0731-small_hybrid_model_Allqm_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)/100
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 = 10000
# 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))

    #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=i)) for i in range(n_qubits)]
```

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

[ ]:
```
[tensor(0.5498), tensor(-0.2218), tensor(0.2184), tensor(0.6324)]
```

[ ]:
```
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)]

for i in range(len(layers_dim)-1):
    layers += [nn.Linear(layers_dim[i], layers_dim[(i+1)]), nn.Sigmoid()]
layers += [nn.Linear(layers_dim[-1], 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: 1.5898, Loss validation: 1.2955

/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: 0.3633,     target:
-0.8790,        loss: 1.5433
         Validation string,      i: 1;   prediction: 0.3633,     target:
-0.7216,        loss: 1.1769
         Validation string,      i: 2;   prediction: 0.3633,     target: 0.2145,
loss: 0.0221
Epoch [1/25], Loss: 1.6422, Loss validation: 1.2894, Time remaining: ~0.0h 52.0m
6s
         Validation string,      i: 0;   prediction: 0.2890,     target:
-0.8790,        loss: 1.3643
         Validation string,      i: 1;   prediction: 0.2890,     target:
-0.7216,        loss: 1.0212
         Validation string,      i: 2;   prediction: 0.2890,     target: 0.2145,
loss: 0.0055
Epoch [2/25], Loss: 1.5996, Loss validation: 1.2586, Time remaining: ~0.0h 47.0m
14s
         Validation string,      i: 0;   prediction: 0.4359,     target:
-0.8790,        loss: 1.7290
         Validation string,      i: 1;   prediction: 0.4359,     target:
-0.7216,        loss: 1.3396
         Validation string,      i: 2;   prediction: 0.4359,     target: 0.2145,
loss: 0.0490
Epoch [3/25], Loss: 1.5959, Loss validation: 1.3302, Time remaining: ~0.0h 44.0m
3s
         Validation string,      i: 0;   prediction: 0.3273,     target:
-0.8790,        loss: 1.4553
         Validation string,      i: 1;   prediction: 0.3273,     target:
-0.7216,        loss: 1.1002
         Validation string,      i: 2;   prediction: 0.3273,     target: 0.2145,
loss: 0.0127
Epoch [4/25], Loss: 1.5964, Loss validation: 1.2731, Time remaining: ~0.0h 41.0m
17s
         Validation string,      i: 0;   prediction: 0.2588,     target:
-0.8790,        loss: 1.2948
         Validation string,      i: 1;   prediction: 0.2588,     target:
-0.7216,        loss: 0.9612
         Validation string,      i: 2;   prediction: 0.2588,     target: 0.2145,
```

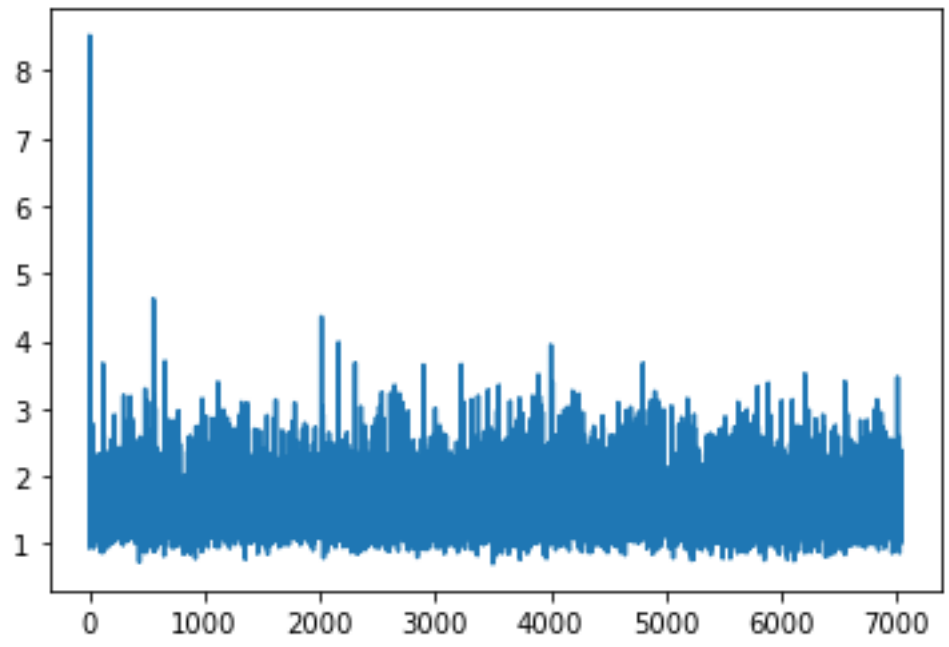
```
loss: 0.0020
Epoch [5/25], Loss: 1.5931, Loss validation: 1.2493, Time remaining: ~0.0h 38.0m
47s
        Validation string,      i: 0;   prediction: 0.2864,     target:
-0.8790,        loss: 1.3582
        Validation string,      i: 1;   prediction: 0.2864,     target:
-0.7216,        loss: 1.0160
        Validation string,      i: 2;   prediction: 0.2864,     target: 0.2145,
loss: 0.0052
Epoch [6/25], Loss: 1.5948, Loss validation: 1.2577, Time remaining: ~0.0h 36.0m
30s
        Validation string,      i: 0;   prediction: 0.3811,     target:
-0.8790,        loss: 1.5879
        Validation string,      i: 1;   prediction: 0.3811,     target:
-0.7216,        loss: 1.2158
        Validation string,      i: 2;   prediction: 0.3811,     target: 0.2145,
loss: 0.0277
Epoch [7/25], Loss: 1.5946, Loss validation: 1.2984, Time remaining: ~0.0h 34.0m
21s
        Validation string,      i: 0;   prediction: 0.1671,     target:
-0.8790,        loss: 1.0944
        Validation string,      i: 1;   prediction: 0.1671,     target:
-0.7216,        loss: 0.7897
        Validation string,      i: 2;   prediction: 0.1671,     target: 0.2145,
loss: 0.0022
Epoch [8/25], Loss: 1.5980, Loss validation: 1.2320, Time remaining: ~0.0h 32.0m
18s
        Validation string,      i: 0;   prediction: 0.4221,     target:
-0.8790,        loss: 1.6929
        Validation string,      i: 1;   prediction: 0.4221,     target:
-0.7216,        loss: 1.3079
        Validation string,      i: 2;   prediction: 0.4221,     target: 0.2145,
loss: 0.0431
Epoch [9/25], Loss: 1.6005, Loss validation: 1.3216, Time remaining: ~0.0h 30.0m
17s
        Validation string,      i: 0;   prediction: 0.2473,     target:
-0.8790,        loss: 1.2686
        Validation string,      i: 1;   prediction: 0.2473,     target:
-0.7216,        loss: 0.9386
        Validation string,      i: 2;   prediction: 0.2473,     target: 0.2145,
loss: 0.0011
Epoch [10/25], Loss: 1.5946, Loss validation: 1.2461, Time remaining: ~0.0h
28.0m 18s
        Validation string,      i: 0;   prediction: 0.3835,     target:
-0.8790,        loss: 1.5941
        Validation string,      i: 1;   prediction: 0.3835,     target:
-0.7216,        loss: 1.2213
        Validation string,      i: 2;   prediction: 0.3835,     target: 0.2145,
```

```
loss: 0.0286
Epoch [11/25], Loss: 1.5954, Loss validation: 1.2997, Time remaining: ~0.0h
26.0m 20s
         Validation string,      i: 0;   prediction: 0.3557,     target:
-0.8790,        loss: 1.5245
         Validation string,      i: 1;   prediction: 0.3557,     target:
-0.7216,        loss: 1.1604
         Validation string,      i: 2;   prediction: 0.3557,     target: 0.2145,
loss: 0.0199
Epoch [12/25], Loss: 1.5953, Loss validation: 1.2857, Time remaining: ~0.0h
24.0m 24s
         Validation string,      i: 0;   prediction: 0.4859,     target:
-0.8790,        loss: 1.8630
         Validation string,      i: 1;   prediction: 0.4859,     target:
-0.7216,        loss: 1.4579
         Validation string,      i: 2;   prediction: 0.4859,     target: 0.2145,
loss: 0.0736
Epoch [13/25], Loss: 1.5941, Loss validation: 1.3644, Time remaining: ~0.0h
22.0m 29s
         Validation string,      i: 0;   prediction: 0.3304,     target:
-0.8790,        loss: 1.4627
         Validation string,      i: 1;   prediction: 0.3304,     target:
-0.7216,        loss: 1.1066
         Validation string,      i: 2;   prediction: 0.3304,     target: 0.2145,
loss: 0.0134
Epoch [14/25], Loss: 1.5950, Loss validation: 1.2744, Time remaining: ~0.0h
20.0m 34s
         Validation string,      i: 0;   prediction: 0.2851,     target:
-0.8790,        loss: 1.3553
         Validation string,      i: 1;   prediction: 0.2851,     target:
-0.7216,        loss: 1.0134
         Validation string,      i: 2;   prediction: 0.2851,     target: 0.2145,
loss: 0.0050
Epoch [15/25], Loss: 1.5973, Loss validation: 1.2573, Time remaining: ~0.0h
18.0m 40s
         Validation string,      i: 0;   prediction: 0.3607,     target:
-0.8790,        loss: 1.5369
         Validation string,      i: 1;   prediction: 0.3607,     target:
-0.7216,        loss: 1.1712
         Validation string,      i: 2;   prediction: 0.3607,     target: 0.2145,
loss: 0.0214
Epoch [16/25], Loss: 1.5933, Loss validation: 1.2881, Time remaining: ~0.0h
16.0m 47s
         Validation string,      i: 0;   prediction: 0.4028,     target:
-0.8790,        loss: 1.6431
         Validation string,      i: 1;   prediction: 0.4028,     target:
-0.7216,        loss: 1.2642
         Validation string,      i: 2;   prediction: 0.4028,     target: 0.2145,
```

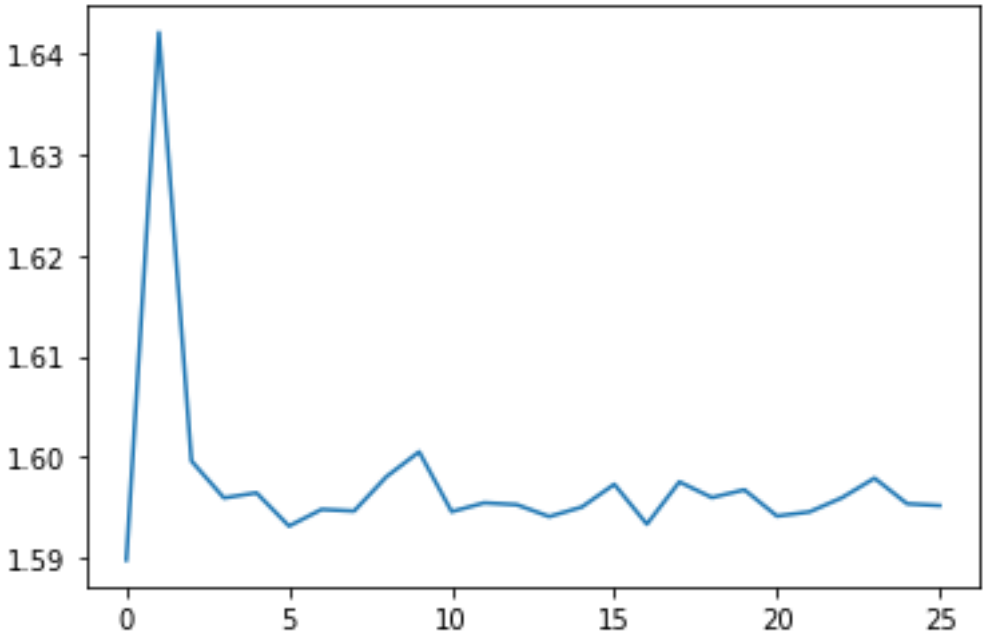
```
loss: 0.0354
Epoch [17/25], Loss: 1.5975, Loss validation: 1.3103, Time remaining: ~0.0h
14.0m 54s
         Validation string,      i: 0;   prediction: 0.3845,     target:
-0.8790,        loss: 1.5967
         Validation string,      i: 1;   prediction: 0.3845,     target:
-0.7216,        loss: 1.2235
         Validation string,      i: 2;   prediction: 0.3845,     target: 0.2145,
loss: 0.0289
Epoch [18/25], Loss: 1.5960, Loss validation: 1.3003, Time remaining: ~0.0h
13.0m 2s
         Validation string,      i: 0;   prediction: 0.4184,     target:
-0.8790,        loss: 1.6835
         Validation string,      i: 1;   prediction: 0.4184,     target:
-0.7216,        loss: 1.2996
         Validation string,      i: 2;   prediction: 0.4184,     target: 0.2145,
loss: 0.0416
Epoch [19/25], Loss: 1.5967, Loss validation: 1.3194, Time remaining: ~0.0h
11.0m 9s
         Validation string,      i: 0;   prediction: 0.2414,     target:
-0.8790,        loss: 1.2554
         Validation string,      i: 1;   prediction: 0.2414,     target:
-0.7216,        loss: 0.9273
         Validation string,      i: 2;   prediction: 0.2414,     target: 0.2145,
loss: 0.0007
Epoch [20/25], Loss: 1.5941, Loss validation: 1.2447, Time remaining: ~0.0h 9.0m
18s
         Validation string,      i: 0;   prediction: 0.3005,     target:
-0.8790,        loss: 1.3912
         Validation string,      i: 1;   prediction: 0.3005,     target:
-0.7216,        loss: 1.0445
         Validation string,      i: 2;   prediction: 0.3005,     target: 0.2145,
loss: 0.0074
Epoch [21/25], Loss: 1.5945, Loss validation: 1.2626, Time remaining: ~0.0h 7.0m
26s
         Validation string,      i: 0;   prediction: 0.1774,     target:
-0.8790,        loss: 1.1161
         Validation string,      i: 1;   prediction: 0.1774,     target:
-0.7216,        loss: 0.8081
         Validation string,      i: 2;   prediction: 0.1774,     target: 0.2145,
loss: 0.0014
Epoch [22/25], Loss: 1.5959, Loss validation: 1.2331, Time remaining: ~0.0h 5.0m
34s
         Validation string,      i: 0;   prediction: 0.3712,     target:
-0.8790,        loss: 1.5631
         Validation string,      i: 1;   prediction: 0.3712,     target:
-0.7216,        loss: 1.1941
         Validation string,      i: 2;   prediction: 0.3712,     target: 0.2145,
```

