

```

import torch
import torch.nn.functional as F
import torch.nn as nn
import torch.optim as optim
from torch.utils.data import DataLoader
from torch.utils.data import sampler
import torchvision.datasets as dset
import torchvision.transforms as T
import numpy as np

from google.colab import drive
drive.mount('/content/gdrive/', force_remount=True)

import sys
sys.path.insert(0, '/content/gdrive/My Drive/Colab Notebooks')

## Loss function and efficiency metrics are already provided to you.
from project_utilities import Loss
from project_utilities import efficiency
from project_utilities import ValueSet

Mounted at /content/gdrive/

DEVICE = torch.device('cuda:0' if torch.cuda.is_available() else
'cpu')

from sklearn.model_selection import train_test_split
train_set_idx, val_set_idx = train_test_split(list(range(1,3)),
test_size=1)

print(train_set_idx)
print(val_set_idx)

[2]
[1]

%cd /content/gdrive/MyDrive/Project/data

/content/gdrive/MyDrive/Project/data

%ls

bi_rnn.pt          Set_1.npz    Set_36.npz    Set_52.npz
Set_69.npz
linear.pt          Set_20.npz   Set_37.npz    Set_53.npz    Set_6.npz
RCNN_h64_l3_loss0351.pt Set_21.npz   Set_38.npz    Set_54.npz
Set_70.npz
RCNN_h64_l3_loss0356.pt Set_22.npz   Set_39.npz    Set_55.npz
Set_71.npz
RCNN_h64_l3.pt     Set_23.npz   Set_3.npz     Set_56.npz
Set_72.npz
RCNN.pt            Set_24.npz   Set_40.npz    Set_57.npz

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Set_73.npz				
res_cnn.pt	Set_25.npz	Set_41.npz	Set_58.npz	
Set_74.npz				
RNN.pt	Set_26.npz	Set_42.npz	Set_59.npz	
Set_75.npz				
Set_10.npz	Set_27.npz	Set_43.npz	Set_5.npz	
Set_76.npz				
Set_11.npz	Set_28.npz	Set_44.npz	Set_60.npz	
Set_77.npz				
Set_12.npz	Set_29.npz	Set_45.npz	Set_61.npz	
Set_78.npz				
Set_13.npz	Set_2.npz	Set_46.npz	Set_62.npz	
Set_79.npz				
Set_14.npz	Set_30.npz	Set_47.npz	Set_63.npz	Set_7.npz
Set_15.npz	Set_31.npz	Set_48.npz	Set_64.npz	
Set_80.npz				
Set_16.npz	Set_32.npz	Set_49.npz	Set_65.npz	Set_8.npz
Set_17.npz	Set_33.npz	Set_4.npz	Set_66.npz	Set_9.npz
Set_18.npz	Set_34.npz	Set_50.npz	Set_67.npz	
Set_19.npz	Set_35.npz	Set_51.npz	Set_68.npz	

```

class MyDataset(torch.utils.data.Dataset):
    def __init__(self, setID):
        'Initialization'
        npz_files_content = np.load("./Set_"+str(setID)+".npz")
        self.X_set = torch.tensor(npz_files_content['X'])
        self.y_set = torch.tensor(npz_files_content['y'])

        # sets all nans to 0.0
        self.y_set[self.y_set != self.y_set] = 0.0
        self.X_set[self.X_set != self.X_set] = 0.0
    def __len__(self):
        'Denotes the total number of samples'
        return len(self.y_set)
    def __getitem__(self, index):
        'Generates one sample of data'
        # Select sample
        X = self.X_set[index]
        y = self.y_set[index]
        return X, y

# Train loader
for setID in train_set_idx:
    train_set = MyDataset(setID)
    train_loader = torch.utils.data.DataLoader(train_set,
                                                batch_size=128,
                                                shuffle=True)

    print(setID)
    for X_train, y_train in train_loader:
        print(X_train.shape)

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    print(y_train.shape)
    #print(X_train.sum())
    #print(set(y_train.reshape(-1).numpy()))
    break

# Validation loader
for setID in val_set_idx:
    val_set = MyDataset(setID)
    val_loader = torch.utils.data.DataLoader(val_set,
                                              batch_size=128,
                                              shuffle=True)

    print(setID)
    for X_val, y_val in val_loader:
        print(X_val.shape)
        print(y_val.shape)
        break

2
torch.Size([128, 4, 4000])
torch.Size([128, 4000])
1
torch.Size([128, 4, 4000])
torch.Size([128, 4000])

loss_model = Loss(0.00001)

# Once created this class object can be used in training and
validation.
computed_loss = loss_model.forward(X_train[1][1].squeeze(),
y_train[1])
print(computed_loss)

tensor(1.6912)

computed_loss = loss_model.forward(y_train[1], y_train[1])
print(computed_loss)

tensor(0.)

class CNN(torch.nn.Module):
    def __init__(self):
        super(CNN, self).__init__()

        # Encoder

        # 4000
        self.conv1 = torch.nn.Conv1d(in_channels=4, out_channels=64,
kernel_size=5, stride=4, padding=2)
        self.bn1 = torch.nn.BatchNorm1d(num_features=64)

        # 1000

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        self.conv2 = torch.nn.Conv1d(in_channels=64, out_channels=128,
kernel_size=5, stride=2, padding=2)
        self.bn2 = torch.nn.BatchNorm1d(num_features=128)

        # 500
        self.conv3 = torch.nn.Conv1d(in_channels=128, out_channels=256,
kernel_size=5, stride=2, padding=2)
        self.bn3 = torch.nn.BatchNorm1d(num_features=256)

        # 250
        self.conv4 = torch.nn.Conv1d(in_channels=256, out_channels=256,
kernel_size=5, stride=2, padding=2)
        self.bn4 = torch.nn.BatchNorm1d(num_features=256)

        # Decoder

        # 125
        self.tconv1 = torch.nn.ConvTranspose1d(in_channels=256,
out_channels=256, kernel_size=5, stride=2, padding=2,
output_padding=1)
        self.bn5 = torch.nn.BatchNorm1d(num_features=256)

        # 250
        self.tconv2 = torch.nn.ConvTranspose1d(in_channels=256,
out_channels=128, kernel_size=5, stride=2, padding=2,
output_padding=1)
        self.bn6 = torch.nn.BatchNorm1d(num_features=128)

        # 500
        self.tconv3 = torch.nn.ConvTranspose1d(in_channels=128,
out_channels=64, kernel_size=5, stride=2, padding=2, output_padding=1)
        self.bn7 = torch.nn.BatchNorm1d(num_features=64)

        # 1000
        self.tconv4 = torch.nn.ConvTranspose1d(in_channels=64,
out_channels=32, kernel_size=5, stride=4, padding=2, output_padding=3)
        self.bn8 = torch.nn.BatchNorm1d(num_features=(32))

        # 4000
        # reduces out_channels
        self.conv5 = torch.nn.Conv1d(in_channels=(32), out_channels=1,
kernel_size=1, stride=1, padding=0)

```

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def forward(self, input_x):
    # x dim: [batch size, feature dim=4, sentence length=4000]

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    conv1_x = self.conv1(input_x)

```

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        x = self.bn1(conv1_x)

        conv2_x = self.conv2(x)
        x = self.bn2(conv2_x)

        conv3_x = self.conv3(x)
        x = self.bn3(conv3_x)

        conv4_x = self.conv4(x)
        x = self.bn4(conv4_x)

        x = self.tconv1(x)
        x = self.bn5(x)

        x = self.tconv2(x)
        x = self.bn6(x)

        x = self.tconv3(x)
        x = self.bn7(x)

        x = self.tconv4(x)
        x = self.bn8(x)

        x = self.conv5(x)

        return x.squeeze()

print(train_set_idx)
print(val_set_idx)

[2]
[1]

#####
##### Training and evaluation wrappers
#####

def train(model, num_epochs, learning_rate=0.01, seed=123,
batch_size=128, beta1=0.9, beta2=0.999):
    cost = []
    val_cost = []
    torch.manual_seed(seed)
    optimizer = torch.optim.Adam(model.parameters(), lr=learning_rate,
betas=(beta1, beta2))

    for e in range(1,num_epochs):
        batch_num = 0

        for setID in train_set_idx:
            train_set = MyDataset(setID+1)

```

```

train_generator = torch.utils.data.DataLoader(train_set,
batch_size=batch_size,
shuffle=True,
num_workers=4)

print(setID)
for X_train, y_train in train_generator:
    batch_num = batch_num + 1

    # move to DEVICE
    X_train = X_train.to(DEVICE)
    y_train = y_train.to(DEVICE)

    ##### Compute outputs #####
    yhat = model(X_train)
    loss = loss_model.forward(yhat, y_train)
    ##### Reset gradients from previous iteration #####
    optimizer.zero_grad()
    ##### Compute gradients #####
    loss.backward()
    ##### Update weights #####
    optimizer.step()
    ##### Logging #####
    with torch.no_grad():
        if batch_num%20 == 0:
            yhat = model.forward(X_train)
            curr_loss = loss_model.forward(yhat, y_train)
            print('Epoch ID: %d ' % e, end="")
            print(' Set ID: %d' % setID, end="")
            print(' Batch ID: %d' % batch_num, end="")
            print(' | Loss: %.5f' % curr_loss)
            cost.append(curr_loss)
            #loss_val, eff_rate, fp_rate = validate(model)
            #val_cost.append(loss_val)
    model.train()
return cost, val_cost

def validate(model):
    loss_val = []
    eff = ValueSet(0, 0, 0, 0)
    # switch to evaluate mode
    #model.to("cpu")
    model.eval()
    with torch.no_grad():
        for setID in val_set_idx:
            #val_set = MyDataset(setID+1)
            val_set = MyDataset(11)
            val_generator = torch.utils.data.DataLoader(val_set,
batch_size=64,
shuffle=True)

```

```

    #print(setID)
    for X_val, y_val in val_generator:
        # Forward pass
        X_val = X_val.to(DEVICE)
        y_val = y_val.to(DEVICE)
        val_outputs = model(X_val)
        loss_output = loss_model.forward(val_outputs, y_val)
        loss_val.append(loss_output)
        for label, output in zip(y_val.cpu().numpy(),
val_outputs.cpu().numpy()):
            eff += efficiency(label, output, difference = 5.0,
                            threshold = 1e-2, integral_threshold
= 0.2,
                            min_width = 3)
    return sum(loss_val)/len(loss_val), eff.eff_rate, eff.fp_rate

```

lr=0.001, beta1=0.9, beta2=0.999

model = CNN()

model = model.to(DEVICE)

```

cost, val_cost = train(model,
    num_epochs=50,
    learning_rate=0.001,
    seed=123, batch_size=64,
    beta1=0.9, beta2=0.999)

```

```

1
Epoch ID: 1   Set ID: 1   Batch ID: 20 | Loss: 7.37072
Epoch ID: 1   Set ID: 1   Batch ID: 40 | Loss: 5.99923
Epoch ID: 1   Set ID: 1   Batch ID: 60 | Loss: 4.18076
1
Epoch ID: 2   Set ID: 1   Batch ID: 20 | Loss: 4.16210
Epoch ID: 2   Set ID: 1   Batch ID: 40 | Loss: 4.35569
Epoch ID: 2   Set ID: 1   Batch ID: 60 | Loss: 4.48609
1
Epoch ID: 3   Set ID: 1   Batch ID: 20 | Loss: 4.39214
Epoch ID: 3   Set ID: 1   Batch ID: 40 | Loss: 4.33365
Epoch ID: 3   Set ID: 1   Batch ID: 60 | Loss: 4.01284
1
Epoch ID: 4   Set ID: 1   Batch ID: 20 | Loss: 4.14783
Epoch ID: 4   Set ID: 1   Batch ID: 40 | Loss: 4.06835
Epoch ID: 4   Set ID: 1   Batch ID: 60 | Loss: 4.17266
1
Epoch ID: 5   Set ID: 1   Batch ID: 20 | Loss: 4.14627
Epoch ID: 5   Set ID: 1   Batch ID: 40 | Loss: 3.83659
Epoch ID: 5   Set ID: 1   Batch ID: 60 | Loss: 3.89540
1
Epoch ID: 6   Set ID: 1   Batch ID: 20 | Loss: 4.07663
Epoch ID: 6   Set ID: 1   Batch ID: 40 | Loss: 3.95533

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Epoch ID: 6	Set ID: 1	Batch ID: 60		Loss: 3.94552
1				
Epoch ID: 7	Set ID: 1	Batch ID: 20		Loss: 3.62822
Epoch ID: 7	Set ID: 1	Batch ID: 40		Loss: 3.86510
Epoch ID: 7	Set ID: 1	Batch ID: 60		Loss: 3.74932
1				
Epoch ID: 8	Set ID: 1	Batch ID: 20		Loss: 3.62718
Epoch ID: 8	Set ID: 1	Batch ID: 40		Loss: 3.44448
Epoch ID: 8	Set ID: 1	Batch ID: 60		Loss: 3.30400
1				
Epoch ID: 9	Set ID: 1	Batch ID: 20		Loss: 3.81136
Epoch ID: 9	Set ID: 1	Batch ID: 40		Loss: 3.51672
Epoch ID: 9	Set ID: 1	Batch ID: 60		Loss: 3.56572
1				
Epoch ID: 10	Set ID: 1	Batch ID: 20		Loss: 3.58965
Epoch ID: 10	Set ID: 1	Batch ID: 40		Loss: 3.73231
Epoch ID: 10	Set ID: 1	Batch ID: 60		Loss: 3.75638
1				
Epoch ID: 11	Set ID: 1	Batch ID: 20		Loss: 3.32002
Epoch ID: 11	Set ID: 1	Batch ID: 40		Loss: 3.62194
Epoch ID: 11	Set ID: 1	Batch ID: 60		Loss: 3.78797
1				
Epoch ID: 12	Set ID: 1	Batch ID: 20		Loss: 3.24855
Epoch ID: 12	Set ID: 1	Batch ID: 40		Loss: 3.46876
Epoch ID: 12	Set ID: 1	Batch ID: 60		Loss: 3.69288
1				
Epoch ID: 13	Set ID: 1	Batch ID: 20		Loss: 3.27341
Epoch ID: 13	Set ID: 1	Batch ID: 40		Loss: 3.63029
Epoch ID: 13	Set ID: 1	Batch ID: 60		Loss: 3.73500
1				
Epoch ID: 14	Set ID: 1	Batch ID: 20		Loss: 3.52130
Epoch ID: 14	Set ID: 1	Batch ID: 40		Loss: 3.71979
Epoch ID: 14	Set ID: 1	Batch ID: 60		Loss: 3.65786
1				
Epoch ID: 15	Set ID: 1	Batch ID: 20		Loss: 3.52645
Epoch ID: 15	Set ID: 1	Batch ID: 40		Loss: 3.65433
Epoch ID: 15	Set ID: 1	Batch ID: 60		Loss: 3.42597
1				
Epoch ID: 16	Set ID: 1	Batch ID: 20		Loss: 3.49598
Epoch ID: 16	Set ID: 1	Batch ID: 40		Loss: 2.95876
Epoch ID: 16	Set ID: 1	Batch ID: 60		Loss: 2.97157
1				
Epoch ID: 17	Set ID: 1	Batch ID: 20		Loss: 2.99126
Epoch ID: 17	Set ID: 1	Batch ID: 40		Loss: 2.85979
Epoch ID: 17	Set ID: 1	Batch ID: 60		Loss: 3.63602
1				
Epoch ID: 18	Set ID: 1	Batch ID: 20		Loss: 2.88618
Epoch ID: 18	Set ID: 1	Batch ID: 40		Loss: 2.94793
Epoch ID: 18	Set ID: 1	Batch ID: 60		Loss: 3.62413
1				

