output: -0.028,         loss: 0.258
i: 974,          target: 0.041,          output: -0.014,         loss: 0.012
i: 975,          target: 0.174,          output: -0.108,         loss: 0.087
i: 976,          target: -0.021,         output: -0.044,         loss: 0.000
i: 977,          target: -0.051,         output: -0.012,         loss: 0.002
i: 978,          target: -0.061,         output: -0.080,         loss: 0.001
i: 979,          target: -0.068,         output: -0.060,         loss: 0.000
i: 980,          target: 0.221,          output: -0.058,         loss: 0.057
i: 981,          target: 0.175,          output: -0.032,         loss: 0.050
i: 982,          target: -0.065,         output: -0.030,         loss: 0.008
i: 983,          target: 0.221,          output: -0.098,         loss: 0.091
i: 984,          target: -0.018,         output: -0.074,         loss: 0.000
i: 985,          target: -0.078,         output: -0.054,         loss: 0.003
i: 986,          target: 0.120,          output: -0.066,         loss: 0.020
i: 987,          target: 0.198,          output: -0.054,         loss: 0.050
i: 988,          target: 0.090,          output: -0.028,         loss: 0.024
i: 989,          target: -0.095,         output: -0.080,         loss: 0.001
i: 990,          target: -0.049,         output: -0.036,         loss: 0.000
i: 991,          target: 0.211,          output: -0.078,         loss: 0.072
i: 992,          target: 0.041,          output: -0.068,         loss: 0.021
i: 993,          target: -0.049,         output: -0.058,         loss: 0.000
i: 994,          target: -0.013,         output: -0.036,         loss: 0.000
i: 995,          target: -0.069,         output: -0.016,         loss: 0.000
i: 996,          target: 0.036,          output: -0.058,         loss: 0.022
i: 997,          target: -0.074,         output: -0.050,         loss: 0.003
i: 998,          target: -0.079,         output: -0.078,         loss: 0.000
i: 999,          target: -0.067,         output: -0.100,         loss: 0.002
Average loss: 0.022
```