```
loss: 0.0245
Epoch [23/25], Loss: 1.5979, Loss validation: 1.2933, Time remaining: ~0.0h 3.0m
43s
         Validation string,      i: 0;   prediction: 0.3824,     target:
-0.8790,        loss: 1.5912
         Validation string,      i: 1;   prediction: 0.3824,     target:
-0.7216,        loss: 1.2187
         Validation string,      i: 2;   prediction: 0.3824,     target: 0.2145,
loss: 0.0282
Epoch [24/25], Loss: 1.5953, Loss validation: 1.2991, Time remaining: ~0.0h 1.0m
51s
         Validation string,      i: 0;   prediction: 0.2624,     target:
-0.8790,        loss: 1.3028
         Validation string,      i: 1;   prediction: 0.2624,     target:
-0.7216,        loss: 0.9682
         Validation string,      i: 2;   prediction: 0.2624,     target: 0.2145,
loss: 0.0023
Epoch [25/25], Loss: 1.5952, Loss validation: 1.2503, Time remaining: ~0.0h 0.0m
0s
```

[ ]:
```python
#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()
```



[ ]:
```
import os

name_notebook = "0731-small_hybrid_model_Allqm_shots.ipynb"

output_filename = initial_path + "Notebooks/models/"+ name_notebook[:4] +"/" +␣
 ↪name_notebook[:-6] + "_0.pth"

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


torch.save(model.state_dict(), output_filename)
```

[ ]:
```
!cd peptide-QML && git add . && git commit -m "data trained model" && git push
```

```
[main 92667d0] data trained model
 1 file changed, 0 insertions(+), 0 deletions(-)
 create mode 100644
```

```
Notebooks/models/0731/0731-small_hybrid_model_Allqm_shots_0.pth
Enumerating objects: 10, done.
Counting objects: 100% (10/10), done.
Delta compression using up to 24 threads
Compressing objects: 100% (5/5), done.
Writing objects: 100% (6/6), 89.37 KiB | 6.88 MiB/s, done.
Total 6 (delta 2), reused 0 (delta 0)
remote: Resolving deltas: 100% (2/2), completed with 2 local objects.
To github.com:raulconchello/peptide-QML.git
   06d0ee4..92667d0  main -> main
```

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

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

```
i: 0,    target: -0.879,         output: 0.262,          loss: 1.303
i: 1,    target: 1.533,          output: 0.262,          loss: 1.613
i: 2,    target: 0.908,          output: 0.262,          loss: 0.417
i: 3,    target: 2.895,          output: 0.262,          loss: 6.930
i: 4,    target: -0.794,         output: 0.262,          loss: 1.116
i: 5,    target: -0.680,         output: 0.262,          loss: 0.888
i: 6,    target: 2.630,          output: 0.262,          loss: 5.606
i: 7,    target: 0.725,          output: 0.262,          loss: 0.214
i: 8,    target: -0.550,         output: 0.262,          loss: 0.661
i: 9,    target: -0.604,         output: 0.262,          loss: 0.751
i: 10,   target: -0.722,         output: 0.262,          loss: 0.968
i: 11,   target: 0.456,          output: 0.262,          loss: 0.037
i: 12,   target: 1.778,          output: 0.262,          loss: 2.298
i: 13,   target: -0.785,         output: 0.262,          loss: 1.097
i: 14,   target: 2.904,          output: 0.262,          loss: 6.980
i: 15,   target: -0.355,         output: 0.262,          loss: 0.381
i: 16,   target: 0.299,          output: 0.262,          loss: 0.001
i: 17,   target: 2.053,          output: 0.262,          loss: 3.206
i: 18,   target: -0.658,         output: 0.262,          loss: 0.847
i: 19,   target: -0.994,         output: 0.262,          loss: 1.578
i: 20,   target: 0.215,          output: 0.262,          loss: 0.002
i: 21,   target: 1.577,          output: 0.262,          loss: 1.728
i: 22,   target: -0.870,         output: 0.262,          loss: 1.282
i: 23,   target: 0.648,          output: 0.262,          loss: 0.148
i: 24,   target: 1.860,          output: 0.262,          loss: 2.553
i: 25,   target: 0.343,          output: 0.262,          loss: 0.006
i: 26,   target: 1.350,          output: 0.262,          loss: 1.183
```

```
i: 27,   target: 0.138,          output: 0.262,          loss: 0.016
i: 28,   target: -0.736,         output: 0.262,          loss: 0.997
i: 29,   target: -1.101,         output: 0.262,          loss: 1.860
i: 30,   target: 0.660,          output: 0.262,          loss: 0.158
i: 31,   target: -0.741,         output: 0.262,          loss: 1.007
i: 32,   target: -0.489,         output: 0.262,          loss: 0.565
i: 33,   target: 3.959,          output: 0.262,          loss: 13.667
i: 34,   target: 0.297,          output: 0.262,          loss: 0.001
i: 35,   target: -0.192,         output: 0.262,          loss: 0.206
i: 36,   target: -0.530,         output: 0.262,          loss: 0.629
i: 37,   target: -0.611,         output: 0.262,          loss: 0.763
i: 38,   target: 2.280,          output: 0.262,          loss: 4.071
i: 39,   target: 2.026,          output: 0.262,          loss: 3.110
i: 40,   target: -0.724,         output: 0.262,          loss: 0.972
i: 41,   target: 1.236,          output: 0.262,          loss: 0.947
i: 42,   target: 2.177,          output: 0.262,          loss: 3.667
i: 43,   target: 2.481,          output: 0.262,          loss: 4.920
i: 44,   target: 1.490,          output: 0.262,          loss: 1.508
i: 45,   target: 0.853,          output: 0.262,          loss: 0.349
i: 46,   target: 2.255,          output: 0.262,          loss: 3.970
i: 47,   target: -1.013,         output: 0.262,          loss: 1.626
i: 48,   target: -0.807,         output: 0.262,          loss: 1.144
i: 49,   target: -0.637,         output: 0.262,          loss: 0.809
i: 50,   target: 0.385,          output: 0.262,          loss: 0.015
i: 51,   target: -0.605,         output: 0.262,          loss: 0.753
i: 52,   target: -0.773,         output: 0.262,          loss: 1.073
i: 53,   target: -0.743,         output: 0.262,          loss: 1.010
i: 54,   target: -0.685,         output: 0.262,          loss: 0.898
i: 55,   target: 2.938,          output: 0.262,          loss: 7.158
i: 56,   target: 0.202,          output: 0.262,          loss: 0.004
i: 57,   target: -0.854,         output: 0.262,          loss: 1.245
i: 58,   target: 0.490,          output: 0.262,          loss: 0.052
i: 59,   target: -0.797,         output: 0.262,          loss: 1.122
i: 60,   target: -0.758,         output: 0.262,          loss: 1.042
i: 61,   target: 0.914,          output: 0.262,          loss: 0.424
i: 62,   target: 0.763,          output: 0.262,          loss: 0.250
i: 63,   target: -0.512,         output: 0.262,          loss: 0.600
i: 64,   target: 0.618,          output: 0.262,          loss: 0.126
i: 65,   target: 1.481,          output: 0.262,          loss: 1.484
i: 66,   target: -0.400,         output: 0.262,          loss: 0.439
i: 67,   target: 0.347,          output: 0.262,          loss: 0.007
i: 68,   target: -0.489,         output: 0.262,          loss: 0.564
i: 69,   target: 0.248,          output: 0.262,          loss: 0.000
i: 70,   target: -0.775,         output: 0.262,          loss: 1.075
i: 71,   target: 3.069,          output: 0.262,          loss: 7.879
i: 72,   target: 2.270,          output: 0.262,          loss: 4.032
i: 73,   target: -0.337,         output: 0.262,          loss: 0.359
i: 74,   target: 0.484,          output: 0.262,          loss: 0.049
```