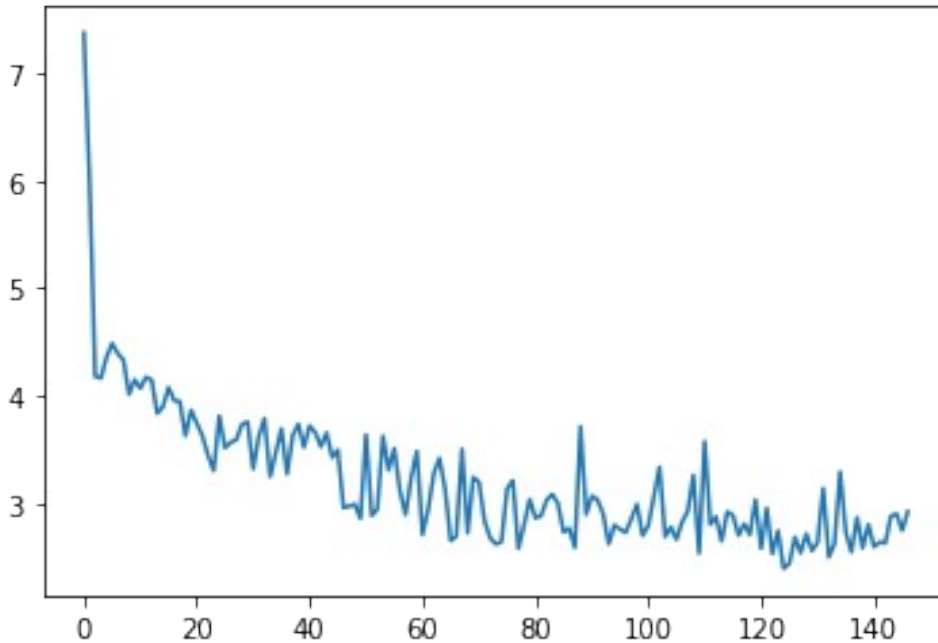
Epoch ID: 19	Set ID: 1	Batch ID: 20		Loss: 3.30844
Epoch ID: 19	Set ID: 1	Batch ID: 40		Loss: 3.50984
Epoch ID: 19	Set ID: 1	Batch ID: 60		Loss: 3.11562
1				
Epoch ID: 20	Set ID: 1	Batch ID: 20		Loss: 2.89462
Epoch ID: 20	Set ID: 1	Batch ID: 40		Loss: 3.24069
Epoch ID: 20	Set ID: 1	Batch ID: 60		Loss: 3.48260
1				
Epoch ID: 21	Set ID: 1	Batch ID: 20		Loss: 2.71084
Epoch ID: 21	Set ID: 1	Batch ID: 40		Loss: 2.94167
Epoch ID: 21	Set ID: 1	Batch ID: 60		Loss: 3.27704
1				
Epoch ID: 22	Set ID: 1	Batch ID: 20		Loss: 3.41913
Epoch ID: 22	Set ID: 1	Batch ID: 40		Loss: 3.13344
Epoch ID: 22	Set ID: 1	Batch ID: 60		Loss: 2.65238
1				
Epoch ID: 23	Set ID: 1	Batch ID: 20		Loss: 2.69609
Epoch ID: 23	Set ID: 1	Batch ID: 40		Loss: 3.50331
Epoch ID: 23	Set ID: 1	Batch ID: 60		Loss: 2.72498
1				
Epoch ID: 24	Set ID: 1	Batch ID: 20		Loss: 3.24144
Epoch ID: 24	Set ID: 1	Batch ID: 40		Loss: 3.19686
Epoch ID: 24	Set ID: 1	Batch ID: 60		Loss: 2.83478
1				
Epoch ID: 25	Set ID: 1	Batch ID: 20		Loss: 2.67621
Epoch ID: 25	Set ID: 1	Batch ID: 40		Loss: 2.62048
Epoch ID: 25	Set ID: 1	Batch ID: 60		Loss: 2.64248
1				
Epoch ID: 26	Set ID: 1	Batch ID: 20		Loss: 3.13758
Epoch ID: 26	Set ID: 1	Batch ID: 40		Loss: 3.21089
Epoch ID: 26	Set ID: 1	Batch ID: 60		Loss: 2.57947
1				
Epoch ID: 27	Set ID: 1	Batch ID: 20		Loss: 2.80169
Epoch ID: 27	Set ID: 1	Batch ID: 40		Loss: 3.03694
Epoch ID: 27	Set ID: 1	Batch ID: 60		Loss: 2.86447
1				
Epoch ID: 28	Set ID: 1	Batch ID: 20		Loss: 2.88248
Epoch ID: 28	Set ID: 1	Batch ID: 40		Loss: 3.02962
Epoch ID: 28	Set ID: 1	Batch ID: 60		Loss: 3.08387
1				
Epoch ID: 29	Set ID: 1	Batch ID: 20		Loss: 2.99737
Epoch ID: 29	Set ID: 1	Batch ID: 40		Loss: 2.73286
Epoch ID: 29	Set ID: 1	Batch ID: 60		Loss: 2.76752
1				
Epoch ID: 30	Set ID: 1	Batch ID: 20		Loss: 2.58929
Epoch ID: 30	Set ID: 1	Batch ID: 40		Loss: 3.71415
Epoch ID: 30	Set ID: 1	Batch ID: 60		Loss: 2.89746
1				
Epoch ID: 31	Set ID: 1	Batch ID: 20		Loss: 3.06760
Epoch ID: 31	Set ID: 1	Batch ID: 40		Loss: 3.03495

Epoch ID: 31	Set ID: 1	Batch ID: 60		Loss: 2.90188
1				
Epoch ID: 32	Set ID: 1	Batch ID: 20		Loss: 2.62315
Epoch ID: 32	Set ID: 1	Batch ID: 40		Loss: 2.79644
Epoch ID: 32	Set ID: 1	Batch ID: 60		Loss: 2.75952
1				
Epoch ID: 33	Set ID: 1	Batch ID: 20		Loss: 2.72877
Epoch ID: 33	Set ID: 1	Batch ID: 40		Loss: 2.85531
Epoch ID: 33	Set ID: 1	Batch ID: 60		Loss: 2.99096
1				
Epoch ID: 34	Set ID: 1	Batch ID: 20		Loss: 2.70112
Epoch ID: 34	Set ID: 1	Batch ID: 40		Loss: 2.79103
Epoch ID: 34	Set ID: 1	Batch ID: 60		Loss: 3.07124
1				
Epoch ID: 35	Set ID: 1	Batch ID: 20		Loss: 3.33717
Epoch ID: 35	Set ID: 1	Batch ID: 40		Loss: 2.69018
Epoch ID: 35	Set ID: 1	Batch ID: 60		Loss: 2.77826
1				
Epoch ID: 36	Set ID: 1	Batch ID: 20		Loss: 2.66491
Epoch ID: 36	Set ID: 1	Batch ID: 40		Loss: 2.82587
Epoch ID: 36	Set ID: 1	Batch ID: 60		Loss: 2.92562
1				
Epoch ID: 37	Set ID: 1	Batch ID: 20		Loss: 3.26209
Epoch ID: 37	Set ID: 1	Batch ID: 40		Loss: 2.53607
Epoch ID: 37	Set ID: 1	Batch ID: 60		Loss: 3.57508
1				
Epoch ID: 38	Set ID: 1	Batch ID: 20		Loss: 2.80271
Epoch ID: 38	Set ID: 1	Batch ID: 40		Loss: 2.87492
Epoch ID: 38	Set ID: 1	Batch ID: 60		Loss: 2.64920
1				
Epoch ID: 39	Set ID: 1	Batch ID: 20		Loss: 2.92032
Epoch ID: 39	Set ID: 1	Batch ID: 40		Loss: 2.88845
Epoch ID: 39	Set ID: 1	Batch ID: 60		Loss: 2.70287
1				
Epoch ID: 40	Set ID: 1	Batch ID: 20		Loss: 2.80849
Epoch ID: 40	Set ID: 1	Batch ID: 40		Loss: 2.70879
Epoch ID: 40	Set ID: 1	Batch ID: 60		Loss: 3.03167
1				
Epoch ID: 41	Set ID: 1	Batch ID: 20		Loss: 2.58057
Epoch ID: 41	Set ID: 1	Batch ID: 40		Loss: 2.95446
Epoch ID: 41	Set ID: 1	Batch ID: 60		Loss: 2.53097
1				
Epoch ID: 42	Set ID: 1	Batch ID: 20		Loss: 2.74498
Epoch ID: 42	Set ID: 1	Batch ID: 40		Loss: 2.39278
Epoch ID: 42	Set ID: 1	Batch ID: 60		Loss: 2.44067
1				
Epoch ID: 43	Set ID: 1	Batch ID: 20		Loss: 2.68512
Epoch ID: 43	Set ID: 1	Batch ID: 40		Loss: 2.53997
Epoch ID: 43	Set ID: 1	Batch ID: 60		Loss: 2.71610
1				

Epoch ID: 44	Set ID: 1	Batch ID: 20		Loss: 2.56012
Epoch ID: 44	Set ID: 1	Batch ID: 40		Loss: 2.63592
Epoch ID: 44	Set ID: 1	Batch ID: 60		Loss: 3.13950
1				
Epoch ID: 45	Set ID: 1	Batch ID: 20		Loss: 2.50133
Epoch ID: 45	Set ID: 1	Batch ID: 40		Loss: 2.62334
Epoch ID: 45	Set ID: 1	Batch ID: 60		Loss: 3.29256
1				
Epoch ID: 46	Set ID: 1	Batch ID: 20		Loss: 2.73360
Epoch ID: 46	Set ID: 1	Batch ID: 40		Loss: 2.54669
Epoch ID: 46	Set ID: 1	Batch ID: 60		Loss: 2.86700
1				
Epoch ID: 47	Set ID: 1	Batch ID: 20		Loss: 2.58547
Epoch ID: 47	Set ID: 1	Batch ID: 40		Loss: 2.80409
Epoch ID: 47	Set ID: 1	Batch ID: 60		Loss: 2.59640
1				
Epoch ID: 48	Set ID: 1	Batch ID: 20		Loss: 2.63882
Epoch ID: 48	Set ID: 1	Batch ID: 40		Loss: 2.62991
Epoch ID: 48	Set ID: 1	Batch ID: 60		Loss: 2.88127
1				
Epoch ID: 49	Set ID: 1	Batch ID: 20		Loss: 2.90044
Epoch ID: 49	Set ID: 1	Batch ID: 40		Loss: 2.74824
Epoch ID: 49	Set ID: 1	Batch ID: 60		Loss: 2.92284

```
import matplotlib.pyplot as plt
```

```
cost = [c.to('cpu') for c in cost]
val_cost = [c.to('cpu') for c in val_cost]
plt.plot(cost)
#plt.plot(val_cost)
plt.show()
```



```
loss_val, eff_rate, fp_rate = validate(model)
```

```
print(f"Loss: {loss_val}")
```

```
print(f"Eff: {eff_rate}")
```

```
print(f"FP: {fp_rate}")
```

```
Loss: 3.8393235206604004
```

```
Eff: 0.8776450637764507
```

```
FP: 1.3637272545490902
```

```
import matplotlib.pyplot as plt
```

```
model.to("cpu")
```

```
model.eval()
```

```
with torch.no_grad():
```

```
    for setID in val_set_idx:
```

```
        val_set = MyDataset(setID+1)
```

```
        val_generator = torch.utils.data.DataLoader(val_set,
                                                    batch_size=64,
                                                    shuffle=True)
```

```
        print(setID)
```

```
        for X_val, y_val in val_generator:
```

```
            # Forward pass
```

```
            val_outputs = model(X_val)
```

```
            fig, axs = plt.subplots(2)
```

```
            fig.suptitle('Vertically stacked subplots')
```

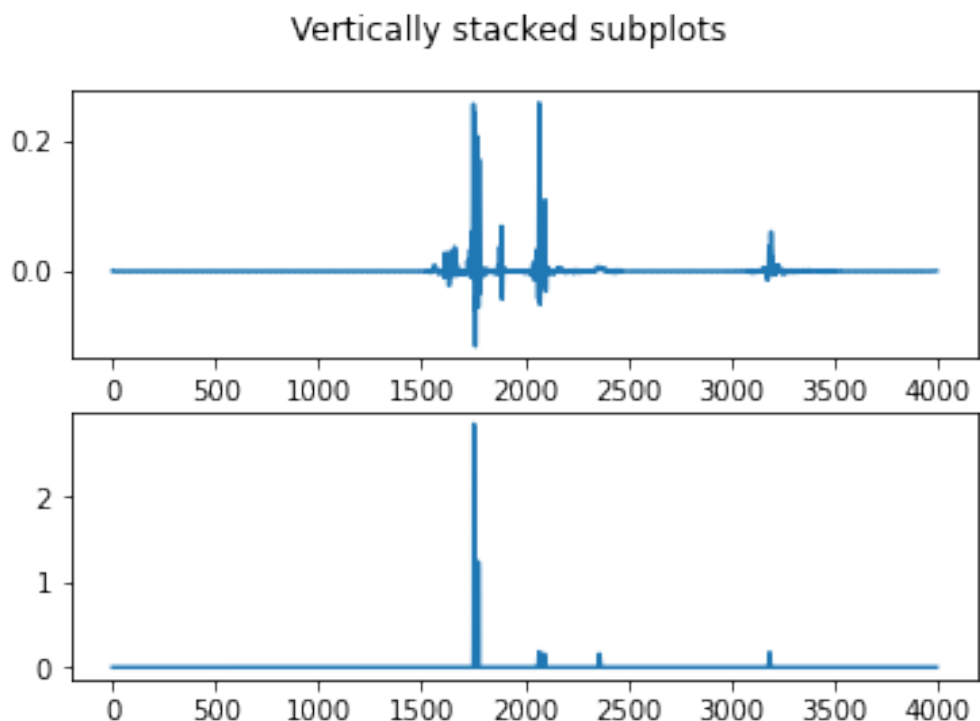
```
            axs[0].plot(val_outputs[0])
```

```
            axs[1].plot(y_val[0])
```

```
            plt.show()
```

```
            break
```

2



lr=0.0005, beta1=0.95, beta2=0.9995

```
model = CNN()
```

```
model = model.to(DEVICE)
```

```
cost, val_cost = train(model,  
                        num_epochs=50,  
                        learning_rate=0.0005,  
                        seed=123, batch_size=64,  
                        beta1=0.95, beta2=0.9995)
```

1

```
/usr/local/lib/python3.7/dist-packages/torch/utils/data/  
dataloader.py:566: UserWarning: This DataLoader will create 4 worker  
processes in total. Our suggested max number of worker in current  
system is 2, which is smaller than what this DataLoader is going to  
create. Please be aware that excessive worker creation might get  
DataLoader running slow or even freeze, lower the worker number to  
avoid potential slowness/freeze if necessary.  
  (cpuset_checked))
```

```
Epoch ID: 1   Set ID: 1   Batch ID: 20 | Loss: 8.55992
```

```
Epoch ID: 1   Set ID: 1   Batch ID: 40 | Loss: 8.22200
```

```
Epoch ID: 1   Set ID: 1   Batch ID: 60 | Loss: 7.71018
```

1

Epoch ID: 2	Set ID: 1	Batch ID: 20		Loss: 5.60413
Epoch ID: 2	Set ID: 1	Batch ID: 40		Loss: 5.52522
Epoch ID: 2	Set ID: 1	Batch ID: 60		Loss: 4.95227
1				
Epoch ID: 3	Set ID: 1	Batch ID: 20		Loss: 3.61004
Epoch ID: 3	Set ID: 1	Batch ID: 40		Loss: 3.36022
Epoch ID: 3	Set ID: 1	Batch ID: 60		Loss: 3.09882
1				
Epoch ID: 4	Set ID: 1	Batch ID: 20		Loss: 3.68206
Epoch ID: 4	Set ID: 1	Batch ID: 40		Loss: 3.59008
Epoch ID: 4	Set ID: 1	Batch ID: 60		Loss: 3.18031
1				
Epoch ID: 5	Set ID: 1	Batch ID: 20		Loss: 3.29585
Epoch ID: 5	Set ID: 1	Batch ID: 40		Loss: 3.37737
Epoch ID: 5	Set ID: 1	Batch ID: 60		Loss: 2.97347
1				
Epoch ID: 6	Set ID: 1	Batch ID: 20		Loss: 3.08349
Epoch ID: 6	Set ID: 1	Batch ID: 40		Loss: 3.44790
Epoch ID: 6	Set ID: 1	Batch ID: 60		Loss: 3.28514
1				
Epoch ID: 7	Set ID: 1	Batch ID: 20		Loss: 2.77426
Epoch ID: 7	Set ID: 1	Batch ID: 40		Loss: 3.24695
Epoch ID: 7	Set ID: 1	Batch ID: 60		Loss: 2.99483
1				
Epoch ID: 8	Set ID: 1	Batch ID: 20		Loss: 3.11021
Epoch ID: 8	Set ID: 1	Batch ID: 40		Loss: 3.27404
Epoch ID: 8	Set ID: 1	Batch ID: 60		Loss: 3.06670
1				
Epoch ID: 9	Set ID: 1	Batch ID: 20		Loss: 2.99012
Epoch ID: 9	Set ID: 1	Batch ID: 40		Loss: 3.32224
Epoch ID: 9	Set ID: 1	Batch ID: 60		Loss: 3.16681
1				
Epoch ID: 10	Set ID: 1	Batch ID: 20		Loss: 3.30702
Epoch ID: 10	Set ID: 1	Batch ID: 40		Loss: 3.44131
Epoch ID: 10	Set ID: 1	Batch ID: 60		Loss: 3.16397
1				
Epoch ID: 11	Set ID: 1	Batch ID: 20		Loss: 3.12286
Epoch ID: 11	Set ID: 1	Batch ID: 40		Loss: 3.39137
Epoch ID: 11	Set ID: 1	Batch ID: 60		Loss: 3.17933
1				
Epoch ID: 12	Set ID: 1	Batch ID: 20		Loss: 3.13095
Epoch ID: 12	Set ID: 1	Batch ID: 40		Loss: 3.26072
Epoch ID: 12	Set ID: 1	Batch ID: 60		Loss: 3.19585
1				
Epoch ID: 13	Set ID: 1	Batch ID: 20		Loss: 3.22846
Epoch ID: 13	Set ID: 1	Batch ID: 40		Loss: 3.22750
Epoch ID: 13	Set ID: 1	Batch ID: 60		Loss: 3.26773
1				
Epoch ID: 14	Set ID: 1	Batch ID: 20		Loss: 3.26505
Epoch ID: 14	Set ID: 1	Batch ID: 40		Loss: 3.35784

Epoch ID: 14	Set ID: 1	Batch ID: 60		Loss: 3.51793
1				
Epoch ID: 15	Set ID: 1	Batch ID: 20		Loss: 3.15284
Epoch ID: 15	Set ID: 1	Batch ID: 40		Loss: 3.38781
Epoch ID: 15	Set ID: 1	Batch ID: 60		Loss: 3.07551
1				
Epoch ID: 16	Set ID: 1	Batch ID: 20		Loss: 3.10461
Epoch ID: 16	Set ID: 1	Batch ID: 40		Loss: 2.81863
Epoch ID: 16	Set ID: 1	Batch ID: 60		Loss: 3.09722
1				
Epoch ID: 17	Set ID: 1	Batch ID: 20		Loss: 3.19747
Epoch ID: 17	Set ID: 1	Batch ID: 40		Loss: 3.04380
Epoch ID: 17	Set ID: 1	Batch ID: 60		Loss: 3.26454
1				
Epoch ID: 18	Set ID: 1	Batch ID: 20		Loss: 3.56687
Epoch ID: 18	Set ID: 1	Batch ID: 40		Loss: 3.29629
Epoch ID: 18	Set ID: 1	Batch ID: 60		Loss: 3.11082
1				
Epoch ID: 19	Set ID: 1	Batch ID: 20		Loss: 3.29210
Epoch ID: 19	Set ID: 1	Batch ID: 40		Loss: 3.19225
Epoch ID: 19	Set ID: 1	Batch ID: 60		Loss: 3.60851
1				
Epoch ID: 20	Set ID: 1	Batch ID: 20		Loss: 3.27769
Epoch ID: 20	Set ID: 1	Batch ID: 40		Loss: 2.87304
Epoch ID: 20	Set ID: 1	Batch ID: 60		Loss: 2.81461
1				
Epoch ID: 21	Set ID: 1	Batch ID: 20		Loss: 3.52487
Epoch ID: 21	Set ID: 1	Batch ID: 40		Loss: 3.16525
Epoch ID: 21	Set ID: 1	Batch ID: 60		Loss: 3.13724
1				
Epoch ID: 22	Set ID: 1	Batch ID: 20		Loss: 3.34222
Epoch ID: 22	Set ID: 1	Batch ID: 40		Loss: 3.43572
Epoch ID: 22	Set ID: 1	Batch ID: 60		Loss: 3.32848
1				
Epoch ID: 23	Set ID: 1	Batch ID: 20		Loss: 3.29544
Epoch ID: 23	Set ID: 1	Batch ID: 40		Loss: 3.64464
Epoch ID: 23	Set ID: 1	Batch ID: 60		Loss: 3.27895
1				
Epoch ID: 24	Set ID: 1	Batch ID: 20		Loss: 3.44445
Epoch ID: 24	Set ID: 1	Batch ID: 40		Loss: 3.21433
Epoch ID: 24	Set ID: 1	Batch ID: 60		Loss: 2.98949
1				
Epoch ID: 25	Set ID: 1	Batch ID: 20		Loss: 3.12603
Epoch ID: 25	Set ID: 1	Batch ID: 40		Loss: 3.01034
Epoch ID: 25	Set ID: 1	Batch ID: 60		Loss: 3.31887
1				
Epoch ID: 26	Set ID: 1	Batch ID: 20		Loss: 3.22063
Epoch ID: 26	Set ID: 1	Batch ID: 40		Loss: 3.13116
Epoch ID: 26	Set ID: 1	Batch ID: 60		Loss: 3.04725
1				

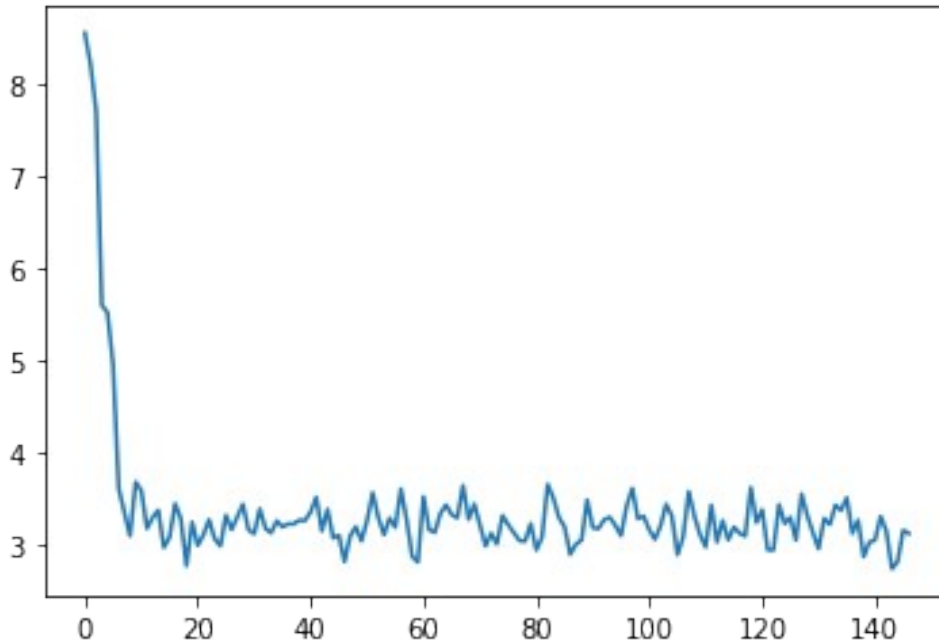
Epoch ID: 27	Set ID: 1	Batch ID: 20	Loss: 3.04075
Epoch ID: 27	Set ID: 1	Batch ID: 40	Loss: 3.23133
Epoch ID: 27	Set ID: 1	Batch ID: 60	Loss: 2.94551
1			
Epoch ID: 28	Set ID: 1	Batch ID: 20	Loss: 3.08209
Epoch ID: 28	Set ID: 1	Batch ID: 40	Loss: 3.65744
Epoch ID: 28	Set ID: 1	Batch ID: 60	Loss: 3.51097
1			
Epoch ID: 29	Set ID: 1	Batch ID: 20	Loss: 3.29712
Epoch ID: 29	Set ID: 1	Batch ID: 40	Loss: 3.19518
Epoch ID: 29	Set ID: 1	Batch ID: 60	Loss: 2.89785
1			
Epoch ID: 30	Set ID: 1	Batch ID: 20	Loss: 3.00684
Epoch ID: 30	Set ID: 1	Batch ID: 40	Loss: 3.05135
Epoch ID: 30	Set ID: 1	Batch ID: 60	Loss: 3.48876
1			
Epoch ID: 31	Set ID: 1	Batch ID: 20	Loss: 3.18796
Epoch ID: 31	Set ID: 1	Batch ID: 40	Loss: 3.17797
Epoch ID: 31	Set ID: 1	Batch ID: 60	Loss: 3.27296
1			
Epoch ID: 32	Set ID: 1	Batch ID: 20	Loss: 3.30132
Epoch ID: 32	Set ID: 1	Batch ID: 40	Loss: 3.21161
Epoch ID: 32	Set ID: 1	Batch ID: 60	Loss: 3.10240
1			
Epoch ID: 33	Set ID: 1	Batch ID: 20	Loss: 3.42425
Epoch ID: 33	Set ID: 1	Batch ID: 40	Loss: 3.61459
Epoch ID: 33	Set ID: 1	Batch ID: 60	Loss: 3.28537
1			
Epoch ID: 34	Set ID: 1	Batch ID: 20	Loss: 3.31188
Epoch ID: 34	Set ID: 1	Batch ID: 40	Loss: 3.16729
Epoch ID: 34	Set ID: 1	Batch ID: 60	Loss: 3.06176
1			
Epoch ID: 35	Set ID: 1	Batch ID: 20	Loss: 3.20603
Epoch ID: 35	Set ID: 1	Batch ID: 40	Loss: 3.44187
Epoch ID: 35	Set ID: 1	Batch ID: 60	Loss: 3.31594
1			
Epoch ID: 36	Set ID: 1	Batch ID: 20	Loss: 2.89464
Epoch ID: 36	Set ID: 1	Batch ID: 40	Loss: 3.08567
Epoch ID: 36	Set ID: 1	Batch ID: 60	Loss: 3.58006
1			
Epoch ID: 37	Set ID: 1	Batch ID: 20	Loss: 3.31313
Epoch ID: 37	Set ID: 1	Batch ID: 40	Loss: 3.11206
Epoch ID: 37	Set ID: 1	Batch ID: 60	Loss: 2.97834
1			
Epoch ID: 38	Set ID: 1	Batch ID: 20	Loss: 3.43276
Epoch ID: 38	Set ID: 1	Batch ID: 40	Loss: 3.03256
Epoch ID: 38	Set ID: 1	Batch ID: 60	Loss: 3.26448
1			
Epoch ID: 39	Set ID: 1	Batch ID: 20	Loss: 3.05613
Epoch ID: 39	Set ID: 1	Batch ID: 40	Loss: 3.19441

Epoch ID: 39	Set ID: 1	Batch ID: 60	Loss: 3.12758
1			
Epoch ID: 40	Set ID: 1	Batch ID: 20	Loss: 3.09648
Epoch ID: 40	Set ID: 1	Batch ID: 40	Loss: 3.62320
Epoch ID: 40	Set ID: 1	Batch ID: 60	Loss: 3.24465
1			
Epoch ID: 41	Set ID: 1	Batch ID: 20	Loss: 3.38333
Epoch ID: 41	Set ID: 1	Batch ID: 40	Loss: 2.94775
Epoch ID: 41	Set ID: 1	Batch ID: 60	Loss: 2.94562
1			
Epoch ID: 42	Set ID: 1	Batch ID: 20	Loss: 3.43845
Epoch ID: 42	Set ID: 1	Batch ID: 40	Loss: 3.23211
Epoch ID: 42	Set ID: 1	Batch ID: 60	Loss: 3.30021
1			
Epoch ID: 43	Set ID: 1	Batch ID: 20	Loss: 3.05296
Epoch ID: 43	Set ID: 1	Batch ID: 40	Loss: 3.55219
Epoch ID: 43	Set ID: 1	Batch ID: 60	Loss: 3.32179
1			
Epoch ID: 44	Set ID: 1	Batch ID: 20	Loss: 3.13460
Epoch ID: 44	Set ID: 1	Batch ID: 40	Loss: 2.95912
Epoch ID: 44	Set ID: 1	Batch ID: 60	Loss: 3.28829
1			
Epoch ID: 45	Set ID: 1	Batch ID: 20	Loss: 3.22239
Epoch ID: 45	Set ID: 1	Batch ID: 40	Loss: 3.43358
Epoch ID: 45	Set ID: 1	Batch ID: 60	Loss: 3.37624
1			
Epoch ID: 46	Set ID: 1	Batch ID: 20	Loss: 3.51112
Epoch ID: 46	Set ID: 1	Batch ID: 40	Loss: 3.12665
Epoch ID: 46	Set ID: 1	Batch ID: 60	Loss: 3.26920
1			
Epoch ID: 47	Set ID: 1	Batch ID: 20	Loss: 2.87343
Epoch ID: 47	Set ID: 1	Batch ID: 40	Loss: 3.03150
Epoch ID: 47	Set ID: 1	Batch ID: 60	Loss: 3.05139
1			
Epoch ID: 48	Set ID: 1	Batch ID: 20	Loss: 3.30963
Epoch ID: 48	Set ID: 1	Batch ID: 40	Loss: 3.15349
Epoch ID: 48	Set ID: 1	Batch ID: 60	Loss: 2.74295
1			
Epoch ID: 49	Set ID: 1	Batch ID: 20	Loss: 2.81804
Epoch ID: 49	Set ID: 1	Batch ID: 40	Loss: 3.15836
Epoch ID: 49	Set ID: 1	Batch ID: 60	Loss: 3.12396

```

cost = [c.to('cpu') for c in cost]
val_cost = [c.to('cpu') for c in val_cost]
plt.plot(cost)
#plt.plot(val_cost)
plt.show()