```
i: 75,   target: -0.814,         output: 0.262,          loss: 1.159
i: 76,   target: -0.132,         output: 0.262,          loss: 0.155
i: 77,   target: 0.285,          output: 0.262,          loss: 0.000
i: 78,   target: -0.305,         output: 0.262,          loss: 0.322
i: 79,   target: -0.692,         output: 0.262,          loss: 0.912
i: 80,   target: -0.761,         output: 0.262,          loss: 1.047
i: 81,   target: -1.123,         output: 0.262,          loss: 1.918
i: 82,   target: -0.045,         output: 0.262,          loss: 0.094
i: 83,   target: -0.684,         output: 0.262,          loss: 0.895
i: 84,   target: 3.199,          output: 0.262,          loss: 8.625
i: 85,   target: 1.952,          output: 0.262,          loss: 2.854
i: 86,   target: 3.099,          output: 0.262,          loss: 8.044
i: 87,   target: 1.936,          output: 0.262,          loss: 2.800
i: 88,   target: -0.654,         output: 0.262,          loss: 0.840
i: 89,   target: -0.785,         output: 0.262,          loss: 1.097
i: 90,   target: -0.479,         output: 0.262,          loss: 0.549
i: 91,   target: -0.659,         output: 0.262,          loss: 0.849
i: 92,   target: 0.463,          output: 0.262,          loss: 0.040
i: 93,   target: -0.634,         output: 0.262,          loss: 0.803
i: 94,   target: 2.014,          output: 0.262,          loss: 3.069
i: 95,   target: 0.404,          output: 0.262,          loss: 0.020
i: 96,   target: -0.553,         output: 0.262,          loss: 0.666
i: 97,   target: -0.540,         output: 0.262,          loss: 0.644
i: 98,   target: -0.450,         output: 0.262,          loss: 0.507
i: 99,   target: -0.713,         output: 0.262,          loss: 0.951
i: 100,          target: -0.430,         output: 0.262,          loss: 0.480
i: 101,          target: 2.682,          output: 0.262,          loss: 5.856
i: 102,          target: -0.980,         output: 0.262,          loss: 1.544
i: 103,          target: -0.597,         output: 0.262,          loss: 0.739
i: 104,          target: 0.127,          output: 0.262,          loss: 0.018
i: 105,          target: 2.152,          output: 0.262,          loss: 3.570
i: 106,          target: -0.772,         output: 0.262,          loss: 1.069
i: 107,          target: -0.357,         output: 0.262,          loss: 0.383
i: 108,          target: -0.394,         output: 0.262,          loss: 0.430
i: 109,          target: -0.376,         output: 0.262,          loss: 0.407
i: 110,          target: 2.324,          output: 0.262,          loss: 4.250
i: 111,          target: 1.610,          output: 0.262,          loss: 1.815
i: 112,          target: -0.738,         output: 0.262,          loss: 1.002
i: 113,          target: -0.213,         output: 0.262,          loss: 0.226
i: 114,          target: -0.799,         output: 0.262,          loss: 1.127
i: 115,          target: 2.155,          output: 0.262,          loss: 3.583
i: 116,          target: -0.497,         output: 0.262,          loss: 0.576
i: 117,          target: -0.590,         output: 0.262,          loss: 0.726
i: 118,          target: 1.942,          output: 0.262,          loss: 2.821
i: 119,          target: 2.159,          output: 0.262,          loss: 3.596
i: 120,          target: -0.847,         output: 0.262,          loss: 1.231
i: 121,          target: -0.698,         output: 0.262,          loss: 0.922
i: 122,          target: 1.722,          output: 0.262,          loss: 2.131
```

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i: 123,         target: 0.042,         output: 0.262,         loss: 0.049
i: 124,         target: 1.142,         output: 0.262,         loss: 0.774
i: 125,         target: -0.663,        output: 0.262,         loss: 0.856
i: 126,         target: 1.911,         output: 0.262,         loss: 2.718
i: 127,         target: 0.189,         output: 0.262,         loss: 0.005
i: 128,         target: 2.311,         output: 0.262,         loss: 4.196
i: 129,         target: -0.563,        output: 0.262,         loss: 0.682
i: 130,         target: -0.492,        output: 0.262,         loss: 0.569
i: 131,         target: 0.373,         output: 0.262,         loss: 0.012
i: 132,         target: 3.238,         output: 0.262,         loss: 8.852
i: 133,         target: 2.552,         output: 0.262,         loss: 5.244
i: 134,         target: 1.705,         output: 0.262,         loss: 2.082
i: 135,         target: -0.763,        output: 0.262,         loss: 1.051
i: 136,         target: 0.497,         output: 0.262,         loss: 0.055
i: 137,         target: -0.738,        output: 0.262,         loss: 1.001
i: 138,         target: 0.411,         output: 0.262,         loss: 0.022
i: 139,         target: -1.092,        output: 0.262,         loss: 1.834
i: 140,         target: -0.629,        output: 0.262,         loss: 0.795
i: 141,         target: 0.113,         output: 0.262,         loss: 0.022
i: 142,         target: 2.331,         output: 0.262,         loss: 4.278
i: 143,         target: 1.970,         output: 0.262,         loss: 2.917
i: 144,         target: -0.919,        output: 0.262,         loss: 1.395
i: 145,         target: 0.214,         output: 0.262,         loss: 0.002
i: 146,         target: 0.102,         output: 0.262,         loss: 0.026
i: 147,         target: -0.630,        output: 0.262,         loss: 0.797
i: 148,         target: 1.400,         output: 0.262,         loss: 1.293
i: 149,         target: 0.919,         output: 0.262,         loss: 0.431
i: 150,         target: -0.553,        output: 0.262,         loss: 0.665
i: 151,         target: 0.586,         output: 0.262,         loss: 0.105
i: 152,         target: -0.749,        output: 0.262,         loss: 1.023
i: 153,         target: -0.696,        output: 0.262,         loss: 0.918
i: 154,         target: 1.931,         output: 0.262,         loss: 2.786
i: 155,         target: -0.765,        output: 0.262,         loss: 1.055
i: 156,         target: -0.747,        output: 0.262,         loss: 1.019
i: 157,         target: -0.738,        output: 0.262,         loss: 1.000
i: 158,         target: 2.565,         output: 0.262,         loss: 5.303
i: 159,         target: 1.752,         output: 0.262,         loss: 2.218
i: 160,         target: -0.498,        output: 0.262,         loss: 0.578
i: 161,         target: -0.912,        output: 0.262,         loss: 1.380
i: 162,         target: -0.859,        output: 0.262,         loss: 1.257
i: 163,         target: 3.021,         output: 0.262,         loss: 7.612
i: 164,         target: 1.298,         output: 0.262,         loss: 1.072
i: 165,         target: -0.952,        output: 0.262,         loss: 1.475
i: 166,         target: -0.984,        output: 0.262,         loss: 1.553
i: 167,         target: 1.074,         output: 0.262,         loss: 0.658
i: 168,         target: -0.851,        output: 0.262,         loss: 1.240
i: 169,         target: -0.973,        output: 0.262,         loss: 1.526
i: 170,         target: 2.460,         output: 0.262,         loss: 4.828
```

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i: 171,         target: -1.083,         output: 0.262,         loss: 1.811
i: 172,         target: -0.692,         output: 0.262,         loss: 0.911
i: 173,         target: -0.823,         output: 0.262,         loss: 1.178
i: 174,         target: -0.642,         output: 0.262,         loss: 0.818
i: 175,         target: 0.211,          output: 0.262,         loss: 0.003
i: 176,         target: 1.314,          output: 0.262,         loss: 1.106
i: 177,         target: 2.728,          output: 0.262,         loss: 6.080
i: 178,         target: -0.616,         output: 0.262,         loss: 0.771
i: 179,         target: 2.199,          output: 0.262,         loss: 3.752
i: 180,         target: -0.626,         output: 0.262,         loss: 0.789
i: 181,         target: 1.582,          output: 0.262,         loss: 1.742
i: 182,         target: 0.003,          output: 0.262,         loss: 0.067
i: 183,         target: 0.928,          output: 0.262,         loss: 0.444
i: 184,         target: 0.393,          output: 0.262,         loss: 0.017
i: 185,         target: 0.848,          output: 0.262,         loss: 0.343
i: 186,         target: -0.593,         output: 0.262,         loss: 0.732
i: 187,         target: -0.366,         output: 0.262,         loss: 0.394
i: 188,         target: 0.504,          output: 0.262,         loss: 0.058
i: 189,         target: 1.535,          output: 0.262,         loss: 1.619
i: 190,         target: -0.141,         output: 0.262,         loss: 0.162
i: 191,         target: -0.567,         output: 0.262,         loss: 0.689
i: 192,         target: 0.221,          output: 0.262,         loss: 0.002
i: 193,         target: 0.469,          output: 0.262,         loss: 0.043
i: 194,         target: 4.538,          output: 0.262,         loss: 18.284
i: 195,         target: 0.217,          output: 0.262,         loss: 0.002
i: 196,         target: 1.984,          output: 0.262,         loss: 2.964
i: 197,         target: 1.161,          output: 0.262,         loss: 0.808
i: 198,         target: 1.172,          output: 0.262,         loss: 0.828
i: 199,         target: -0.580,         output: 0.262,         loss: 0.709
i: 200,         target: -0.671,         output: 0.262,         loss: 0.872
i: 201,         target: -0.796,         output: 0.262,         loss: 1.119
i: 202,         target: -0.768,         output: 0.262,         loss: 1.062
i: 203,         target: 0.151,          output: 0.262,         loss: 0.012
i: 204,         target: -0.619,         output: 0.262,         loss: 0.777
i: 205,         target: -0.734,         output: 0.262,         loss: 0.993
i: 206,         target: 2.804,          output: 0.262,         loss: 6.458
i: 207,         target: 0.313,          output: 0.262,         loss: 0.003
i: 208,         target: -0.828,         output: 0.262,         loss: 1.189
i: 209,         target: -0.757,         output: 0.262,         loss: 1.039
i: 210,         target: -0.724,         output: 0.262,         loss: 0.973
i: 211,         target: -0.323,         output: 0.262,         loss: 0.342
i: 212,         target: 0.153,          output: 0.262,         loss: 0.012
i: 213,         target: -0.791,         output: 0.262,         loss: 1.110
i: 214,         target: -0.938,         output: 0.262,         loss: 1.442
i: 215,         target: 1.946,          output: 0.262,         loss: 2.834
i: 216,         target: 1.531,          output: 0.262,         loss: 1.609
i: 217,         target: 0.867,          output: 0.262,         loss: 0.365
i: 218,         target: 1.349,          output: 0.262,         loss: 1.181
```