```



```
loss_val, eff_rate, fp_rate = validate(model)
```

```
print(f"Loss: {loss_val}")
```

```
print(f"Eff: {eff_rate}")
```

```
print(f"FP: {fp_rate}")
```

```
Loss: 3.062436103820801
```

```
Eff: 0.8727420187274202
```

```
FP: 1.45750849830034
```

```
model.to("cpu")
```

```
model.eval()
```

```
with torch.no_grad():
```

```
    for setID in val_set_idx:
```

```
        val_set = MyDataset(setID+1)
```

```
        val_generator = torch.utils.data.DataLoader(val_set,
                                                    batch_size=64,
                                                    shuffle=True)
```

```
        print(setID)
```

```
        for X_val, y_val in val_generator:
```

```
            # Forward pass
```

```
            val_outputs = model(X_val)
```

```
            fig, axs = plt.subplots(2)
```

```
            fig.suptitle('Vertically stacked subplots')
```

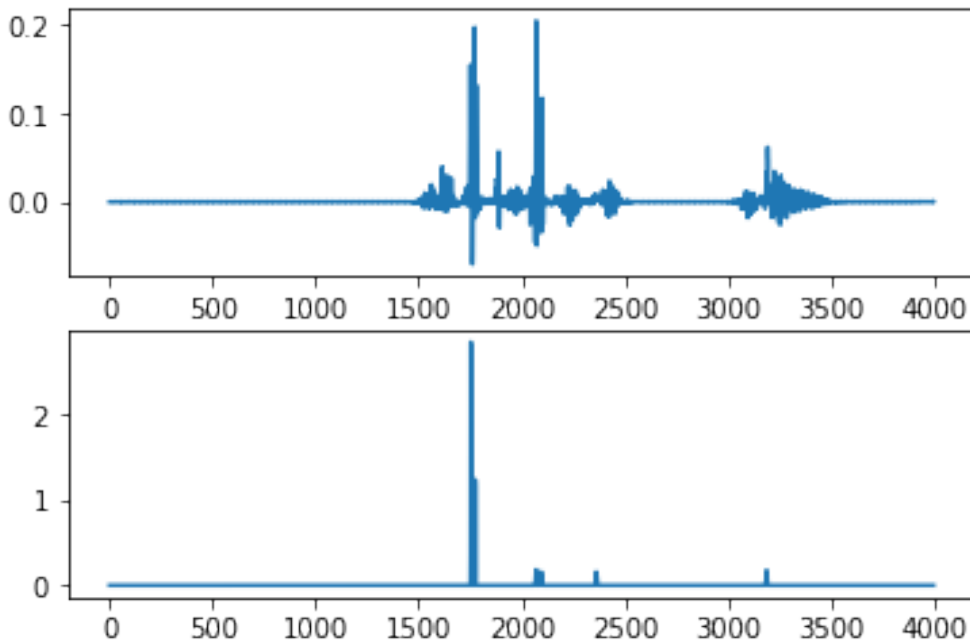
```
            axs[0].plot(val_outputs[0])
```

```
            axs[1].plot(y_val[0])
```

```
            plt.show()
```

```
            break
```

Vertically stacked subplots



lr=0.001, beta1=0.9, beta2=0.9

model = CNN()

model = model.to(DEVICE)

```
cost, val_cost = train(model,
                        num_epochs=50,
                        learning_rate=0.001,
                        seed=123, batch_size=64,
                        beta1=0.9, beta2=0.9)
```

1

/usr/local/lib/python3.7/dist-packages/torch/utils/data/
dataloader.py:566: UserWarning: This DataLoader will create 4 worker
processes in total. Our suggested max number of worker in current
system is 2, which is smaller than what this DataLoader is going to
create. Please be aware that excessive worker creation might get
DataLoader running slow or even freeze, lower the worker number to
avoid potential slowness/freeze if necessary.
cpuset_checked))

Epoch ID: 1 Set ID: 1 Batch ID: 20 | Loss: 8.34757

Epoch ID: 1 Set ID: 1 Batch ID: 40 | Loss: 7.04317

Epoch ID: 1 Set ID: 1 Batch ID: 60 | Loss: 5.85546

1

Epoch ID: 2 Set ID: 1 Batch ID: 20 | Loss: 4.30283

Epoch ID: 2	Set ID: 1	Batch ID: 40		Loss: 4.25035
Epoch ID: 2	Set ID: 1	Batch ID: 60		Loss: 4.10612
1				
Epoch ID: 3	Set ID: 1	Batch ID: 20		Loss: 3.95106
Epoch ID: 3	Set ID: 1	Batch ID: 40		Loss: 3.95913
Epoch ID: 3	Set ID: 1	Batch ID: 60		Loss: 3.96672
1				
Epoch ID: 4	Set ID: 1	Batch ID: 20		Loss: 4.04755
Epoch ID: 4	Set ID: 1	Batch ID: 40		Loss: 3.56144
Epoch ID: 4	Set ID: 1	Batch ID: 60		Loss: 2.85243
1				
Epoch ID: 5	Set ID: 1	Batch ID: 20		Loss: 3.41834
Epoch ID: 5	Set ID: 1	Batch ID: 40		Loss: 3.09974
Epoch ID: 5	Set ID: 1	Batch ID: 60		Loss: 2.67041
1				
Epoch ID: 6	Set ID: 1	Batch ID: 20		Loss: 3.00103
Epoch ID: 6	Set ID: 1	Batch ID: 40		Loss: 2.98977
Epoch ID: 6	Set ID: 1	Batch ID: 60		Loss: 2.80285
1				
Epoch ID: 7	Set ID: 1	Batch ID: 20		Loss: 3.21117
Epoch ID: 7	Set ID: 1	Batch ID: 40		Loss: 2.82419
Epoch ID: 7	Set ID: 1	Batch ID: 60		Loss: 2.68383
1				
Epoch ID: 8	Set ID: 1	Batch ID: 20		Loss: 3.37955
Epoch ID: 8	Set ID: 1	Batch ID: 40		Loss: 2.74581
Epoch ID: 8	Set ID: 1	Batch ID: 60		Loss: 3.06250
1				
Epoch ID: 9	Set ID: 1	Batch ID: 20		Loss: 2.89359
Epoch ID: 9	Set ID: 1	Batch ID: 40		Loss: 2.52013
Epoch ID: 9	Set ID: 1	Batch ID: 60		Loss: 3.29082
1				
Epoch ID: 10	Set ID: 1	Batch ID: 20		Loss: 2.81993
Epoch ID: 10	Set ID: 1	Batch ID: 40		Loss: 2.57254
Epoch ID: 10	Set ID: 1	Batch ID: 60		Loss: 2.67488
1				
Epoch ID: 11	Set ID: 1	Batch ID: 20		Loss: 3.49067
Epoch ID: 11	Set ID: 1	Batch ID: 40		Loss: 3.27004
Epoch ID: 11	Set ID: 1	Batch ID: 60		Loss: 3.63533
1				
Epoch ID: 12	Set ID: 1	Batch ID: 20		Loss: 2.63623
Epoch ID: 12	Set ID: 1	Batch ID: 40		Loss: 3.79348
Epoch ID: 12	Set ID: 1	Batch ID: 60		Loss: 2.52107
1				
Epoch ID: 13	Set ID: 1	Batch ID: 20		Loss: 2.83856
Epoch ID: 13	Set ID: 1	Batch ID: 40		Loss: 3.40549
Epoch ID: 13	Set ID: 1	Batch ID: 60		Loss: 3.16354
1				
Epoch ID: 14	Set ID: 1	Batch ID: 20		Loss: 2.54102
Epoch ID: 14	Set ID: 1	Batch ID: 40		Loss: 2.83584
Epoch ID: 14	Set ID: 1	Batch ID: 60		Loss: 3.54346

```

1
Epoch ID: 15    Set ID: 1    Batch ID: 20 | Loss: 2.87611
Epoch ID: 15    Set ID: 1    Batch ID: 40 | Loss: 3.14803
Epoch ID: 15    Set ID: 1    Batch ID: 60 | Loss: 2.80147
1
Epoch ID: 16    Set ID: 1    Batch ID: 20 | Loss: 2.86736
Epoch ID: 16    Set ID: 1    Batch ID: 40 | Loss: 3.05246
Epoch ID: 16    Set ID: 1    Batch ID: 60 | Loss: 2.51911
1
Epoch ID: 17    Set ID: 1    Batch ID: 20 | Loss: 3.09047
Epoch ID: 17    Set ID: 1    Batch ID: 40 | Loss: 2.79484
Epoch ID: 17    Set ID: 1    Batch ID: 60 | Loss: 2.84419
1
Epoch ID: 18    Set ID: 1    Batch ID: 20 | Loss: 2.52433
Epoch ID: 18    Set ID: 1    Batch ID: 40 | Loss: 2.78188
Epoch ID: 18    Set ID: 1    Batch ID: 60 | Loss: 2.70824
1
Epoch ID: 19    Set ID: 1    Batch ID: 20 | Loss: 2.61485
Epoch ID: 19    Set ID: 1    Batch ID: 40 | Loss: 2.71249
Epoch ID: 19    Set ID: 1    Batch ID: 60 | Loss: 2.39981
1
Epoch ID: 20    Set ID: 1    Batch ID: 20 | Loss: 3.25647
Epoch ID: 20    Set ID: 1    Batch ID: 40 | Loss: 2.36478
Epoch ID: 20    Set ID: 1    Batch ID: 60 | Loss: 2.79514
1
Epoch ID: 21    Set ID: 1    Batch ID: 20 | Loss: 2.43269
Epoch ID: 21    Set ID: 1    Batch ID: 40 | Loss: 2.74657
Epoch ID: 21    Set ID: 1    Batch ID: 60 | Loss: 2.51988
1
Epoch ID: 22    Set ID: 1    Batch ID: 20 | Loss: 2.58285
Epoch ID: 22    Set ID: 1    Batch ID: 40 | Loss: 2.67099
Epoch ID: 22    Set ID: 1    Batch ID: 60 | Loss: 2.62335
1
Epoch ID: 23    Set ID: 1    Batch ID: 20 | Loss: 2.66434
Epoch ID: 23    Set ID: 1    Batch ID: 40 | Loss: 2.56746
Epoch ID: 23    Set ID: 1    Batch ID: 60 | Loss: 2.70612
1
Epoch ID: 24    Set ID: 1    Batch ID: 20 | Loss: 3.08626
Epoch ID: 24    Set ID: 1    Batch ID: 40 | Loss: 2.47407
Epoch ID: 24    Set ID: 1    Batch ID: 60 | Loss: 3.41581
1
Epoch ID: 25    Set ID: 1    Batch ID: 20 | Loss: 3.46712
Epoch ID: 25    Set ID: 1    Batch ID: 40 | Loss: 2.74630
Epoch ID: 25    Set ID: 1    Batch ID: 60 | Loss: 2.45126
1
Epoch ID: 26    Set ID: 1    Batch ID: 20 | Loss: 2.72803
Epoch ID: 26    Set ID: 1    Batch ID: 40 | Loss: 2.38177
Epoch ID: 26    Set ID: 1    Batch ID: 60 | Loss: 2.39755
1
Epoch ID: 27    Set ID: 1    Batch ID: 20 | Loss: 3.06918

```

Epoch ID: 27	Set ID: 1	Batch ID: 40		Loss: 3.33712
Epoch ID: 27	Set ID: 1	Batch ID: 60		Loss: 2.55683
1				
Epoch ID: 28	Set ID: 1	Batch ID: 20		Loss: 3.20191
Epoch ID: 28	Set ID: 1	Batch ID: 40		Loss: 3.26721
Epoch ID: 28	Set ID: 1	Batch ID: 60		Loss: 2.81459
1				
Epoch ID: 29	Set ID: 1	Batch ID: 20		Loss: 2.76766
Epoch ID: 29	Set ID: 1	Batch ID: 40		Loss: 2.98261
Epoch ID: 29	Set ID: 1	Batch ID: 60		Loss: 3.04627
1				
Epoch ID: 30	Set ID: 1	Batch ID: 20		Loss: 2.45941
Epoch ID: 30	Set ID: 1	Batch ID: 40		Loss: 2.49283
Epoch ID: 30	Set ID: 1	Batch ID: 60		Loss: 2.58412
1				
Epoch ID: 31	Set ID: 1	Batch ID: 20		Loss: 3.10170
Epoch ID: 31	Set ID: 1	Batch ID: 40		Loss: 2.62999
Epoch ID: 31	Set ID: 1	Batch ID: 60		Loss: 2.57099
1				
Epoch ID: 32	Set ID: 1	Batch ID: 20		Loss: 2.48028
Epoch ID: 32	Set ID: 1	Batch ID: 40		Loss: 3.15854
Epoch ID: 32	Set ID: 1	Batch ID: 60		Loss: 2.36633
1				
Epoch ID: 33	Set ID: 1	Batch ID: 20		Loss: 2.68521
Epoch ID: 33	Set ID: 1	Batch ID: 40		Loss: 2.59568
Epoch ID: 33	Set ID: 1	Batch ID: 60		Loss: 2.73405
1				
Epoch ID: 34	Set ID: 1	Batch ID: 20		Loss: 2.39161
Epoch ID: 34	Set ID: 1	Batch ID: 40		Loss: 2.73452
Epoch ID: 34	Set ID: 1	Batch ID: 60		Loss: 2.92866
1				
Epoch ID: 35	Set ID: 1	Batch ID: 20		Loss: 2.56512
Epoch ID: 35	Set ID: 1	Batch ID: 40		Loss: 2.57319
Epoch ID: 35	Set ID: 1	Batch ID: 60		Loss: 3.08287
1				
Epoch ID: 36	Set ID: 1	Batch ID: 20		Loss: 2.48376
Epoch ID: 36	Set ID: 1	Batch ID: 40		Loss: 2.73620
Epoch ID: 36	Set ID: 1	Batch ID: 60		Loss: 2.42652
1				
Epoch ID: 37	Set ID: 1	Batch ID: 20		Loss: 2.91030
Epoch ID: 37	Set ID: 1	Batch ID: 40		Loss: 3.08113
Epoch ID: 37	Set ID: 1	Batch ID: 60		Loss: 2.67485
1				
Epoch ID: 38	Set ID: 1	Batch ID: 20		Loss: 3.60005
Epoch ID: 38	Set ID: 1	Batch ID: 40		Loss: 2.63563
Epoch ID: 38	Set ID: 1	Batch ID: 60		Loss: 2.88134
1				
Epoch ID: 39	Set ID: 1	Batch ID: 20		Loss: 3.09719
Epoch ID: 39	Set ID: 1	Batch ID: 40		Loss: 2.48651
Epoch ID: 39	Set ID: 1	Batch ID: 60		Loss: 3.34843

```

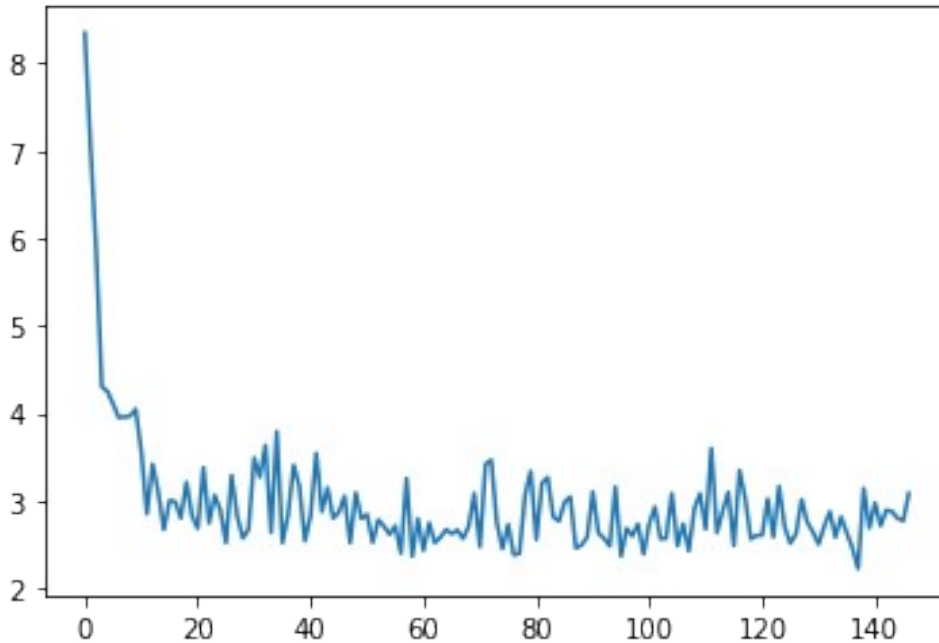
1
Epoch ID: 40    Set ID: 1    Batch ID: 20 | Loss: 3.02678
Epoch ID: 40    Set ID: 1    Batch ID: 40 | Loss: 2.56471
Epoch ID: 40    Set ID: 1    Batch ID: 60 | Loss: 2.60234
1
Epoch ID: 41    Set ID: 1    Batch ID: 20 | Loss: 2.60803
Epoch ID: 41    Set ID: 1    Batch ID: 40 | Loss: 3.02102
Epoch ID: 41    Set ID: 1    Batch ID: 60 | Loss: 2.58614
1
Epoch ID: 42    Set ID: 1    Batch ID: 20 | Loss: 3.16541
Epoch ID: 42    Set ID: 1    Batch ID: 40 | Loss: 2.69829
Epoch ID: 42    Set ID: 1    Batch ID: 60 | Loss: 2.51467
1
Epoch ID: 43    Set ID: 1    Batch ID: 20 | Loss: 2.62061
Epoch ID: 43    Set ID: 1    Batch ID: 40 | Loss: 3.01299
Epoch ID: 43    Set ID: 1    Batch ID: 60 | Loss: 2.75549
1
Epoch ID: 44    Set ID: 1    Batch ID: 20 | Loss: 2.64271
Epoch ID: 44    Set ID: 1    Batch ID: 40 | Loss: 2.50323
Epoch ID: 44    Set ID: 1    Batch ID: 60 | Loss: 2.70745
1
Epoch ID: 45    Set ID: 1    Batch ID: 20 | Loss: 2.87485
Epoch ID: 45    Set ID: 1    Batch ID: 40 | Loss: 2.58488
Epoch ID: 45    Set ID: 1    Batch ID: 60 | Loss: 2.81494
1
Epoch ID: 46    Set ID: 1    Batch ID: 20 | Loss: 2.63264
Epoch ID: 46    Set ID: 1    Batch ID: 40 | Loss: 2.46122
Epoch ID: 46    Set ID: 1    Batch ID: 60 | Loss: 2.22417
1
Epoch ID: 47    Set ID: 1    Batch ID: 20 | Loss: 3.14226
Epoch ID: 47    Set ID: 1    Batch ID: 40 | Loss: 2.68868
Epoch ID: 47    Set ID: 1    Batch ID: 60 | Loss: 2.97435
1
Epoch ID: 48    Set ID: 1    Batch ID: 20 | Loss: 2.71385
Epoch ID: 48    Set ID: 1    Batch ID: 40 | Loss: 2.89222
Epoch ID: 48    Set ID: 1    Batch ID: 60 | Loss: 2.87864
1
Epoch ID: 49    Set ID: 1    Batch ID: 20 | Loss: 2.79935
Epoch ID: 49    Set ID: 1    Batch ID: 40 | Loss: 2.77237
Epoch ID: 49    Set ID: 1    Batch ID: 60 | Loss: 3.08449

```

```

cost = [c.to('cpu') for c in cost]
val_cost = [c.to('cpu') for c in val_cost]
plt.plot(cost)
#plt.plot(val_cost)
plt.show()

```



```
model.to(DEVICE)
```

```
loss_val, eff_rate, fp_rate = validate(model)
```

```
print(f"Loss: {loss_val}")
print(f"Eff: {eff_rate}")
print(f"FP: {fp_rate}")
```

```
Loss: 2.2011327743530273
Eff: 0.8917643589176436
FP: 1.624875024995001
```

```
model.to("cpu")
```

```
model.eval()
```

```
with torch.no_grad():
```

```
    for setID in val_set_idx:
```

```
        val_set = MyDataset(setID+1)
```

```
        val_generator = torch.utils.data.DataLoader(val_set,
                                                    batch_size=64,
                                                    shuffle=True)
```

```
        print(setID)
```

```
        for X_val, y_val in val_generator:
```

```
            # Forward pass
```

```
            val_outputs = model(X_val)
```

```
            fig, axs = plt.subplots(2)
```

```
            fig.suptitle('Vertically stacked subplots')
```

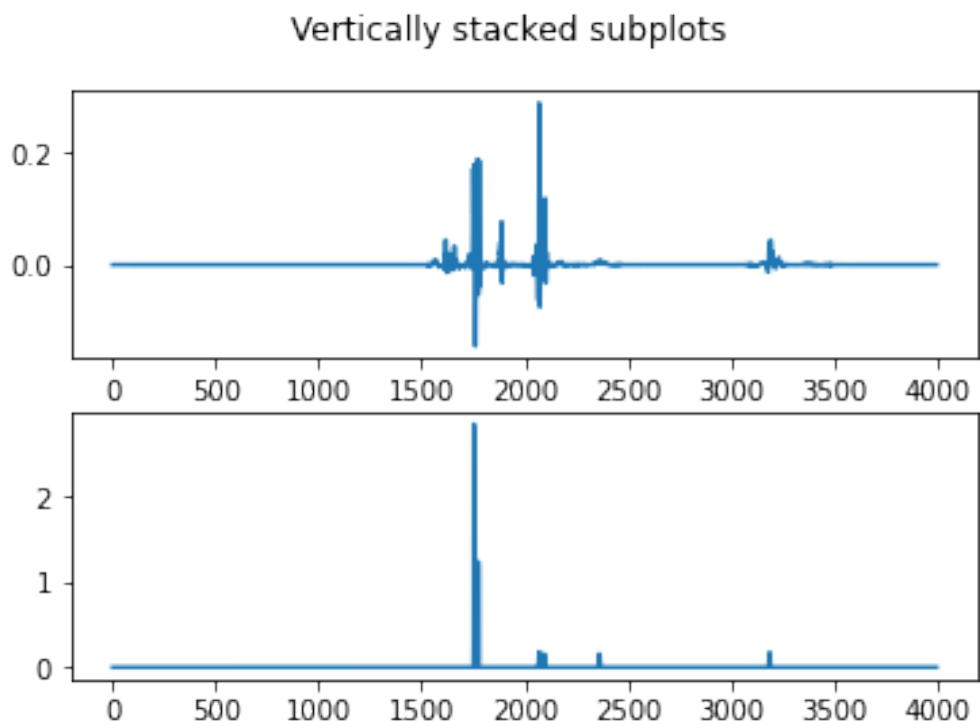
```
            axs[0].plot(val_outputs[0])
```

```
            axs[1].plot(y_val[0])
```

```
            plt.show()
```

```
            break
```


2



Sample Size: 10,000

```
from sklearn.model_selection import train_test_split
train_set_idx, val_set_idx = train_test_split(list(range(1,4)),
test_size=1)

print(train_set_idx)
print(val_set_idx)

[1, 3]
[2]

model = CNN()

model = model.to(DEVICE)

cost, val_cost = train(model,
    num_epochs=50,
    learning_rate=0.001,
    seed=123, batch_size=64,
    beta1=0.9, beta2=0.9)
```

1

/usr/local/lib/python3.7/dist-packages/torch/utils/data/
dataloader.py:566: UserWarning: This DataLoader will create 4 worker
processes in total. Our suggested max number of worker in current

system is 2, which is smaller than what this DataLoader is going to create. Please be aware that excessive worker creation might get DataLoader running slow or even freeze, lower the worker number to avoid potential slowness/freeze if necessary.

cpuset_checked))

Epoch ID: 1	Set ID: 1	Batch ID: 20		Loss: 5.43199
Epoch ID: 1	Set ID: 1	Batch ID: 40		Loss: 4.26541
Epoch ID: 1	Set ID: 1	Batch ID: 60		Loss: 4.00605
3				
Epoch ID: 1	Set ID: 3	Batch ID: 80		Loss: 4.36592
Epoch ID: 1	Set ID: 3	Batch ID: 100		Loss: 4.30615
Epoch ID: 1	Set ID: 3	Batch ID: 120		Loss: 3.80611
Epoch ID: 1	Set ID: 3	Batch ID: 140		Loss: 3.64365
1				
Epoch ID: 2	Set ID: 1	Batch ID: 20		Loss: 3.82925
Epoch ID: 2	Set ID: 1	Batch ID: 40		Loss: 3.96415
Epoch ID: 2	Set ID: 1	Batch ID: 60		Loss: 4.02508
3				
Epoch ID: 2	Set ID: 3	Batch ID: 80		Loss: 3.07516
Epoch ID: 2	Set ID: 3	Batch ID: 100		Loss: 2.75632
Epoch ID: 2	Set ID: 3	Batch ID: 120		Loss: 3.25614
Epoch ID: 2	Set ID: 3	Batch ID: 140		Loss: 2.93995
1				
Epoch ID: 3	Set ID: 1	Batch ID: 20		Loss: 3.11958
Epoch ID: 3	Set ID: 1	Batch ID: 40		Loss: 3.14109
Epoch ID: 3	Set ID: 1	Batch ID: 60		Loss: 2.44253
3				
Epoch ID: 3	Set ID: 3	Batch ID: 80		Loss: 3.00485
Epoch ID: 3	Set ID: 3	Batch ID: 100		Loss: 3.64258
Epoch ID: 3	Set ID: 3	Batch ID: 120		Loss: 3.04270
Epoch ID: 3	Set ID: 3	Batch ID: 140		Loss: 3.21027
1				
Epoch ID: 4	Set ID: 1	Batch ID: 20		Loss: 3.07088
Epoch ID: 4	Set ID: 1	Batch ID: 40		Loss: 2.61465
Epoch ID: 4	Set ID: 1	Batch ID: 60		Loss: 3.22344
3				
Epoch ID: 4	Set ID: 3	Batch ID: 80		Loss: 3.15768
Epoch ID: 4	Set ID: 3	Batch ID: 100		Loss: 3.40046
Epoch ID: 4	Set ID: 3	Batch ID: 120		Loss: 3.06790
Epoch ID: 4	Set ID: 3	Batch ID: 140		Loss: 2.72727
1				
Epoch ID: 5	Set ID: 1	Batch ID: 20		Loss: 2.78360
Epoch ID: 5	Set ID: 1	Batch ID: 40		Loss: 2.88646
Epoch ID: 5	Set ID: 1	Batch ID: 60		Loss: 2.91291
3				
Epoch ID: 5	Set ID: 3	Batch ID: 80		Loss: 2.76736
Epoch ID: 5	Set ID: 3	Batch ID: 100		Loss: 2.68747
Epoch ID: 5	Set ID: 3	Batch ID: 120		Loss: 2.85906
Epoch ID: 5	Set ID: 3	Batch ID: 140		Loss: 2.72700

```

1
Epoch ID: 6   Set ID: 1   Batch ID: 20 | Loss: 2.75156
Epoch ID: 6   Set ID: 1   Batch ID: 40 | Loss: 3.01657
Epoch ID: 6   Set ID: 1   Batch ID: 60 | Loss: 3.33613
3
Epoch ID: 6   Set ID: 3   Batch ID: 80 | Loss: 2.90328
Epoch ID: 6   Set ID: 3   Batch ID: 100 | Loss: 2.85767
Epoch ID: 6   Set ID: 3   Batch ID: 120 | Loss: 2.99136
Epoch ID: 6   Set ID: 3   Batch ID: 140 | Loss: 2.77748
1
Epoch ID: 7   Set ID: 1   Batch ID: 20 | Loss: 3.11771
Epoch ID: 7   Set ID: 1   Batch ID: 40 | Loss: 3.05153
Epoch ID: 7   Set ID: 1   Batch ID: 60 | Loss: 3.32967
3
Epoch ID: 7   Set ID: 3   Batch ID: 80 | Loss: 2.90755
Epoch ID: 7   Set ID: 3   Batch ID: 100 | Loss: 2.68703
Epoch ID: 7   Set ID: 3   Batch ID: 120 | Loss: 3.20050
Epoch ID: 7   Set ID: 3   Batch ID: 140 | Loss: 2.75092
1
Epoch ID: 8   Set ID: 1   Batch ID: 20 | Loss: 2.75594
Epoch ID: 8   Set ID: 1   Batch ID: 40 | Loss: 2.93510
Epoch ID: 8   Set ID: 1   Batch ID: 60 | Loss: 2.58346
3
Epoch ID: 8   Set ID: 3   Batch ID: 80 | Loss: 2.85900
Epoch ID: 8   Set ID: 3   Batch ID: 100 | Loss: 2.85476
Epoch ID: 8   Set ID: 3   Batch ID: 120 | Loss: 2.80707
Epoch ID: 8   Set ID: 3   Batch ID: 140 | Loss: 2.62138
1
Epoch ID: 9   Set ID: 1   Batch ID: 20 | Loss: 2.67999
Epoch ID: 9   Set ID: 1   Batch ID: 40 | Loss: 2.59063
Epoch ID: 9   Set ID: 1   Batch ID: 60 | Loss: 2.99538
3
Epoch ID: 9   Set ID: 3   Batch ID: 80 | Loss: 2.63336
Epoch ID: 9   Set ID: 3   Batch ID: 100 | Loss: 2.96762
Epoch ID: 9   Set ID: 3   Batch ID: 120 | Loss: 2.43929
Epoch ID: 9   Set ID: 3   Batch ID: 140 | Loss: 3.04083
1
Epoch ID: 10  Set ID: 1   Batch ID: 20 | Loss: 2.90190
Epoch ID: 10  Set ID: 1   Batch ID: 40 | Loss: 2.66475
Epoch ID: 10  Set ID: 1   Batch ID: 60 | Loss: 3.02284
3
Epoch ID: 10  Set ID: 3   Batch ID: 80 | Loss: 2.69169
Epoch ID: 10  Set ID: 3   Batch ID: 100 | Loss: 2.83188
Epoch ID: 10  Set ID: 3   Batch ID: 120 | Loss: 2.58183
Epoch ID: 10  Set ID: 3   Batch ID: 140 | Loss: 3.31234
1
Epoch ID: 11  Set ID: 1   Batch ID: 20 | Loss: 2.68904
Epoch ID: 11  Set ID: 1   Batch ID: 40 | Loss: 3.16965
Epoch ID: 11  Set ID: 1   Batch ID: 60 | Loss: 2.58683
3