```
i: 219,         target: 1.877,         output: 0.262,         loss: 2.607
i: 220,         target: 1.626,         output: 0.262,         loss: 1.860
i: 221,         target: -1.040,        output: 0.262,         loss: 1.695
i: 222,         target: 1.351,         output: 0.262,         loss: 1.185
i: 223,         target: -0.516,        output: 0.262,         loss: 0.606
i: 224,         target: 1.904,         output: 0.262,         loss: 2.695
i: 225,         target: -0.340,        output: 0.262,         loss: 0.363
i: 226,         target: 1.841,         output: 0.262,         loss: 2.491
i: 227,         target: -0.536,        output: 0.262,         loss: 0.638
i: 228,         target: -0.785,        output: 0.262,         loss: 1.097
i: 229,         target: -0.657,        output: 0.262,         loss: 0.846
i: 230,         target: 2.283,         output: 0.262,         loss: 4.084
i: 231,         target: 1.904,         output: 0.262,         loss: 2.696
i: 232,         target: -0.960,        output: 0.262,         loss: 1.495
i: 233,         target: -0.934,        output: 0.262,         loss: 1.431
i: 234,         target: 2.167,         output: 0.262,         loss: 3.626
i: 235,         target: -0.756,        output: 0.262,         loss: 1.037
i: 236,         target: -0.727,        output: 0.262,         loss: 0.980
i: 237,         target: -0.191,        output: 0.262,         loss: 0.206
i: 238,         target: 1.035,         output: 0.262,         loss: 0.596
i: 239,         target: 2.254,         output: 0.262,         loss: 3.967
i: 240,         target: 2.756,         output: 0.262,         loss: 6.220
i: 241,         target: -0.604,        output: 0.262,         loss: 0.751
i: 242,         target: -0.897,        output: 0.262,         loss: 1.345
i: 243,         target: -0.827,        output: 0.262,         loss: 1.188
i: 244,         target: 0.555,         output: 0.262,         loss: 0.086
i: 245,         target: -0.458,        output: 0.262,         loss: 0.519
i: 246,         target: -0.277,        output: 0.262,         loss: 0.291
i: 247,         target: 1.417,         output: 0.262,         loss: 1.334
i: 248,         target: 1.944,         output: 0.262,         loss: 2.829
i: 249,         target: 0.044,         output: 0.262,         loss: 0.048
i: 250,         target: 1.605,         output: 0.262,         loss: 1.803
i: 251,         target: -0.920,        output: 0.262,         loss: 1.398
i: 252,         target: -1.042,        output: 0.262,         loss: 1.701
i: 253,         target: 1.453,         output: 0.262,         loss: 1.419
i: 254,         target: -0.892,        output: 0.262,         loss: 1.333
i: 255,         target: 1.705,         output: 0.262,         loss: 2.082
i: 256,         target: -0.396,        output: 0.262,         loss: 0.433
i: 257,         target: -0.674,        output: 0.262,         loss: 0.877
i: 258,         target: -0.248,        output: 0.262,         loss: 0.260
i: 259,         target: 1.709,         output: 0.262,         loss: 2.094
i: 260,         target: -0.130,        output: 0.262,         loss: 0.154
i: 261,         target: 0.155,         output: 0.262,         loss: 0.012
i: 262,         target: -0.938,        output: 0.262,         loss: 1.442
i: 263,         target: 1.582,         output: 0.262,         loss: 1.742
i: 264,         target: -1.004,        output: 0.262,         loss: 1.603
i: 265,         target: 2.330,         output: 0.262,         loss: 4.275
i: 266,         target: -0.652,        output: 0.262,         loss: 0.836
```

```
i: 267,         target: -0.570,         output: 0.262,         loss: 0.693
i: 268,         target: -0.480,         output: 0.262,         loss: 0.551
i: 269,         target: 4.716,          output: 0.262,         loss: 19.831
i: 270,         target: -0.323,         output: 0.262,         loss: 0.342
i: 271,         target: -0.938,         output: 0.262,         loss: 1.442
i: 272,         target: 0.538,          output: 0.262,         loss: 0.076
i: 273,         target: 1.829,          output: 0.262,         loss: 2.454
i: 274,         target: -0.733,         output: 0.262,         loss: 0.992
i: 275,         target: -0.629,         output: 0.262,         loss: 0.795
i: 276,         target: -0.681,         output: 0.262,         loss: 0.890
i: 277,         target: 0.498,          output: 0.262,         loss: 0.056
i: 278,         target: -0.718,         output: 0.262,         loss: 0.960
i: 279,         target: -0.686,         output: 0.262,         loss: 0.900
i: 280,         target: 0.351,          output: 0.262,         loss: 0.008
i: 281,         target: -0.767,         output: 0.262,         loss: 1.060
i: 282,         target: 0.456,          output: 0.262,         loss: 0.037
i: 283,         target: -0.479,         output: 0.262,         loss: 0.550
i: 284,         target: 1.918,          output: 0.262,         loss: 2.740
i: 285,         target: -0.851,         output: 0.262,         loss: 1.241
i: 286,         target: 1.916,          output: 0.262,         loss: 2.736
i: 287,         target: -0.892,         output: 0.262,         loss: 1.333
i: 288,         target: 1.707,          output: 0.262,         loss: 2.086
i: 289,         target: 1.077,          output: 0.262,         loss: 0.664
i: 290,         target: 2.011,          output: 0.262,         loss: 3.057
i: 291,         target: 1.933,          output: 0.262,         loss: 2.792
i: 292,         target: 2.090,          output: 0.262,         loss: 3.340
i: 293,         target: 1.809,          output: 0.262,         loss: 2.392
i: 294,         target: 3.357,          output: 0.262,         loss: 9.580
i: 295,         target: 1.937,          output: 0.262,         loss: 2.804
i: 296,         target: 2.208,          output: 0.262,         loss: 3.784
i: 297,         target: -0.532,         output: 0.262,         loss: 0.632
i: 298,         target: 1.175,          output: 0.262,         loss: 0.833
i: 299,         target: -0.575,         output: 0.262,         loss: 0.702
i: 300,         target: -0.758,         output: 0.262,         loss: 1.040
i: 301,         target: -0.740,         output: 0.262,         loss: 1.004
i: 302,         target: 0.010,          output: 0.262,         loss: 0.064
i: 303,         target: 2.513,          output: 0.262,         loss: 5.066
i: 304,         target: 0.415,          output: 0.262,         loss: 0.023
i: 305,         target: 1.964,          output: 0.262,         loss: 2.897
i: 306,         target: -0.596,         output: 0.262,         loss: 0.737
i: 307,         target: -0.828,         output: 0.262,         loss: 1.190
i: 308,         target: 1.284,          output: 0.262,         loss: 1.043
i: 309,         target: 0.105,          output: 0.262,         loss: 0.025
i: 310,         target: -0.522,         output: 0.262,         loss: 0.615
i: 311,         target: -0.811,         output: 0.262,         loss: 1.152
i: 312,         target: 0.477,          output: 0.262,         loss: 0.046
i: 313,         target: 0.953,          output: 0.262,         loss: 0.477
i: 314,         target: -0.326,         output: 0.262,         loss: 0.346
```

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i: 315,         target: -0.340,         output: 0.262,         loss: 0.363
i: 316,         target: 0.523,          output: 0.262,         loss: 0.068
i: 317,         target: 0.172,          output: 0.262,         loss: 0.008
i: 318,         target: -0.805,         output: 0.262,         loss: 1.139
i: 319,         target: 2.199,          output: 0.262,         loss: 3.749
i: 320,         target: -0.382,         output: 0.262,         loss: 0.415
i: 321,         target: 1.412,          output: 0.262,         loss: 1.323
i: 322,         target: -0.418,         output: 0.262,         loss: 0.463
i: 323,         target: 1.780,          output: 0.262,         loss: 2.305
i: 324,         target: -0.728,         output: 0.262,         loss: 0.982
i: 325,         target: -0.377,         output: 0.262,         loss: 0.409
i: 326,         target: -0.612,         output: 0.262,         loss: 0.765
i: 327,         target: 0.686,          output: 0.262,         loss: 0.179
i: 328,         target: -0.929,         output: 0.262,         loss: 1.420
i: 329,         target: 3.940,          output: 0.262,         loss: 13.525
i: 330,         target: -0.801,         output: 0.262,         loss: 1.132
i: 331,         target: 0.954,          output: 0.262,         loss: 0.478
i: 332,         target: 0.084,          output: 0.262,         loss: 0.032
i: 333,         target: -0.804,         output: 0.262,         loss: 1.138
i: 334,         target: -0.798,         output: 0.262,         loss: 1.125
i: 335,         target: 0.805,          output: 0.262,         loss: 0.295
i: 336,         target: 2.213,          output: 0.262,         loss: 3.803
i: 337,         target: -0.812,         output: 0.262,         loss: 1.155
i: 338,         target: -0.729,         output: 0.262,         loss: 0.982
i: 339,         target: 0.823,          output: 0.262,         loss: 0.314
i: 340,         target: 1.739,          output: 0.262,         loss: 2.182
i: 341,         target: -0.607,         output: 0.262,         loss: 0.755
i: 342,         target: -0.846,         output: 0.262,         loss: 1.229
i: 343,         target: 1.689,          output: 0.262,         loss: 2.037
i: 344,         target: -0.362,         output: 0.262,         loss: 0.390
i: 345,         target: -0.960,         output: 0.262,         loss: 1.494
i: 346,         target: 1.476,          output: 0.262,         loss: 1.473
i: 347,         target: 1.783,          output: 0.262,         loss: 2.311
i: 348,         target: 0.353,          output: 0.262,         loss: 0.008
i: 349,         target: -0.907,         output: 0.262,         loss: 1.369
i: 350,         target: -0.664,         output: 0.262,         loss: 0.858
i: 351,         target: 1.563,          output: 0.262,         loss: 1.691
i: 352,         target: 1.450,          output: 0.262,         loss: 1.411
i: 353,         target: -0.365,         output: 0.262,         loss: 0.393
i: 354,         target: 0.886,          output: 0.262,         loss: 0.390
i: 355,         target: -0.684,         output: 0.262,         loss: 0.896
i: 356,         target: 1.715,          output: 0.262,         loss: 2.110
i: 357,         target: 1.164,          output: 0.262,         loss: 0.813
i: 358,         target: -0.570,         output: 0.262,         loss: 0.693
i: 359,         target: -0.173,         output: 0.262,         loss: 0.189
i: 360,         target: 1.154,          output: 0.262,         loss: 0.795
i: 361,         target: -0.576,         output: 0.262,         loss: 0.703
i: 362,         target: -0.839,         output: 0.262,         loss: 1.214
```

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i: 363,         target: -0.460,         output: 0.262,         loss: 0.521
i: 364,         target: -0.512,         output: 0.262,         loss: 0.600
i: 365,         target: -0.818,         output: 0.262,         loss: 1.167
i: 366,         target: 0.446,          output: 0.262,         loss: 0.034
i: 367,         target: -0.368,         output: 0.262,         loss: 0.398
i: 368,         target: 1.982,          output: 0.262,         loss: 2.955
i: 369,         target: -0.805,         output: 0.262,         loss: 1.140
i: 370,         target: 1.439,          output: 0.262,         loss: 1.384
i: 371,         target: 1.093,          output: 0.262,         loss: 0.690
i: 372,         target: -0.303,         output: 0.262,         loss: 0.320
i: 373,         target: 0.201,          output: 0.262,         loss: 0.004
i: 374,         target: -0.606,         output: 0.262,         loss: 0.754
i: 375,         target: -0.730,         output: 0.262,         loss: 0.984
i: 376,         target: -0.377,         output: 0.262,         loss: 0.408
i: 377,         target: 1.248,          output: 0.262,         loss: 0.972
i: 378,         target: 1.645,          output: 0.262,         loss: 1.912
i: 379,         target: -0.742,         output: 0.262,         loss: 1.009
i: 380,         target: -0.836,         output: 0.262,         loss: 1.206
i: 381,         target: 1.621,          output: 0.262,         loss: 1.846
i: 382,         target: -0.616,         output: 0.262,         loss: 0.771
i: 383,         target: 1.199,          output: 0.262,         loss: 0.877
i: 384,         target: -0.786,         output: 0.262,         loss: 1.099
i: 385,         target: 3.277,          output: 0.262,         loss: 9.088
i: 386,         target: -0.057,         output: 0.262,         loss: 0.102
i: 387,         target: 2.053,          output: 0.262,         loss: 3.208
i: 388,         target: -0.845,         output: 0.262,         loss: 1.227
i: 389,         target: -0.343,         output: 0.262,         loss: 0.367
i: 390,         target: 0.130,          output: 0.262,         loss: 0.017
i: 391,         target: 1.096,          output: 0.262,         loss: 0.696
i: 392,         target: 0.496,          output: 0.262,         loss: 0.054
i: 393,         target: -0.712,         output: 0.262,         loss: 0.949
i: 394,         target: 1.393,          output: 0.262,         loss: 1.279
i: 395,         target: -0.415,         output: 0.262,         loss: 0.459
i: 396,         target: 1.952,          output: 0.262,         loss: 2.855
i: 397,         target: 1.816,          output: 0.262,         loss: 2.413
i: 398,         target: 1.944,          output: 0.262,         loss: 2.827
i: 399,         target: -0.433,         output: 0.262,         loss: 0.484
i: 400,         target: 1.781,          output: 0.262,         loss: 2.307
i: 401,         target: 1.852,          output: 0.262,         loss: 2.526
i: 402,         target: 1.179,          output: 0.262,         loss: 0.841
i: 403,         target: -1.170,         output: 0.262,         loss: 2.052
i: 404,         target: 0.908,          output: 0.262,         loss: 0.417
i: 405,         target: -0.700,         output: 0.262,         loss: 0.926
i: 406,         target: -0.715,         output: 0.262,         loss: 0.955
i: 407,         target: -0.169,         output: 0.262,         loss: 0.186
i: 408,         target: -0.688,         output: 0.262,         loss: 0.903
i: 409,         target: -0.504,         output: 0.262,         loss: 0.587
i: 410,         target: -0.886,         output: 0.262,         loss: 1.320
```

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i: 411,         target: -0.498,         output: 0.262,         loss: 0.578
i: 412,         target: 0.822,          output: 0.262,         loss: 0.313
i: 413,         target: -0.843,         output: 0.262,         loss: 1.222
i: 414,         target: 1.144,          output: 0.262,         loss: 0.778
i: 415,         target: 2.243,          output: 0.262,         loss: 3.922
i: 416,         target: 1.772,          output: 0.262,         loss: 2.280
i: 417,         target: -0.751,         output: 0.262,         loss: 1.026
i: 418,         target: -0.306,         output: 0.262,         loss: 0.324
i: 419,         target: -0.710,         output: 0.262,         loss: 0.946
i: 420,         target: -0.640,         output: 0.262,         loss: 0.814
i: 421,         target: -0.639,         output: 0.262,         loss: 0.812
i: 422,         target: -0.333,         output: 0.262,         loss: 0.354
i: 423,         target: 2.180,          output: 0.262,         loss: 3.676
i: 424,         target: 0.765,          output: 0.262,         loss: 0.253
i: 425,         target: -0.649,         output: 0.262,         loss: 0.831
i: 426,         target: 2.539,          output: 0.262,         loss: 5.185
i: 427,         target: -0.526,         output: 0.262,         loss: 0.622
i: 428,         target: -0.811,         output: 0.262,         loss: 1.152
i: 429,         target: -0.343,         output: 0.262,         loss: 0.366
i: 430,         target: -0.484,         output: 0.262,         loss: 0.558
i: 431,         target: -0.819,         output: 0.262,         loss: 1.170
i: 432,         target: 0.140,          output: 0.262,         loss: 0.015
i: 433,         target: 2.029,          output: 0.262,         loss: 3.121
i: 434,         target: 0.198,          output: 0.262,         loss: 0.004
i: 435,         target: -0.748,         output: 0.262,         loss: 1.021
i: 436,         target: 1.856,          output: 0.262,         loss: 2.539
i: 437,         target: 1.266,          output: 0.262,         loss: 1.007
i: 438,         target: -1.090,         output: 0.262,         loss: 1.829
i: 439,         target: 2.177,          output: 0.262,         loss: 3.667
i: 440,         target: 1.435,          output: 0.262,         loss: 1.376
i: 441,         target: -0.629,         output: 0.262,         loss: 0.794
i: 442,         target: 2.276,          output: 0.262,         loss: 4.055
i: 443,         target: 0.702,          output: 0.262,         loss: 0.193
i: 444,         target: 1.861,          output: 0.262,         loss: 2.556
i: 445,         target: 1.685,          output: 0.262,         loss: 2.024
i: 446,         target: 1.424,          output: 0.262,         loss: 1.349
i: 447,         target: -1.007,         output: 0.262,         loss: 1.611
i: 448,         target: -0.939,         output: 0.262,         loss: 1.443
i: 449,         target: 1.138,          output: 0.262,         loss: 0.766
i: 450,         target: 2.043,          output: 0.262,         loss: 3.170
i: 451,         target: 0.365,          output: 0.262,         loss: 0.011
i: 452,         target: 1.571,          output: 0.262,         loss: 1.713
i: 453,         target: 1.952,          output: 0.262,         loss: 2.856
i: 454,         target: -0.388,         output: 0.262,         loss: 0.423
i: 455,         target: -0.379,         output: 0.262,         loss: 0.412
i: 456,         target: 0.272,          output: 0.262,         loss: 0.000
i: 457,         target: 0.729,          output: 0.262,         loss: 0.218
i: 458,         target: -0.741,         output: 0.262,         loss: 1.007
```

```
i: 459,         target: 2.338,         output: 0.262,         loss: 4.309
i: 460,         target: -0.956,        output: 0.262,         loss: 1.484
i: 461,         target: -0.715,        output: 0.262,         loss: 0.955
i: 462,         target: -0.542,        output: 0.262,         loss: 0.648
i: 463,         target: 1.642,         output: 0.262,         loss: 1.904
i: 464,         target: -0.676,        output: 0.262,         loss: 0.881
i: 465,         target: -1.003,        output: 0.262,         loss: 1.602
i: 466,         target: -0.621,        output: 0.262,         loss: 0.780
i: 467,         target: 0.169,         output: 0.262,         loss: 0.009
i: 468,         target: 1.473,         output: 0.262,         loss: 1.465
i: 469,         target: 1.934,         output: 0.262,         loss: 2.795
i: 470,         target: 0.664,         output: 0.262,         loss: 0.161
i: 471,         target: -0.796,        output: 0.262,         loss: 1.120
i: 472,         target: -0.735,        output: 0.262,         loss: 0.995
i: 473,         target: -0.792,        output: 0.262,         loss: 1.111
i: 474,         target: 0.283,         output: 0.262,         loss: 0.000
i: 475,         target: 0.592,         output: 0.262,         loss: 0.109
i: 476,         target: -0.968,        output: 0.262,         loss: 1.513
i: 477,         target: -0.597,        output: 0.262,         loss: 0.739
i: 478,         target: -0.749,        output: 0.262,         loss: 1.022
i: 479,         target: -0.860,        output: 0.262,         loss: 1.260
i: 480,         target: -0.419,        output: 0.262,         loss: 0.465
i: 481,         target: 1.682,         output: 0.262,         loss: 2.015
i: 482,         target: -0.883,        output: 0.262,         loss: 1.312
i: 483,         target: -0.841,        output: 0.262,         loss: 1.217
i: 484,         target: -0.799,        output: 0.262,         loss: 1.127
i: 485,         target: -0.043,        output: 0.262,         loss: 0.093
i: 486,         target: 0.029,         output: 0.262,         loss: 0.054
i: 487,         target: -0.339,        output: 0.262,         loss: 0.362
i: 488,         target: 2.418,         output: 0.262,         loss: 4.648
i: 489,         target: -0.398,        output: 0.262,         loss: 0.436
i: 490,         target: -0.833,        output: 0.262,         loss: 1.200
i: 491,         target: -0.873,        output: 0.262,         loss: 1.289
i: 492,         target: 1.848,         output: 0.262,         loss: 2.514
i: 493,         target: -0.888,        output: 0.262,         loss: 1.323
i: 494,         target: -0.670,        output: 0.262,         loss: 0.870
i: 495,         target: 0.939,         output: 0.262,         loss: 0.458
i: 496,         target: 3.271,         output: 0.262,         loss: 9.053
i: 497,         target: -0.487,        output: 0.262,         loss: 0.562
i: 498,         target: -0.591,        output: 0.262,         loss: 0.729
i: 499,         target: -0.457,        output: 0.262,         loss: 0.518
i: 500,         target: -0.646,        output: 0.262,         loss: 0.826
i: 501,         target: -0.262,        output: 0.262,         loss: 0.275
i: 502,         target: -0.768,        output: 0.262,         loss: 1.063
i: 503,         target: -0.640,        output: 0.262,         loss: 0.814
i: 504,         target: 0.910,         output: 0.262,         loss: 0.419
i: 505,         target: -0.784,        output: 0.262,         loss: 1.095
i: 506,         target: -0.723,        output: 0.262,         loss: 0.970
```