```

Epoch ID: 11	Set ID: 3	Batch ID: 80		Loss: 2.73214
Epoch ID: 11	Set ID: 3	Batch ID: 100		Loss: 2.57936
Epoch ID: 11	Set ID: 3	Batch ID: 120		Loss: 2.52626
Epoch ID: 11	Set ID: 3	Batch ID: 140		Loss: 2.99877
1				
Epoch ID: 12	Set ID: 1	Batch ID: 20		Loss: 2.29257
Epoch ID: 12	Set ID: 1	Batch ID: 40		Loss: 3.26244
Epoch ID: 12	Set ID: 1	Batch ID: 60		Loss: 2.49467
3				
Epoch ID: 12	Set ID: 3	Batch ID: 80		Loss: 2.74554
Epoch ID: 12	Set ID: 3	Batch ID: 100		Loss: 2.54843
Epoch ID: 12	Set ID: 3	Batch ID: 120		Loss: 2.91019
Epoch ID: 12	Set ID: 3	Batch ID: 140		Loss: 2.62420
1				
Epoch ID: 13	Set ID: 1	Batch ID: 20		Loss: 2.71170
Epoch ID: 13	Set ID: 1	Batch ID: 40		Loss: 2.36651
Epoch ID: 13	Set ID: 1	Batch ID: 60		Loss: 2.43329
3				
Epoch ID: 13	Set ID: 3	Batch ID: 80		Loss: 2.80394
Epoch ID: 13	Set ID: 3	Batch ID: 100		Loss: 2.82833
Epoch ID: 13	Set ID: 3	Batch ID: 120		Loss: 3.37838
Epoch ID: 13	Set ID: 3	Batch ID: 140		Loss: 2.71958
1				
Epoch ID: 14	Set ID: 1	Batch ID: 20		Loss: 2.96975
Epoch ID: 14	Set ID: 1	Batch ID: 40		Loss: 3.03733
Epoch ID: 14	Set ID: 1	Batch ID: 60		Loss: 2.83624
3				
Epoch ID: 14	Set ID: 3	Batch ID: 80		Loss: 3.40310
Epoch ID: 14	Set ID: 3	Batch ID: 100		Loss: 3.22948
Epoch ID: 14	Set ID: 3	Batch ID: 120		Loss: 2.38737
Epoch ID: 14	Set ID: 3	Batch ID: 140		Loss: 2.94193
1				
Epoch ID: 15	Set ID: 1	Batch ID: 20		Loss: 2.66556
Epoch ID: 15	Set ID: 1	Batch ID: 40		Loss: 2.62093
Epoch ID: 15	Set ID: 1	Batch ID: 60		Loss: 2.49772
3				
Epoch ID: 15	Set ID: 3	Batch ID: 80		Loss: 2.57496
Epoch ID: 15	Set ID: 3	Batch ID: 100		Loss: 3.04079
Epoch ID: 15	Set ID: 3	Batch ID: 120		Loss: 2.49440
Epoch ID: 15	Set ID: 3	Batch ID: 140		Loss: 2.69733
1				
Epoch ID: 16	Set ID: 1	Batch ID: 20		Loss: 2.50829
Epoch ID: 16	Set ID: 1	Batch ID: 40		Loss: 2.78591
Epoch ID: 16	Set ID: 1	Batch ID: 60		Loss: 2.58309
3				
Epoch ID: 16	Set ID: 3	Batch ID: 80		Loss: 2.71025
Epoch ID: 16	Set ID: 3	Batch ID: 100		Loss: 2.42055
Epoch ID: 16	Set ID: 3	Batch ID: 120		Loss: 2.87581
Epoch ID: 16	Set ID: 3	Batch ID: 140		Loss: 2.58642
1				

Epoch ID: 17	Set ID: 1	Batch ID: 20		Loss: 3.20189
Epoch ID: 17	Set ID: 1	Batch ID: 40		Loss: 2.69485
Epoch ID: 17	Set ID: 1	Batch ID: 60		Loss: 2.49602
3				
Epoch ID: 17	Set ID: 3	Batch ID: 80		Loss: 2.45720
Epoch ID: 17	Set ID: 3	Batch ID: 100		Loss: 2.65016
Epoch ID: 17	Set ID: 3	Batch ID: 120		Loss: 2.35153
Epoch ID: 17	Set ID: 3	Batch ID: 140		Loss: 2.97617
1				
Epoch ID: 18	Set ID: 1	Batch ID: 20		Loss: 3.19624
Epoch ID: 18	Set ID: 1	Batch ID: 40		Loss: 2.54960
Epoch ID: 18	Set ID: 1	Batch ID: 60		Loss: 2.76021
3				
Epoch ID: 18	Set ID: 3	Batch ID: 80		Loss: 2.23927
Epoch ID: 18	Set ID: 3	Batch ID: 100		Loss: 3.01041
Epoch ID: 18	Set ID: 3	Batch ID: 120		Loss: 2.47095
Epoch ID: 18	Set ID: 3	Batch ID: 140		Loss: 2.52871
1				
Epoch ID: 19	Set ID: 1	Batch ID: 20		Loss: 2.49692
Epoch ID: 19	Set ID: 1	Batch ID: 40		Loss: 2.55744
Epoch ID: 19	Set ID: 1	Batch ID: 60		Loss: 2.49647
3				
Epoch ID: 19	Set ID: 3	Batch ID: 80		Loss: 2.28301
Epoch ID: 19	Set ID: 3	Batch ID: 100		Loss: 2.47985
Epoch ID: 19	Set ID: 3	Batch ID: 120		Loss: 3.02335
Epoch ID: 19	Set ID: 3	Batch ID: 140		Loss: 2.45819
1				
Epoch ID: 20	Set ID: 1	Batch ID: 20		Loss: 2.47011
Epoch ID: 20	Set ID: 1	Batch ID: 40		Loss: 2.99975
Epoch ID: 20	Set ID: 1	Batch ID: 60		Loss: 2.31756
3				
Epoch ID: 20	Set ID: 3	Batch ID: 80		Loss: 3.11465
Epoch ID: 20	Set ID: 3	Batch ID: 100		Loss: 2.53838
Epoch ID: 20	Set ID: 3	Batch ID: 120		Loss: 2.55996
Epoch ID: 20	Set ID: 3	Batch ID: 140		Loss: 2.34166
1				
Epoch ID: 21	Set ID: 1	Batch ID: 20		Loss: 2.42390
Epoch ID: 21	Set ID: 1	Batch ID: 40		Loss: 2.80638
Epoch ID: 21	Set ID: 1	Batch ID: 60		Loss: 3.25953
3				
Epoch ID: 21	Set ID: 3	Batch ID: 80		Loss: 2.34387
Epoch ID: 21	Set ID: 3	Batch ID: 100		Loss: 3.09306
Epoch ID: 21	Set ID: 3	Batch ID: 120		Loss: 2.62726
Epoch ID: 21	Set ID: 3	Batch ID: 140		Loss: 2.51327
1				
Epoch ID: 22	Set ID: 1	Batch ID: 20		Loss: 2.87941
Epoch ID: 22	Set ID: 1	Batch ID: 40		Loss: 2.78176
Epoch ID: 22	Set ID: 1	Batch ID: 60		Loss: 2.67300
3				
Epoch ID: 22	Set ID: 3	Batch ID: 80		Loss: 2.62866

Epoch ID: 22	Set ID: 3	Batch ID: 100		Loss: 2.68315
Epoch ID: 22	Set ID: 3	Batch ID: 120		Loss: 2.73138
Epoch ID: 22	Set ID: 3	Batch ID: 140		Loss: 3.00037
1				
Epoch ID: 23	Set ID: 1	Batch ID: 20		Loss: 2.21668
Epoch ID: 23	Set ID: 1	Batch ID: 40		Loss: 2.35488
Epoch ID: 23	Set ID: 1	Batch ID: 60		Loss: 2.22005
3				
Epoch ID: 23	Set ID: 3	Batch ID: 80		Loss: 3.22286
Epoch ID: 23	Set ID: 3	Batch ID: 100		Loss: 3.22788
Epoch ID: 23	Set ID: 3	Batch ID: 120		Loss: 2.84800
Epoch ID: 23	Set ID: 3	Batch ID: 140		Loss: 2.57376
1				
Epoch ID: 24	Set ID: 1	Batch ID: 20		Loss: 2.65855
Epoch ID: 24	Set ID: 1	Batch ID: 40		Loss: 2.49620
Epoch ID: 24	Set ID: 1	Batch ID: 60		Loss: 3.10221
3				
Epoch ID: 24	Set ID: 3	Batch ID: 80		Loss: 2.53864
Epoch ID: 24	Set ID: 3	Batch ID: 100		Loss: 2.70187
Epoch ID: 24	Set ID: 3	Batch ID: 120		Loss: 2.79121
Epoch ID: 24	Set ID: 3	Batch ID: 140		Loss: 2.38296
1				
Epoch ID: 25	Set ID: 1	Batch ID: 20		Loss: 2.68290
Epoch ID: 25	Set ID: 1	Batch ID: 40		Loss: 2.16078
Epoch ID: 25	Set ID: 1	Batch ID: 60		Loss: 2.66137
3				
Epoch ID: 25	Set ID: 3	Batch ID: 80		Loss: 2.44554
Epoch ID: 25	Set ID: 3	Batch ID: 100		Loss: 2.83812
Epoch ID: 25	Set ID: 3	Batch ID: 120		Loss: 2.55316
Epoch ID: 25	Set ID: 3	Batch ID: 140		Loss: 2.62029
1				
Epoch ID: 26	Set ID: 1	Batch ID: 20		Loss: 2.51084
Epoch ID: 26	Set ID: 1	Batch ID: 40		Loss: 2.42456
Epoch ID: 26	Set ID: 1	Batch ID: 60		Loss: 2.54509
3				
Epoch ID: 26	Set ID: 3	Batch ID: 80		Loss: 3.27235
Epoch ID: 26	Set ID: 3	Batch ID: 100		Loss: 2.78422
Epoch ID: 26	Set ID: 3	Batch ID: 120		Loss: 2.97784
Epoch ID: 26	Set ID: 3	Batch ID: 140		Loss: 2.81547
1				
Epoch ID: 27	Set ID: 1	Batch ID: 20		Loss: 2.22577
Epoch ID: 27	Set ID: 1	Batch ID: 40		Loss: 2.18116
Epoch ID: 27	Set ID: 1	Batch ID: 60		Loss: 2.35832
3				
Epoch ID: 27	Set ID: 3	Batch ID: 80		Loss: 2.77651
Epoch ID: 27	Set ID: 3	Batch ID: 100		Loss: 3.02816
Epoch ID: 27	Set ID: 3	Batch ID: 120		Loss: 2.45219
Epoch ID: 27	Set ID: 3	Batch ID: 140		Loss: 3.28034
1				
Epoch ID: 28	Set ID: 1	Batch ID: 20		Loss: 2.68859

Epoch ID: 28	Set ID: 1	Batch ID: 40		Loss: 2.63001
Epoch ID: 28	Set ID: 1	Batch ID: 60		Loss: 2.69857
3				
Epoch ID: 28	Set ID: 3	Batch ID: 80		Loss: 2.37071
Epoch ID: 28	Set ID: 3	Batch ID: 100		Loss: 3.07762
Epoch ID: 28	Set ID: 3	Batch ID: 120		Loss: 2.63368
Epoch ID: 28	Set ID: 3	Batch ID: 140		Loss: 2.57892
1				
Epoch ID: 29	Set ID: 1	Batch ID: 20		Loss: 2.61222
Epoch ID: 29	Set ID: 1	Batch ID: 40		Loss: 2.74411
Epoch ID: 29	Set ID: 1	Batch ID: 60		Loss: 2.60011
3				
Epoch ID: 29	Set ID: 3	Batch ID: 80		Loss: 3.31903
Epoch ID: 29	Set ID: 3	Batch ID: 100		Loss: 2.89196
Epoch ID: 29	Set ID: 3	Batch ID: 120		Loss: 2.77622
Epoch ID: 29	Set ID: 3	Batch ID: 140		Loss: 2.35550
1				
Epoch ID: 30	Set ID: 1	Batch ID: 20		Loss: 2.54195
Epoch ID: 30	Set ID: 1	Batch ID: 40		Loss: 2.38994
Epoch ID: 30	Set ID: 1	Batch ID: 60		Loss: 2.65726
3				
Epoch ID: 30	Set ID: 3	Batch ID: 80		Loss: 2.24476
Epoch ID: 30	Set ID: 3	Batch ID: 100		Loss: 2.60159
Epoch ID: 30	Set ID: 3	Batch ID: 120		Loss: 2.24285
Epoch ID: 30	Set ID: 3	Batch ID: 140		Loss: 2.67556
1				
Epoch ID: 31	Set ID: 1	Batch ID: 20		Loss: 2.73396
Epoch ID: 31	Set ID: 1	Batch ID: 40		Loss: 2.28803
Epoch ID: 31	Set ID: 1	Batch ID: 60		Loss: 2.58615
3				
Epoch ID: 31	Set ID: 3	Batch ID: 80		Loss: 2.72239
Epoch ID: 31	Set ID: 3	Batch ID: 100		Loss: 2.60195
Epoch ID: 31	Set ID: 3	Batch ID: 120		Loss: 2.39392
Epoch ID: 31	Set ID: 3	Batch ID: 140		Loss: 2.92215
1				
Epoch ID: 32	Set ID: 1	Batch ID: 20		Loss: 3.09085
Epoch ID: 32	Set ID: 1	Batch ID: 40		Loss: 2.43775
Epoch ID: 32	Set ID: 1	Batch ID: 60		Loss: 2.44958
3				
Epoch ID: 32	Set ID: 3	Batch ID: 80		Loss: 3.08109
Epoch ID: 32	Set ID: 3	Batch ID: 100		Loss: 2.24529
Epoch ID: 32	Set ID: 3	Batch ID: 120		Loss: 2.89798
Epoch ID: 32	Set ID: 3	Batch ID: 140		Loss: 2.59567
1				
Epoch ID: 33	Set ID: 1	Batch ID: 20		Loss: 2.40617
Epoch ID: 33	Set ID: 1	Batch ID: 40		Loss: 2.68198
Epoch ID: 33	Set ID: 1	Batch ID: 60		Loss: 2.00063
3				
Epoch ID: 33	Set ID: 3	Batch ID: 80		Loss: 2.40498
Epoch ID: 33	Set ID: 3	Batch ID: 100		Loss: 2.36176