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i: 507,         target: -0.852,         output: 0.262,         loss: 1.242
i: 508,         target: -0.779,         output: 0.262,         loss: 1.085
i: 509,         target: 0.645,          output: 0.262,         loss: 0.146
i: 510,         target: -0.898,         output: 0.262,         loss: 1.347
i: 511,         target: -0.829,         output: 0.262,         loss: 1.191
i: 512,         target: -1.116,         output: 0.262,         loss: 1.900
i: 513,         target: 0.995,          output: 0.262,         loss: 0.537
i: 514,         target: -0.800,         output: 0.262,         loss: 1.128
i: 515,         target: 2.755,          output: 0.262,         loss: 6.215
i: 516,         target: -0.468,         output: 0.262,         loss: 0.533
i: 517,         target: -0.796,         output: 0.262,         loss: 1.121
i: 518,         target: -0.741,         output: 0.262,         loss: 1.006
i: 519,         target: 0.864,          output: 0.262,         loss: 0.362
i: 520,         target: 3.358,          output: 0.262,         loss: 9.584
i: 521,         target: 2.501,          output: 0.262,         loss: 5.010
i: 522,         target: -1.031,         output: 0.262,         loss: 1.672
i: 523,         target: -0.712,         output: 0.262,         loss: 0.950
i: 524,         target: 1.927,          output: 0.262,         loss: 2.770
i: 525,         target: 0.704,          output: 0.262,         loss: 0.195
i: 526,         target: 1.818,          output: 0.262,         loss: 2.419
i: 527,         target: 2.443,          output: 0.262,         loss: 4.754
i: 528,         target: -0.392,         output: 0.262,         loss: 0.429
i: 529,         target: -0.798,         output: 0.262,         loss: 1.125
i: 530,         target: 1.927,          output: 0.262,         loss: 2.772
i: 531,         target: 1.082,          output: 0.262,         loss: 0.673
i: 532,         target: -0.812,         output: 0.262,         loss: 1.155
i: 533,         target: -0.714,         output: 0.262,         loss: 0.954
i: 534,         target: 1.337,          output: 0.262,         loss: 1.154
i: 535,         target: -0.734,         output: 0.262,         loss: 0.993
i: 536,         target: -0.516,         output: 0.262,         loss: 0.606
i: 537,         target: 0.938,          output: 0.262,         loss: 0.456
i: 538,         target: -0.654,         output: 0.262,         loss: 0.839
i: 539,         target: -0.528,         output: 0.262,         loss: 0.625
i: 540,         target: 1.345,          output: 0.262,         loss: 1.172
i: 541,         target: -0.271,         output: 0.262,         loss: 0.284
i: 542,         target: 0.983,          output: 0.262,         loss: 0.520
i: 543,         target: -0.724,         output: 0.262,         loss: 0.974
i: 544,         target: 0.731,          output: 0.262,         loss: 0.220
i: 545,         target: 1.941,          output: 0.262,         loss: 2.818
i: 546,         target: 2.537,          output: 0.262,         loss: 5.174
i: 547,         target: 0.380,          output: 0.262,         loss: 0.014
i: 548,         target: -0.850,         output: 0.262,         loss: 1.236
i: 549,         target: 0.599,          output: 0.262,         loss: 0.113
i: 550,         target: 1.393,          output: 0.262,         loss: 1.279
i: 551,         target: -0.212,         output: 0.262,         loss: 0.225
i: 552,         target: 0.345,          output: 0.262,         loss: 0.007
i: 553,         target: -0.465,         output: 0.262,         loss: 0.529
i: 554,         target: 2.076,          output: 0.262,         loss: 3.290
```

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i: 555,         target: -0.683,         output: 0.262,         loss: 0.893
i: 556,         target: -0.641,         output: 0.262,         loss: 0.815
i: 557,         target: -0.807,         output: 0.262,         loss: 1.143
i: 558,         target: -0.517,         output: 0.262,         loss: 0.607
i: 559,         target: 2.067,          output: 0.262,         loss: 3.256
i: 560,         target: -0.703,         output: 0.262,         loss: 0.932
i: 561,         target: -0.805,         output: 0.262,         loss: 1.139
i: 562,         target: -0.804,         output: 0.262,         loss: 1.138
i: 563,         target: -0.659,         output: 0.262,         loss: 0.848
i: 564,         target: -0.247,         output: 0.262,         loss: 0.259
i: 565,         target: -0.379,         output: 0.262,         loss: 0.411
i: 566,         target: 0.576,          output: 0.262,         loss: 0.098
i: 567,         target: -0.503,         output: 0.262,         loss: 0.586
i: 568,         target: 0.365,          output: 0.262,         loss: 0.011
i: 569,         target: 0.238,          output: 0.262,         loss: 0.001
i: 570,         target: 0.181,          output: 0.262,         loss: 0.007
i: 571,         target: 0.578,          output: 0.262,         loss: 0.099
i: 572,         target: 0.933,          output: 0.262,         loss: 0.450
i: 573,         target: 0.243,          output: 0.262,         loss: 0.000
i: 574,         target: -0.623,         output: 0.262,         loss: 0.784
i: 575,         target: -0.502,         output: 0.262,         loss: 0.584
i: 576,         target: 1.274,          output: 0.262,         loss: 1.024
i: 577,         target: -0.845,         output: 0.262,         loss: 1.227
i: 578,         target: -0.103,         output: 0.262,         loss: 0.134
i: 579,         target: -0.710,         output: 0.262,         loss: 0.945
i: 580,         target: 1.986,          output: 0.262,         loss: 2.971
i: 581,         target: 1.947,          output: 0.262,         loss: 2.838
i: 582,         target: 1.080,          output: 0.262,         loss: 0.669
i: 583,         target: -0.870,         output: 0.262,         loss: 1.282
i: 584,         target: -0.775,         output: 0.262,         loss: 1.076
i: 585,         target: -0.584,         output: 0.262,         loss: 0.716
i: 586,         target: -0.376,         output: 0.262,         loss: 0.408
i: 587,         target: -0.875,         output: 0.262,         loss: 1.295
i: 588,         target: 0.235,          output: 0.262,         loss: 0.001
i: 589,         target: 1.922,          output: 0.262,         loss: 2.754
i: 590,         target: -0.479,         output: 0.262,         loss: 0.549
i: 591,         target: -0.598,         output: 0.262,         loss: 0.741
i: 592,         target: -0.788,         output: 0.262,         loss: 1.103
i: 593,         target: -0.771,         output: 0.262,         loss: 1.068
i: 594,         target: -0.741,         output: 0.262,         loss: 1.007
i: 595,         target: -0.672,         output: 0.262,         loss: 0.873
i: 596,         target: -0.808,         output: 0.262,         loss: 1.146
i: 597,         target: -0.394,         output: 0.262,         loss: 0.430
i: 598,         target: -0.698,         output: 0.262,         loss: 0.922
i: 599,         target: -0.846,         output: 0.262,         loss: 1.228
i: 600,         target: -0.496,         output: 0.262,         loss: 0.575
i: 601,         target: 1.143,          output: 0.262,         loss: 0.775
i: 602,         target: -0.629,         output: 0.262,         loss: 0.794
```

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i: 603,         target: 2.091,         output: 0.262,         loss: 3.344
i: 604,         target: 1.975,         output: 0.262,         loss: 2.934
i: 605,         target: -0.915,        output: 0.262,         loss: 1.385
i: 606,         target: -0.847,        output: 0.262,         loss: 1.231
i: 607,         target: -0.807,        output: 0.262,         loss: 1.143
i: 608,         target: 0.933,         output: 0.262,         loss: 0.449
i: 609,         target: 1.151,         output: 0.262,         loss: 0.789
i: 610,         target: -0.318,        output: 0.262,         loss: 0.337
i: 611,         target: 2.449,         output: 0.262,         loss: 4.780
i: 612,         target: 1.934,         output: 0.262,         loss: 2.793
i: 613,         target: -0.748,        output: 0.262,         loss: 1.021
i: 614,         target: 1.155,         output: 0.262,         loss: 0.797
i: 615,         target: -0.756,        output: 0.262,         loss: 1.037
i: 616,         target: -0.746,        output: 0.262,         loss: 1.018
i: 617,         target: -0.563,        output: 0.262,         loss: 0.682
i: 618,         target: 0.361,         output: 0.262,         loss: 0.010
i: 619,         target: 2.081,         output: 0.262,         loss: 3.306
i: 620,         target: 2.070,         output: 0.262,         loss: 3.269
i: 621,         target: -0.762,        output: 0.262,         loss: 1.049
i: 622,         target: -0.548,        output: 0.262,         loss: 0.657
i: 623,         target: 0.143,         output: 0.262,         loss: 0.014
i: 624,         target: -0.995,        output: 0.262,         loss: 1.580
i: 625,         target: -0.276,        output: 0.262,         loss: 0.290
i: 626,         target: 1.804,         output: 0.262,         loss: 2.376
i: 627,         target: 1.970,         output: 0.262,         loss: 2.915
i: 628,         target: -0.461,        output: 0.262,         loss: 0.523
i: 629,         target: -0.511,        output: 0.262,         loss: 0.597
i: 630,         target: -0.646,        output: 0.262,         loss: 0.825
i: 631,         target: 1.574,         output: 0.262,         loss: 1.720
i: 632,         target: -0.688,        output: 0.262,         loss: 0.903
i: 633,         target: 0.263,         output: 0.262,         loss: 0.000
i: 634,         target: -0.604,        output: 0.262,         loss: 0.750
i: 635,         target: -0.794,        output: 0.262,         loss: 1.115
i: 636,         target: -0.622,        output: 0.262,         loss: 0.782
i: 637,         target: 2.050,         output: 0.262,         loss: 3.194
i: 638,         target: 3.348,         output: 0.262,         loss: 9.524
i: 639,         target: -0.940,        output: 0.262,         loss: 1.445
i: 640,         target: -0.757,        output: 0.262,         loss: 1.040
i: 641,         target: -0.673,        output: 0.262,         loss: 0.874
i: 642,         target: -0.079,        output: 0.262,         loss: 0.117
i: 643,         target: -0.280,        output: 0.262,         loss: 0.294
i: 644,         target: 1.793,         output: 0.262,         loss: 2.343
i: 645,         target: 0.014,         output: 0.262,         loss: 0.062
i: 646,         target: 0.118,         output: 0.262,         loss: 0.021
i: 647,         target: -0.596,        output: 0.262,         loss: 0.736
i: 648,         target: -0.851,        output: 0.262,         loss: 1.239
i: 649,         target: -0.517,        output: 0.262,         loss: 0.608
i: 650,         target: -0.711,        output: 0.262,         loss: 0.948
```

```
i: 651,         target: -0.548,         output: 0.262,         loss: 0.657
i: 652,         target: 1.807,          output: 0.262,         loss: 2.387
i: 653,         target: 0.960,          output: 0.262,         loss: 0.487
i: 654,         target: 0.350,          output: 0.262,         loss: 0.008
i: 655,         target: 2.480,          output: 0.262,         loss: 4.919
i: 656,         target: -0.447,         output: 0.262,         loss: 0.504
i: 657,         target: -0.238,         output: 0.262,         loss: 0.250
i: 658,         target: 0.482,          output: 0.262,         loss: 0.048
i: 659,         target: -0.724,         output: 0.262,         loss: 0.972
i: 660,         target: -0.725,         output: 0.262,         loss: 0.974
i: 661,         target: -0.569,         output: 0.262,         loss: 0.691
i: 662,         target: -0.863,         output: 0.262,         loss: 1.267
i: 663,         target: 2.108,          output: 0.262,         loss: 3.406
i: 664,         target: 2.240,          output: 0.262,         loss: 3.912
i: 665,         target: 1.937,          output: 0.262,         loss: 2.803
i: 666,         target: -0.463,         output: 0.262,         loss: 0.526
i: 667,         target: 0.091,          output: 0.262,         loss: 0.029
i: 668,         target: -0.708,         output: 0.262,         loss: 0.942
i: 669,         target: 2.235,          output: 0.262,         loss: 3.892
i: 670,         target: 0.661,          output: 0.262,         loss: 0.159
i: 671,         target: 0.157,          output: 0.262,         loss: 0.011
i: 672,         target: -0.804,         output: 0.262,         loss: 1.138
i: 673,         target: 3.095,          output: 0.262,         loss: 8.023
i: 674,         target: 1.558,          output: 0.262,         loss: 1.678
i: 675,         target: -0.931,         output: 0.262,         loss: 1.425
i: 676,         target: -0.655,         output: 0.262,         loss: 0.842
i: 677,         target: 2.024,          output: 0.262,         loss: 3.105
i: 678,         target: 5.073,          output: 0.262,         loss: 23.145
i: 679,         target: -0.365,         output: 0.262,         loss: 0.394
i: 680,         target: -0.729,         output: 0.262,         loss: 0.984
i: 681,         target: 1.995,          output: 0.262,         loss: 3.003
i: 682,         target: -0.794,         output: 0.262,         loss: 1.115
i: 683,         target: -0.804,         output: 0.262,         loss: 1.138
i: 684,         target: 1.304,          output: 0.262,         loss: 1.085
i: 685,         target: 0.421,          output: 0.262,         loss: 0.025
i: 686,         target: -0.784,         output: 0.262,         loss: 1.096
i: 687,         target: -0.658,         output: 0.262,         loss: 0.847
i: 688,         target: 1.890,          output: 0.262,         loss: 2.650
i: 689,         target: -0.347,         output: 0.262,         loss: 0.372
i: 690,         target: -0.673,         output: 0.262,         loss: 0.875
i: 691,         target: 0.936,          output: 0.262,         loss: 0.454
i: 692,         target: -0.738,         output: 0.262,         loss: 1.001
i: 693,         target: 3.854,          output: 0.262,         loss: 12.902
i: 694,         target: 1.832,          output: 0.262,         loss: 2.464
i: 695,         target: -0.991,         output: 0.262,         loss: 1.571
i: 696,         target: 0.349,          output: 0.262,         loss: 0.007
i: 697,         target: -0.438,         output: 0.262,         loss: 0.491
i: 698,         target: -0.302,         output: 0.262,         loss: 0.319
```

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i: 699,         target: -1.141,         output: 0.262,         loss: 1.971
i: 700,         target: -0.800,         output: 0.262,         loss: 1.128
i: 701,         target: 1.295,          output: 0.262,         loss: 1.066
i: 702,         target: 2.343,          output: 0.262,         loss: 4.331
i: 703,         target: -0.809,         output: 0.262,         loss: 1.148
i: 704,         target: 0.633,          output: 0.262,         loss: 0.137
i: 705,         target: 3.109,          output: 0.262,         loss: 8.103
i: 706,         target: -0.769,         output: 0.262,         loss: 1.064
i: 707,         target: -0.725,         output: 0.262,         loss: 0.976
i: 708,         target: -0.042,         output: 0.262,         loss: 0.093
i: 709,         target: -0.921,         output: 0.262,         loss: 1.401
i: 710,         target: -0.467,         output: 0.262,         loss: 0.533
i: 711,         target: -1.045,         output: 0.262,         loss: 1.710
i: 712,         target: 2.097,          output: 0.262,         loss: 3.366
i: 713,         target: -0.736,         output: 0.262,         loss: 0.998
i: 714,         target: 1.794,          output: 0.262,         loss: 2.346
i: 715,         target: -0.662,         output: 0.262,         loss: 0.855
i: 716,         target: 2.334,          output: 0.262,         loss: 4.291
i: 717,         target: 2.941,          output: 0.262,         loss: 7.174
i: 718,         target: -0.909,         output: 0.262,         loss: 1.371
i: 719,         target: -0.343,         output: 0.262,         loss: 0.367
i: 720,         target: -0.499,         output: 0.262,         loss: 0.580
i: 721,         target: -0.512,         output: 0.262,         loss: 0.600
i: 722,         target: -0.800,         output: 0.262,         loss: 1.130
i: 723,         target: -1.031,         output: 0.262,         loss: 1.673
i: 724,         target: -0.755,         output: 0.262,         loss: 1.034
i: 725,         target: 3.272,          output: 0.262,         loss: 9.056
i: 726,         target: -0.820,         output: 0.262,         loss: 1.172
i: 727,         target: -0.845,         output: 0.262,         loss: 1.227
i: 728,         target: 0.857,          output: 0.262,         loss: 0.354
i: 729,         target: -0.822,         output: 0.262,         loss: 1.175
i: 730,         target: 1.919,          output: 0.262,         loss: 2.744
i: 731,         target: 2.233,          output: 0.262,         loss: 3.882
i: 732,         target: 0.967,          output: 0.262,         loss: 0.497
i: 733,         target: 1.878,          output: 0.262,         loss: 2.611
i: 734,         target: -0.422,         output: 0.262,         loss: 0.468
i: 735,         target: -0.798,         output: 0.262,         loss: 1.124
i: 736,         target: -0.630,         output: 0.262,         loss: 0.796
i: 737,         target: -0.770,         output: 0.262,         loss: 1.066
i: 738,         target: 1.422,          output: 0.262,         loss: 1.345
i: 739,         target: 0.667,          output: 0.262,         loss: 0.164
i: 740,         target: -0.572,         output: 0.262,         loss: 0.695
i: 741,         target: -0.844,         output: 0.262,         loss: 1.225
i: 742,         target: 1.296,          output: 0.262,         loss: 1.068
i: 743,         target: -0.746,         output: 0.262,         loss: 1.017
i: 744,         target: 2.092,          output: 0.262,         loss: 3.347
i: 745,         target: -0.618,         output: 0.262,         loss: 0.776
i: 746,         target: -0.777,         output: 0.262,         loss: 1.081
```

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i: 747,         target: -0.449,         output: 0.262,         loss: 0.506
i: 748,         target: 2.228,          output: 0.262,         loss: 3.866
i: 749,         target: -0.387,         output: 0.262,         loss: 0.421
i: 750,         target: -0.879,         output: 0.262,         loss: 1.303
i: 751,         target: 1.505,          output: 0.262,         loss: 1.545
i: 752,         target: -0.487,         output: 0.262,         loss: 0.562
i: 753,         target: 1.852,          output: 0.262,         loss: 2.528
i: 754,         target: 0.946,          output: 0.262,         loss: 0.468
i: 755,         target: -0.635,         output: 0.262,         loss: 0.806
i: 756,         target: -0.742,         output: 0.262,         loss: 1.009
i: 757,         target: 0.792,          output: 0.262,         loss: 0.281
i: 758,         target: 2.912,          output: 0.262,         loss: 7.019
i: 759,         target: 1.979,          output: 0.262,         loss: 2.948
i: 760,         target: 0.992,          output: 0.262,         loss: 0.532
i: 761,         target: 1.059,          output: 0.262,         loss: 0.635
i: 762,         target: -0.810,         output: 0.262,         loss: 1.151
i: 763,         target: 0.697,          output: 0.262,         loss: 0.189
i: 764,         target: 1.427,          output: 0.262,         loss: 1.355
i: 765,         target: 1.960,          output: 0.262,         loss: 2.882
i: 766,         target: -0.826,         output: 0.262,         loss: 1.184
i: 767,         target: -0.577,         output: 0.262,         loss: 0.705
i: 768,         target: -0.679,         output: 0.262,         loss: 0.886
i: 769,         target: 2.194,          output: 0.262,         loss: 3.732
i: 770,         target: 0.143,          output: 0.262,         loss: 0.014
i: 771,         target: 0.663,          output: 0.262,         loss: 0.160
i: 772,         target: -0.766,         output: 0.262,         loss: 1.058
i: 773,         target: 0.506,          output: 0.262,         loss: 0.059
i: 774,         target: -0.786,         output: 0.262,         loss: 1.100
i: 775,         target: 0.716,          output: 0.262,         loss: 0.205
i: 776,         target: -0.513,         output: 0.262,         loss: 0.601
i: 777,         target: -0.509,         output: 0.262,         loss: 0.595
i: 778,         target: -0.605,         output: 0.262,         loss: 0.752
i: 779,         target: -0.396,         output: 0.262,         loss: 0.433
i: 780,         target: 1.510,          output: 0.262,         loss: 1.557
i: 781,         target: -0.416,         output: 0.262,         loss: 0.460
i: 782,         target: -0.967,         output: 0.262,         loss: 1.511
i: 783,         target: -0.819,         output: 0.262,         loss: 1.170
i: 784,         target: -0.930,         output: 0.262,         loss: 1.421
i: 785,         target: -0.597,         output: 0.262,         loss: 0.739
i: 786,         target: 0.968,          output: 0.262,         loss: 0.498
i: 787,         target: -0.767,         output: 0.262,         loss: 1.059
i: 788,         target: 1.156,          output: 0.262,         loss: 0.799
i: 789,         target: -0.636,         output: 0.262,         loss: 0.807
i: 790,         target: -0.642,         output: 0.262,         loss: 0.817
i: 791,         target: 1.111,          output: 0.262,         loss: 0.720
i: 792,         target: 1.112,          output: 0.262,         loss: 0.723
i: 793,         target: 0.951,          output: 0.262,         loss: 0.475
i: 794,         target: -0.418,         output: 0.262,         loss: 0.462
```

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i: 795,         target: -0.729,         output: 0.262,         loss: 0.983
i: 796,         target: -1.009,         output: 0.262,         loss: 1.617
i: 797,         target: -0.437,         output: 0.262,         loss: 0.489
i: 798,         target: -0.396,         output: 0.262,         loss: 0.433
i: 799,         target: 0.289,          output: 0.262,         loss: 0.001
i: 800,         target: -0.747,         output: 0.262,         loss: 1.020
i: 801,         target: -0.282,         output: 0.262,         loss: 0.297
i: 802,         target: 2.656,          output: 0.262,         loss: 5.729
i: 803,         target: -0.944,         output: 0.262,         loss: 1.454
i: 804,         target: 1.284,          output: 0.262,         loss: 1.044
i: 805,         target: -0.773,         output: 0.262,         loss: 1.072
i: 806,         target: -0.663,         output: 0.262,         loss: 0.857
i: 807,         target: 2.034,          output: 0.262,         loss: 3.138
i: 808,         target: -0.688,         output: 0.262,         loss: 0.903
i: 809,         target: -0.393,         output: 0.262,         loss: 0.429
i: 810,         target: -0.712,         output: 0.262,         loss: 0.950
i: 811,         target: 0.417,          output: 0.262,         loss: 0.024
i: 812,         target: 0.996,          output: 0.262,         loss: 0.538
i: 813,         target: 1.397,          output: 0.262,         loss: 1.286
i: 814,         target: 1.190,          output: 0.262,         loss: 0.861
i: 815,         target: 1.742,          output: 0.262,         loss: 2.188
i: 816,         target: -0.737,         output: 0.262,         loss: 0.998
i: 817,         target: 0.252,          output: 0.262,         loss: 0.000
i: 818,         target: 2.474,          output: 0.262,         loss: 4.889
i: 819,         target: -0.698,         output: 0.262,         loss: 0.922
i: 820,         target: 0.851,          output: 0.262,         loss: 0.346
i: 821,         target: 2.138,          output: 0.262,         loss: 3.517
i: 822,         target: -0.938,         output: 0.262,         loss: 1.441
i: 823,         target: 2.320,          output: 0.262,         loss: 4.235
i: 824,         target: -0.118,         output: 0.262,         loss: 0.145
i: 825,         target: -0.737,         output: 0.262,         loss: 0.998
i: 826,         target: -0.697,         output: 0.262,         loss: 0.921
i: 827,         target: 0.374,          output: 0.262,         loss: 0.012
i: 828,         target: -0.773,         output: 0.262,         loss: 1.073
i: 829,         target: -0.424,         output: 0.262,         loss: 0.471
i: 830,         target: -0.903,         output: 0.262,         loss: 1.358
i: 831,         target: -0.568,         output: 0.262,         loss: 0.690
i: 832,         target: -0.984,         output: 0.262,         loss: 1.553
i: 833,         target: 2.287,          output: 0.262,         loss: 4.098
i: 834,         target: 1.107,          output: 0.262,         loss: 0.713
i: 835,         target: -0.635,         output: 0.262,         loss: 0.805
i: 836,         target: -0.757,         output: 0.262,         loss: 1.039
i: 837,         target: -0.368,         output: 0.262,         loss: 0.398
i: 838,         target: -0.794,         output: 0.262,         loss: 1.116
i: 839,         target: 0.900,          output: 0.262,         loss: 0.407
i: 840,         target: -0.285,         output: 0.262,         loss: 0.300
i: 841,         target: -0.527,         output: 0.262,         loss: 0.623
i: 842,         target: -0.614,         output: 0.262,         loss: 0.768
```