Epoch ID: 33	Set ID: 3	Batch ID: 120		Loss: 2.43279
Epoch ID: 33	Set ID: 3	Batch ID: 140		Loss: 2.27133
1				
Epoch ID: 34	Set ID: 1	Batch ID: 20		Loss: 2.46447
Epoch ID: 34	Set ID: 1	Batch ID: 40		Loss: 2.75391
Epoch ID: 34	Set ID: 1	Batch ID: 60		Loss: 2.52949
3				
Epoch ID: 34	Set ID: 3	Batch ID: 80		Loss: 2.33028
Epoch ID: 34	Set ID: 3	Batch ID: 100		Loss: 2.42300
Epoch ID: 34	Set ID: 3	Batch ID: 120		Loss: 2.25202
Epoch ID: 34	Set ID: 3	Batch ID: 140		Loss: 2.28636
1				
Epoch ID: 35	Set ID: 1	Batch ID: 20		Loss: 2.24627
Epoch ID: 35	Set ID: 1	Batch ID: 40		Loss: 2.50722
Epoch ID: 35	Set ID: 1	Batch ID: 60		Loss: 2.81781
3				
Epoch ID: 35	Set ID: 3	Batch ID: 80		Loss: 2.32682
Epoch ID: 35	Set ID: 3	Batch ID: 100		Loss: 2.87301
Epoch ID: 35	Set ID: 3	Batch ID: 120		Loss: 2.35161
Epoch ID: 35	Set ID: 3	Batch ID: 140		Loss: 2.70474
1				
Epoch ID: 36	Set ID: 1	Batch ID: 20		Loss: 3.21648
Epoch ID: 36	Set ID: 1	Batch ID: 40		Loss: 2.64625
Epoch ID: 36	Set ID: 1	Batch ID: 60		Loss: 2.99577
3				
Epoch ID: 36	Set ID: 3	Batch ID: 80		Loss: 2.47463
Epoch ID: 36	Set ID: 3	Batch ID: 100		Loss: 2.78176
Epoch ID: 36	Set ID: 3	Batch ID: 120		Loss: 2.58823
Epoch ID: 36	Set ID: 3	Batch ID: 140		Loss: 2.58992
1				
Epoch ID: 37	Set ID: 1	Batch ID: 20		Loss: 2.41992
Epoch ID: 37	Set ID: 1	Batch ID: 40		Loss: 2.75161
Epoch ID: 37	Set ID: 1	Batch ID: 60		Loss: 2.41224
3				
Epoch ID: 37	Set ID: 3	Batch ID: 80		Loss: 2.51474
Epoch ID: 37	Set ID: 3	Batch ID: 100		Loss: 2.60405
Epoch ID: 37	Set ID: 3	Batch ID: 120		Loss: 1.97959
Epoch ID: 37	Set ID: 3	Batch ID: 140		Loss: 2.46863
1				
Epoch ID: 38	Set ID: 1	Batch ID: 20		Loss: 2.98464
Epoch ID: 38	Set ID: 1	Batch ID: 40		Loss: 2.13945
Epoch ID: 38	Set ID: 1	Batch ID: 60		Loss: 2.10638
3				
Epoch ID: 38	Set ID: 3	Batch ID: 80		Loss: 2.43755
Epoch ID: 38	Set ID: 3	Batch ID: 100		Loss: 2.24562
Epoch ID: 38	Set ID: 3	Batch ID: 120		Loss: 2.41450
Epoch ID: 38	Set ID: 3	Batch ID: 140		Loss: 2.98552
1				
Epoch ID: 39	Set ID: 1	Batch ID: 20		Loss: 2.59574
Epoch ID: 39	Set ID: 1	Batch ID: 40		Loss: 2.46402

Epoch ID: 39	Set ID: 1	Batch ID: 60		Loss: 2.40321
3				
Epoch ID: 39	Set ID: 3	Batch ID: 80		Loss: 2.66263
Epoch ID: 39	Set ID: 3	Batch ID: 100		Loss: 2.37629
Epoch ID: 39	Set ID: 3	Batch ID: 120		Loss: 2.33719
Epoch ID: 39	Set ID: 3	Batch ID: 140		Loss: 2.59196
1				
Epoch ID: 40	Set ID: 1	Batch ID: 20		Loss: 3.18729
Epoch ID: 40	Set ID: 1	Batch ID: 40		Loss: 3.19590
Epoch ID: 40	Set ID: 1	Batch ID: 60		Loss: 2.39753
3				
Epoch ID: 40	Set ID: 3	Batch ID: 80		Loss: 2.67875
Epoch ID: 40	Set ID: 3	Batch ID: 100		Loss: 2.34623
Epoch ID: 40	Set ID: 3	Batch ID: 120		Loss: 2.86384
Epoch ID: 40	Set ID: 3	Batch ID: 140		Loss: 2.56225
1				
Epoch ID: 41	Set ID: 1	Batch ID: 20		Loss: 2.84049
Epoch ID: 41	Set ID: 1	Batch ID: 40		Loss: 2.81233
Epoch ID: 41	Set ID: 1	Batch ID: 60		Loss: 2.21533
3				
Epoch ID: 41	Set ID: 3	Batch ID: 80		Loss: 2.55210
Epoch ID: 41	Set ID: 3	Batch ID: 100		Loss: 2.39426
Epoch ID: 41	Set ID: 3	Batch ID: 120		Loss: 2.36589
Epoch ID: 41	Set ID: 3	Batch ID: 140		Loss: 2.43618
1				
Epoch ID: 42	Set ID: 1	Batch ID: 20		Loss: 2.78968
Epoch ID: 42	Set ID: 1	Batch ID: 40		Loss: 2.71520
Epoch ID: 42	Set ID: 1	Batch ID: 60		Loss: 2.93435
3				
Epoch ID: 42	Set ID: 3	Batch ID: 80		Loss: 2.48893
Epoch ID: 42	Set ID: 3	Batch ID: 100		Loss: 2.40186
Epoch ID: 42	Set ID: 3	Batch ID: 120		Loss: 3.05129
Epoch ID: 42	Set ID: 3	Batch ID: 140		Loss: 2.35675
1				
Epoch ID: 43	Set ID: 1	Batch ID: 20		Loss: 2.52781
Epoch ID: 43	Set ID: 1	Batch ID: 40		Loss: 2.98877
Epoch ID: 43	Set ID: 1	Batch ID: 60		Loss: 2.87183
3				
Epoch ID: 43	Set ID: 3	Batch ID: 80		Loss: 2.55742
Epoch ID: 43	Set ID: 3	Batch ID: 100		Loss: 2.33256
Epoch ID: 43	Set ID: 3	Batch ID: 120		Loss: 2.46696
Epoch ID: 43	Set ID: 3	Batch ID: 140		Loss: 2.38282
1				
Epoch ID: 44	Set ID: 1	Batch ID: 20		Loss: 3.11460
Epoch ID: 44	Set ID: 1	Batch ID: 40		Loss: 2.33855
Epoch ID: 44	Set ID: 1	Batch ID: 60		Loss: 2.98196
3				
Epoch ID: 44	Set ID: 3	Batch ID: 80		Loss: 3.39315
Epoch ID: 44	Set ID: 3	Batch ID: 100		Loss: 2.54296
Epoch ID: 44	Set ID: 3	Batch ID: 120		Loss: 2.91832

```

Epoch ID: 44    Set ID: 3    Batch ID: 140 | Loss: 3.10220
1
Epoch ID: 45    Set ID: 1    Batch ID: 20  | Loss: 2.85656
Epoch ID: 45    Set ID: 1    Batch ID: 40  | Loss: 2.27281
Epoch ID: 45    Set ID: 1    Batch ID: 60  | Loss: 2.35682
3
Epoch ID: 45    Set ID: 3    Batch ID: 80  | Loss: 2.22601
Epoch ID: 45    Set ID: 3    Batch ID: 100 | Loss: 2.59321
Epoch ID: 45    Set ID: 3    Batch ID: 120 | Loss: 2.74636
Epoch ID: 45    Set ID: 3    Batch ID: 140 | Loss: 2.37510
1
Epoch ID: 46    Set ID: 1    Batch ID: 20  | Loss: 2.78134
Epoch ID: 46    Set ID: 1    Batch ID: 40  | Loss: 2.43422
Epoch ID: 46    Set ID: 1    Batch ID: 60  | Loss: 2.54598
3
Epoch ID: 46    Set ID: 3    Batch ID: 80  | Loss: 2.38207
Epoch ID: 46    Set ID: 3    Batch ID: 100 | Loss: 2.36781
Epoch ID: 46    Set ID: 3    Batch ID: 120 | Loss: 2.49930
Epoch ID: 46    Set ID: 3    Batch ID: 140 | Loss: 2.70130
1
Epoch ID: 47    Set ID: 1    Batch ID: 20  | Loss: 2.61829
Epoch ID: 47    Set ID: 1    Batch ID: 40  | Loss: 2.47200
Epoch ID: 47    Set ID: 1    Batch ID: 60  | Loss: 2.46883
3
Epoch ID: 47    Set ID: 3    Batch ID: 80  | Loss: 2.45380
Epoch ID: 47    Set ID: 3    Batch ID: 100 | Loss: 2.52330
Epoch ID: 47    Set ID: 3    Batch ID: 120 | Loss: 2.58798
Epoch ID: 47    Set ID: 3    Batch ID: 140 | Loss: 2.54253
1
Epoch ID: 48    Set ID: 1    Batch ID: 20  | Loss: 2.25820
Epoch ID: 48    Set ID: 1    Batch ID: 40  | Loss: 2.62037
Epoch ID: 48    Set ID: 1    Batch ID: 60  | Loss: 2.42279
3
Epoch ID: 48    Set ID: 3    Batch ID: 80  | Loss: 2.38538
Epoch ID: 48    Set ID: 3    Batch ID: 100 | Loss: 2.39365
Epoch ID: 48    Set ID: 3    Batch ID: 120 | Loss: 2.79271
Epoch ID: 48    Set ID: 3    Batch ID: 140 | Loss: 2.85825
1
Epoch ID: 49    Set ID: 1    Batch ID: 20  | Loss: 2.53105
Epoch ID: 49    Set ID: 1    Batch ID: 40  | Loss: 2.27399
Epoch ID: 49    Set ID: 1    Batch ID: 60  | Loss: 2.25801
3
Epoch ID: 49    Set ID: 3    Batch ID: 80  | Loss: 2.22296
Epoch ID: 49    Set ID: 3    Batch ID: 100 | Loss: 2.76193
Epoch ID: 49    Set ID: 3    Batch ID: 120 | Loss: 3.01988
Epoch ID: 49    Set ID: 3    Batch ID: 140 | Loss: 2.51404

```

```
model.to(DEVICE)
```

```
loss_val, eff_rate, fp_rate = validate(model)
```

```
print(f"Loss: {loss_val}")
print(f"Eff: {eff_rate}")
print(f"FP: {fp_rate}")
```

Loss: 2.7491302490234375

Eff: 0.8739954287399543

FP: 1.3117376524695061

Sample Size: 15,000

```
from sklearn.model_selection import train_test_split
train_set_idx, val_set_idx = train_test_split(list(range(1,5)),
test_size=1)
```

```
print(train_set_idx)
print(val_set_idx)
```

[4, 3, 1]

[2]

```
model = CNN()
```

```
model = model.to(DEVICE)
```

```
cost, val_cost = train(model,
                        num_epochs=50,
                        learning_rate=0.001,
                        seed=123, batch_size=64,
                        beta1=0.9, beta2=0.9)
```