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i: 843,         target: 3.068,         output: 0.262,         loss: 7.870
i: 844,         target: -0.761,        output: 0.262,         loss: 1.047
i: 845,         target: -0.515,        output: 0.262,         loss: 0.604
i: 846,         target: 1.949,         output: 0.262,         loss: 2.846
i: 847,         target: -0.881,        output: 0.262,         loss: 1.307
i: 848,         target: 1.126,         output: 0.262,         loss: 0.746
i: 849,         target: -0.908,        output: 0.262,         loss: 1.369
i: 850,         target: -0.710,        output: 0.262,         loss: 0.945
i: 851,         target: -0.682,        output: 0.262,         loss: 0.892
i: 852,         target: -0.943,        output: 0.262,         loss: 1.454
i: 853,         target: -0.411,        output: 0.262,         loss: 0.453
i: 854,         target: -0.565,        output: 0.262,         loss: 0.685
i: 855,         target: -0.678,        output: 0.262,         loss: 0.884
i: 856,         target: -0.817,        output: 0.262,         loss: 1.165
i: 857,         target: -0.512,        output: 0.262,         loss: 0.599
i: 858,         target: 4.579,         output: 0.262,         loss: 18.631
i: 859,         target: -0.893,        output: 0.262,         loss: 1.335
i: 860,         target: -0.733,        output: 0.262,         loss: 0.990
i: 861,         target: -0.502,        output: 0.262,         loss: 0.585
i: 862,         target: 0.737,         output: 0.262,         loss: 0.225
i: 863,         target: 1.303,         output: 0.262,         loss: 1.082
i: 864,         target: 0.028,         output: 0.262,         loss: 0.055
i: 865,         target: 2.354,         output: 0.262,         loss: 4.375
i: 866,         target: -1.070,        output: 0.262,         loss: 1.776
i: 867,         target: 1.188,         output: 0.262,         loss: 0.856
i: 868,         target: 0.999,         output: 0.262,         loss: 0.543
i: 869,         target: 1.957,         output: 0.262,         loss: 2.872
i: 870,         target: 1.749,         output: 0.262,         loss: 2.210
i: 871,         target: 0.425,         output: 0.262,         loss: 0.026
i: 872,         target: -0.656,        output: 0.262,         loss: 0.843
i: 873,         target: 1.145,         output: 0.262,         loss: 0.779
i: 874,         target: -0.888,        output: 0.262,         loss: 1.323
i: 875,         target: 2.141,         output: 0.262,         loss: 3.529
i: 876,         target: -0.593,        output: 0.262,         loss: 0.732
i: 877,         target: 1.119,         output: 0.262,         loss: 0.734
i: 878,         target: 2.461,         output: 0.262,         loss: 4.833
i: 879,         target: 0.348,         output: 0.262,         loss: 0.007
i: 880,         target: 1.417,         output: 0.262,         loss: 1.332
i: 881,         target: -0.755,        output: 0.262,         loss: 1.035
i: 882,         target: -0.717,        output: 0.262,         loss: 0.959
i: 883,         target: 1.979,         output: 0.262,         loss: 2.948
i: 884,         target: 0.299,         output: 0.262,         loss: 0.001
i: 885,         target: 1.395,         output: 0.262,         loss: 1.284
i: 886,         target: -0.195,        output: 0.262,         loss: 0.209
i: 887,         target: 0.903,         output: 0.262,         loss: 0.410
i: 888,         target: -0.348,        output: 0.262,         loss: 0.372
i: 889,         target: 0.525,         output: 0.262,         loss: 0.069
i: 890,         target: -0.766,        output: 0.262,         loss: 1.057
```

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i: 891,         target: 1.476,         output: 0.262,         loss: 1.472
i: 892,         target: 1.428,         output: 0.262,         loss: 1.359
i: 893,         target: -1.133,        output: 0.262,         loss: 1.948
i: 894,         target: 0.477,         output: 0.262,         loss: 0.046
i: 895,         target: -0.876,        output: 0.262,         loss: 1.295
i: 896,         target: -0.416,        output: 0.262,         loss: 0.460
i: 897,         target: 1.725,         output: 0.262,         loss: 2.139
i: 898,         target: 1.974,         output: 0.262,         loss: 2.931
i: 899,         target: -0.562,        output: 0.262,         loss: 0.679
i: 900,         target: -0.554,        output: 0.262,         loss: 0.667
i: 901,         target: 1.760,         output: 0.262,         loss: 2.243
i: 902,         target: -0.438,        output: 0.262,         loss: 0.491
i: 903,         target: 2.457,         output: 0.262,         loss: 4.814
i: 904,         target: -0.733,        output: 0.262,         loss: 0.991
i: 905,         target: -0.911,        output: 0.262,         loss: 1.378
i: 906,         target: 4.576,         output: 0.262,         loss: 18.610
i: 907,         target: -0.277,        output: 0.262,         loss: 0.291
i: 908,         target: -0.402,        output: 0.262,         loss: 0.441
i: 909,         target: -0.280,        output: 0.262,         loss: 0.294
i: 910,         target: 1.426,         output: 0.262,         loss: 1.354
i: 911,         target: -0.960,        output: 0.262,         loss: 1.493
i: 912,         target: -0.308,        output: 0.262,         loss: 0.325
i: 913,         target: -0.747,        output: 0.262,         loss: 1.018
i: 914,         target: -0.552,        output: 0.262,         loss: 0.664
i: 915,         target: -0.232,        output: 0.262,         loss: 0.245
i: 916,         target: 1.082,         output: 0.262,         loss: 0.672
i: 917,         target: -0.927,        output: 0.262,         loss: 1.414
i: 918,         target: -0.289,        output: 0.262,         loss: 0.304
i: 919,         target: -0.979,        output: 0.262,         loss: 1.542
i: 920,         target: 1.897,         output: 0.262,         loss: 2.671
i: 921,         target: -0.733,        output: 0.262,         loss: 0.990
i: 922,         target: 0.436,         output: 0.262,         loss: 0.030
i: 923,         target: 1.926,         output: 0.262,         loss: 2.769
i: 924,         target: 0.725,         output: 0.262,         loss: 0.214
i: 925,         target: -0.939,        output: 0.262,         loss: 1.443
i: 926,         target: 0.736,         output: 0.262,         loss: 0.224
i: 927,         target: -0.561,        output: 0.262,         loss: 0.678
i: 928,         target: -0.505,        output: 0.262,         loss: 0.590
i: 929,         target: 4.830,         output: 0.262,         loss: 20.860
i: 930,         target: -0.472,        output: 0.262,         loss: 0.539
i: 931,         target: -0.759,        output: 0.262,         loss: 1.044
i: 932,         target: 1.268,         output: 0.262,         loss: 1.011
i: 933,         target: 1.022,         output: 0.262,         loss: 0.576
i: 934,         target: -0.593,        output: 0.262,         loss: 0.731
i: 935,         target: -0.787,        output: 0.262,         loss: 1.102
i: 936,         target: -0.805,        output: 0.262,         loss: 1.139
i: 937,         target: 0.300,         output: 0.262,         loss: 0.001
i: 938,         target: -0.787,        output: 0.262,         loss: 1.101
```

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i: 939,         target: -0.927,         output: 0.262,         loss: 1.415
i: 940,         target: -0.916,         output: 0.262,         loss: 1.389
i: 941,         target: -0.444,         output: 0.262,         loss: 0.499
i: 942,         target: -0.694,         output: 0.262,         loss: 0.915
i: 943,         target: -0.518,         output: 0.262,         loss: 0.609
i: 944,         target: -1.039,         output: 0.262,         loss: 1.693
i: 945,         target: -1.092,         output: 0.262,         loss: 1.834
i: 946,         target: -0.580,         output: 0.262,         loss: 0.710
i: 947,         target: 2.620,          output: 0.262,         loss: 5.557
i: 948,         target: -0.680,         output: 0.262,         loss: 0.889
i: 949,         target: 1.488,          output: 0.262,         loss: 1.501
i: 950,         target: -0.847,         output: 0.262,         loss: 1.231
i: 951,         target: -0.868,         output: 0.262,         loss: 1.277
i: 952,         target: 3.761,          output: 0.262,         loss: 12.244
i: 953,         target: 1.960,          output: 0.262,         loss: 2.881
i: 954,         target: -0.663,         output: 0.262,         loss: 0.855
i: 955,         target: 0.355,          output: 0.262,         loss: 0.009
i: 956,         target: 2.013,          output: 0.262,         loss: 3.065
i: 957,         target: -0.683,         output: 0.262,         loss: 0.893
i: 958,         target: -0.831,         output: 0.262,         loss: 1.195
i: 959,         target: 1.516,          output: 0.262,         loss: 1.572
i: 960,         target: -0.559,         output: 0.262,         loss: 0.675
i: 961,         target: 2.934,          output: 0.262,         loss: 7.139
i: 962,         target: -0.870,         output: 0.262,         loss: 1.283
i: 963,         target: -0.667,         output: 0.262,         loss: 0.863
i: 964,         target: -0.706,         output: 0.262,         loss: 0.937
i: 965,         target: 1.816,          output: 0.262,         loss: 2.415
i: 966,         target: -0.730,         output: 0.262,         loss: 0.984
i: 967,         target: 2.437,          output: 0.262,         loss: 4.728
i: 968,         target: 2.063,          output: 0.262,         loss: 3.243
i: 969,         target: 0.338,          output: 0.262,         loss: 0.006
i: 970,         target: -0.795,         output: 0.262,         loss: 1.119
i: 971,         target: -0.435,         output: 0.262,         loss: 0.487
i: 972,         target: 1.809,          output: 0.262,         loss: 2.391
i: 973,         target: 1.453,          output: 0.262,         loss: 1.418
i: 974,         target: 3.500,          output: 0.262,         loss: 10.484
i: 975,         target: 0.249,          output: 0.262,         loss: 0.000
i: 976,         target: -0.463,         output: 0.262,         loss: 0.526
i: 977,         target: -0.487,         output: 0.262,         loss: 0.561
i: 978,         target: 1.180,          output: 0.262,         loss: 0.842
i: 979,         target: -0.560,         output: 0.262,         loss: 0.677
i: 980,         target: 0.148,          output: 0.262,         loss: 0.013
i: 981,         target: 1.256,          output: 0.262,         loss: 0.988
i: 982,         target: -0.105,         output: 0.262,         loss: 0.135
i: 983,         target: -0.916,         output: 0.262,         loss: 1.388
i: 984,         target: 2.396,          output: 0.262,         loss: 4.554
i: 985,         target: -0.608,         output: 0.262,         loss: 0.758
i: 986,         target: -0.834,         output: 0.262,         loss: 1.203
```

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i: 987,          target: -0.840,          output: 0.262,          loss: 1.214
i: 988,          target: 1.552,           output: 0.262,          loss: 1.662
i: 989,          target: -0.572,          output: 0.262,          loss: 0.697
i: 990,          target: -0.165,          output: 0.262,          loss: 0.183
i: 991,          target: -0.917,          output: 0.262,          loss: 1.391
i: 992,          target: -0.520,          output: 0.262,          loss: 0.613
i: 993,          target: -0.663,          output: 0.262,          loss: 0.856
i: 994,          target: 1.981,           output: 0.262,          loss: 2.953
i: 995,          target: 0.387,           output: 0.262,          loss: 0.016
i: 996,          target: -0.627,          output: 0.262,          loss: 0.792
i: 997,          target: 0.915,           output: 0.262,          loss: 0.426
i: 998,          target: 1.701,           output: 0.262,          loss: 2.069
i: 999,          target: -0.581,          output: 0.262,          loss: 0.712
Average loss: 1.527
```