4

Epoch ID: 1 Set ID: 4 Batch ID: 20 | Loss: 7.82760

Epoch ID: 1 Set ID: 4 Batch ID: 40 | Loss: 5.97155

Epoch ID: 1 Set ID: 4 Batch ID: 60 | Loss: 5.62907

3

Epoch ID: 1 Set ID: 3 Batch ID: 80 | Loss: 4.33054

Epoch ID: 1 Set ID: 3 Batch ID: 100 | Loss: 4.20669

Epoch ID: 1 Set ID: 3 Batch ID: 120 | Loss: 4.20754

Epoch ID: 1 Set ID: 3 Batch ID: 140 | Loss: 3.85891

1

Epoch ID: 1 Set ID: 1 Batch ID: 160 | Loss: 4.51517

Epoch ID: 1 Set ID: 1 Batch ID: 180 | Loss: 3.73167

Epoch ID: 1 Set ID: 1 Batch ID: 200 | Loss: 3.33589

Epoch ID: 1 Set ID: 1 Batch ID: 220 | Loss: 2.64447

4

Epoch ID: 2 Set ID: 4 Batch ID: 20 | Loss: 3.06426

Epoch ID: 2 Set ID: 4 Batch ID: 40 | Loss: 2.78084

Epoch ID: 2 Set ID: 4 Batch ID: 60 | Loss: 2.91236

3

Epoch ID: 2 Set ID: 3 Batch ID: 80 | Loss: 3.34122

Epoch ID: 2 Set ID: 3 Batch ID: 100 | Loss: 2.91425

Epoch ID: 2 Set ID: 3 Batch ID: 120 | Loss: 2.48158

Epoch ID: 2	Set ID: 3	Batch ID: 140	Loss: 2.60206
1			
Epoch ID: 2	Set ID: 1	Batch ID: 160	Loss: 3.58295
Epoch ID: 2	Set ID: 1	Batch ID: 180	Loss: 2.34383
Epoch ID: 2	Set ID: 1	Batch ID: 200	Loss: 3.44378
Epoch ID: 2	Set ID: 1	Batch ID: 220	Loss: 3.02609
4			
Epoch ID: 3	Set ID: 4	Batch ID: 20	Loss: 3.14275
Epoch ID: 3	Set ID: 4	Batch ID: 40	Loss: 2.84038
Epoch ID: 3	Set ID: 4	Batch ID: 60	Loss: 2.95262
3			
Epoch ID: 3	Set ID: 3	Batch ID: 80	Loss: 3.17174
Epoch ID: 3	Set ID: 3	Batch ID: 100	Loss: 2.53613
Epoch ID: 3	Set ID: 3	Batch ID: 120	Loss: 2.95373
Epoch ID: 3	Set ID: 3	Batch ID: 140	Loss: 3.03092
1			
Epoch ID: 3	Set ID: 1	Batch ID: 160	Loss: 3.30682
Epoch ID: 3	Set ID: 1	Batch ID: 180	Loss: 2.77360
Epoch ID: 3	Set ID: 1	Batch ID: 200	Loss: 2.66695
Epoch ID: 3	Set ID: 1	Batch ID: 220	Loss: 2.44026
4			
Epoch ID: 4	Set ID: 4	Batch ID: 20	Loss: 3.06117
Epoch ID: 4	Set ID: 4	Batch ID: 40	Loss: 2.71237
Epoch ID: 4	Set ID: 4	Batch ID: 60	Loss: 2.53664
3			
Epoch ID: 4	Set ID: 3	Batch ID: 80	Loss: 2.89866
Epoch ID: 4	Set ID: 3	Batch ID: 100	Loss: 2.97699
Epoch ID: 4	Set ID: 3	Batch ID: 120	Loss: 2.66404
Epoch ID: 4	Set ID: 3	Batch ID: 140	Loss: 2.69559
1			
Epoch ID: 4	Set ID: 1	Batch ID: 160	Loss: 2.97437
Epoch ID: 4	Set ID: 1	Batch ID: 180	Loss: 2.64391
Epoch ID: 4	Set ID: 1	Batch ID: 200	Loss: 3.30693
Epoch ID: 4	Set ID: 1	Batch ID: 220	Loss: 2.77996
4			
Epoch ID: 5	Set ID: 4	Batch ID: 20	Loss: 3.17614
Epoch ID: 5	Set ID: 4	Batch ID: 40	Loss: 3.11571
Epoch ID: 5	Set ID: 4	Batch ID: 60	Loss: 2.86857
3			
Epoch ID: 5	Set ID: 3	Batch ID: 80	Loss: 2.75696
Epoch ID: 5	Set ID: 3	Batch ID: 100	Loss: 2.84382
Epoch ID: 5	Set ID: 3	Batch ID: 120	Loss: 3.26209
Epoch ID: 5	Set ID: 3	Batch ID: 140	Loss: 2.66458
1			
Epoch ID: 5	Set ID: 1	Batch ID: 160	Loss: 2.93085
Epoch ID: 5	Set ID: 1	Batch ID: 180	Loss: 2.94459
Epoch ID: 5	Set ID: 1	Batch ID: 200	Loss: 2.58475
Epoch ID: 5	Set ID: 1	Batch ID: 220	Loss: 2.57086
4			
Epoch ID: 6	Set ID: 4	Batch ID: 20	Loss: 2.92992

Epoch ID: 6	Set ID: 4	Batch ID: 40		Loss: 2.24354
Epoch ID: 6	Set ID: 4	Batch ID: 60		Loss: 3.29261
3				
Epoch ID: 6	Set ID: 3	Batch ID: 80		Loss: 3.28041
Epoch ID: 6	Set ID: 3	Batch ID: 100		Loss: 2.71717
Epoch ID: 6	Set ID: 3	Batch ID: 120		Loss: 3.06751
Epoch ID: 6	Set ID: 3	Batch ID: 140		Loss: 2.82630
1				
Epoch ID: 6	Set ID: 1	Batch ID: 160		Loss: 3.46854
Epoch ID: 6	Set ID: 1	Batch ID: 180		Loss: 3.27446
Epoch ID: 6	Set ID: 1	Batch ID: 200		Loss: 2.82724
Epoch ID: 6	Set ID: 1	Batch ID: 220		Loss: 2.64206
4				
Epoch ID: 7	Set ID: 4	Batch ID: 20		Loss: 2.75550
Epoch ID: 7	Set ID: 4	Batch ID: 40		Loss: 2.68337
Epoch ID: 7	Set ID: 4	Batch ID: 60		Loss: 2.49914
3				
Epoch ID: 7	Set ID: 3	Batch ID: 80		Loss: 2.60570
Epoch ID: 7	Set ID: 3	Batch ID: 100		Loss: 3.24041
Epoch ID: 7	Set ID: 3	Batch ID: 120		Loss: 2.60182
Epoch ID: 7	Set ID: 3	Batch ID: 140		Loss: 2.90931
1				
Epoch ID: 7	Set ID: 1	Batch ID: 160		Loss: 2.93553
Epoch ID: 7	Set ID: 1	Batch ID: 180		Loss: 2.54187
Epoch ID: 7	Set ID: 1	Batch ID: 200		Loss: 2.83039
Epoch ID: 7	Set ID: 1	Batch ID: 220		Loss: 2.63361
4				
Epoch ID: 8	Set ID: 4	Batch ID: 20		Loss: 2.56893
Epoch ID: 8	Set ID: 4	Batch ID: 40		Loss: 2.46967
Epoch ID: 8	Set ID: 4	Batch ID: 60		Loss: 2.68085
3				
Epoch ID: 8	Set ID: 3	Batch ID: 80		Loss: 2.82699
Epoch ID: 8	Set ID: 3	Batch ID: 100		Loss: 2.41194
Epoch ID: 8	Set ID: 3	Batch ID: 120		Loss: 3.09357
Epoch ID: 8	Set ID: 3	Batch ID: 140		Loss: 3.14748
1				
Epoch ID: 8	Set ID: 1	Batch ID: 160		Loss: 3.21012
Epoch ID: 8	Set ID: 1	Batch ID: 180		Loss: 2.68930
Epoch ID: 8	Set ID: 1	Batch ID: 200		Loss: 2.58336
Epoch ID: 8	Set ID: 1	Batch ID: 220		Loss: 2.34002
4				
Epoch ID: 9	Set ID: 4	Batch ID: 20		Loss: 2.99524
Epoch ID: 9	Set ID: 4	Batch ID: 40		Loss: 2.84579
Epoch ID: 9	Set ID: 4	Batch ID: 60		Loss: 3.27789
3				
Epoch ID: 9	Set ID: 3	Batch ID: 80		Loss: 3.00704
Epoch ID: 9	Set ID: 3	Batch ID: 100		Loss: 3.00328
Epoch ID: 9	Set ID: 3	Batch ID: 120		Loss: 2.55564
Epoch ID: 9	Set ID: 3	Batch ID: 140		Loss: 2.90965
1				

Epoch ID: 9	Set ID: 1	Batch ID: 160	Loss: 2.36214
Epoch ID: 9	Set ID: 1	Batch ID: 180	Loss: 2.45438
Epoch ID: 9	Set ID: 1	Batch ID: 200	Loss: 2.56494
Epoch ID: 9	Set ID: 1	Batch ID: 220	Loss: 2.77626
4			
Epoch ID: 10	Set ID: 4	Batch ID: 20	Loss: 2.83242
Epoch ID: 10	Set ID: 4	Batch ID: 40	Loss: 2.58261
Epoch ID: 10	Set ID: 4	Batch ID: 60	Loss: 2.37807
3			
Epoch ID: 10	Set ID: 3	Batch ID: 80	Loss: 2.66938
Epoch ID: 10	Set ID: 3	Batch ID: 100	Loss: 3.02266
Epoch ID: 10	Set ID: 3	Batch ID: 120	Loss: 2.92888
Epoch ID: 10	Set ID: 3	Batch ID: 140	Loss: 2.57832
1			
Epoch ID: 10	Set ID: 1	Batch ID: 160	Loss: 2.82910
Epoch ID: 10	Set ID: 1	Batch ID: 180	Loss: 2.84893
Epoch ID: 10	Set ID: 1	Batch ID: 200	Loss: 2.81572
Epoch ID: 10	Set ID: 1	Batch ID: 220	Loss: 2.78495
4			
Epoch ID: 11	Set ID: 4	Batch ID: 20	Loss: 2.49391
Epoch ID: 11	Set ID: 4	Batch ID: 40	Loss: 3.06925
Epoch ID: 11	Set ID: 4	Batch ID: 60	Loss: 2.71268
3			
Epoch ID: 11	Set ID: 3	Batch ID: 80	Loss: 3.91461
Epoch ID: 11	Set ID: 3	Batch ID: 100	Loss: 2.52334
Epoch ID: 11	Set ID: 3	Batch ID: 120	Loss: 2.77072
Epoch ID: 11	Set ID: 3	Batch ID: 140	Loss: 2.55853
1			
Epoch ID: 11	Set ID: 1	Batch ID: 160	Loss: 3.47579
Epoch ID: 11	Set ID: 1	Batch ID: 180	Loss: 2.82745
Epoch ID: 11	Set ID: 1	Batch ID: 200	Loss: 3.54643
Epoch ID: 11	Set ID: 1	Batch ID: 220	Loss: 2.56557
4			
Epoch ID: 12	Set ID: 4	Batch ID: 20	Loss: 2.30699
Epoch ID: 12	Set ID: 4	Batch ID: 40	Loss: 3.10870
Epoch ID: 12	Set ID: 4	Batch ID: 60	Loss: 2.16836
3			
Epoch ID: 12	Set ID: 3	Batch ID: 80	Loss: 2.90086
Epoch ID: 12	Set ID: 3	Batch ID: 100	Loss: 2.50908
Epoch ID: 12	Set ID: 3	Batch ID: 120	Loss: 3.04897
Epoch ID: 12	Set ID: 3	Batch ID: 140	Loss: 2.38324
1			
Epoch ID: 12	Set ID: 1	Batch ID: 160	Loss: 3.30474
Epoch ID: 12	Set ID: 1	Batch ID: 180	Loss: 3.04539
Epoch ID: 12	Set ID: 1	Batch ID: 200	Loss: 2.54543
Epoch ID: 12	Set ID: 1	Batch ID: 220	Loss: 2.53639
4			
Epoch ID: 13	Set ID: 4	Batch ID: 20	Loss: 2.24004
Epoch ID: 13	Set ID: 4	Batch ID: 40	Loss: 3.11478
Epoch ID: 13	Set ID: 4	Batch ID: 60	Loss: 2.61318

3

Epoch ID: 13	Set ID: 3	Batch ID: 80	Loss: 3.27456
Epoch ID: 13	Set ID: 3	Batch ID: 100	Loss: 2.17342
Epoch ID: 13	Set ID: 3	Batch ID: 120	Loss: 2.57450
Epoch ID: 13	Set ID: 3	Batch ID: 140	Loss: 2.78089

1

Epoch ID: 13	Set ID: 1	Batch ID: 160	Loss: 2.99554
Epoch ID: 13	Set ID: 1	Batch ID: 180	Loss: 2.60774
Epoch ID: 13	Set ID: 1	Batch ID: 200	Loss: 2.71960
Epoch ID: 13	Set ID: 1	Batch ID: 220	Loss: 2.70910

4

Epoch ID: 14	Set ID: 4	Batch ID: 20	Loss: 3.02996
Epoch ID: 14	Set ID: 4	Batch ID: 40	Loss: 2.75375
Epoch ID: 14	Set ID: 4	Batch ID: 60	Loss: 2.78076

3

Epoch ID: 14	Set ID: 3	Batch ID: 80	Loss: 2.63107
Epoch ID: 14	Set ID: 3	Batch ID: 100	Loss: 2.94170
Epoch ID: 14	Set ID: 3	Batch ID: 120	Loss: 3.38728
Epoch ID: 14	Set ID: 3	Batch ID: 140	Loss: 2.21718

1

Epoch ID: 14	Set ID: 1	Batch ID: 160	Loss: 3.35236
Epoch ID: 14	Set ID: 1	Batch ID: 180	Loss: 3.17194
Epoch ID: 14	Set ID: 1	Batch ID: 200	Loss: 2.83306
Epoch ID: 14	Set ID: 1	Batch ID: 220	Loss: 3.00666

4

Epoch ID: 15	Set ID: 4	Batch ID: 20	Loss: 2.27186
Epoch ID: 15	Set ID: 4	Batch ID: 40	Loss: 2.74141
Epoch ID: 15	Set ID: 4	Batch ID: 60	Loss: 2.60464

3

Epoch ID: 15	Set ID: 3	Batch ID: 80	Loss: 3.17041
Epoch ID: 15	Set ID: 3	Batch ID: 100	Loss: 2.79567
Epoch ID: 15	Set ID: 3	Batch ID: 120	Loss: 2.32517
Epoch ID: 15	Set ID: 3	Batch ID: 140	Loss: 2.28028

1

Epoch ID: 15	Set ID: 1	Batch ID: 160	Loss: 2.87215
Epoch ID: 15	Set ID: 1	Batch ID: 180	Loss: 2.51608
Epoch ID: 15	Set ID: 1	Batch ID: 200	Loss: 2.66290
Epoch ID: 15	Set ID: 1	Batch ID: 220	Loss: 2.68547

4

Epoch ID: 16	Set ID: 4	Batch ID: 20	Loss: 2.89076
Epoch ID: 16	Set ID: 4	Batch ID: 40	Loss: 2.41975
Epoch ID: 16	Set ID: 4	Batch ID: 60	Loss: 2.67031

3

Epoch ID: 16	Set ID: 3	Batch ID: 80	Loss: 3.99430
Epoch ID: 16	Set ID: 3	Batch ID: 100	Loss: 2.19240
Epoch ID: 16	Set ID: 3	Batch ID: 120	Loss: 2.34908
Epoch ID: 16	Set ID: 3	Batch ID: 140	Loss: 3.04717

1

Epoch ID: 16	Set ID: 1	Batch ID: 160	Loss: 2.76751
Epoch ID: 16	Set ID: 1	Batch ID: 180	Loss: 2.18444

Epoch ID: 16	Set ID: 1	Batch ID: 200		Loss: 2.91155
Epoch ID: 16	Set ID: 1	Batch ID: 220		Loss: 2.38537
4				
Epoch ID: 17	Set ID: 4	Batch ID: 20		Loss: 2.60409
Epoch ID: 17	Set ID: 4	Batch ID: 40		Loss: 2.47521
Epoch ID: 17	Set ID: 4	Batch ID: 60		Loss: 2.55678
3				
Epoch ID: 17	Set ID: 3	Batch ID: 80		Loss: 3.18906
Epoch ID: 17	Set ID: 3	Batch ID: 100		Loss: 2.59931
Epoch ID: 17	Set ID: 3	Batch ID: 120		Loss: 3.06094
Epoch ID: 17	Set ID: 3	Batch ID: 140		Loss: 2.66506
1				
Epoch ID: 17	Set ID: 1	Batch ID: 160		Loss: 3.22640
Epoch ID: 17	Set ID: 1	Batch ID: 180		Loss: 2.53913
Epoch ID: 17	Set ID: 1	Batch ID: 200		Loss: 2.81903
Epoch ID: 17	Set ID: 1	Batch ID: 220		Loss: 2.56792
4				
Epoch ID: 18	Set ID: 4	Batch ID: 20		Loss: 2.67214
Epoch ID: 18	Set ID: 4	Batch ID: 40		Loss: 2.58695
Epoch ID: 18	Set ID: 4	Batch ID: 60		Loss: 2.15173
3				
Epoch ID: 18	Set ID: 3	Batch ID: 80		Loss: 2.24573
Epoch ID: 18	Set ID: 3	Batch ID: 100		Loss: 2.46361
Epoch ID: 18	Set ID: 3	Batch ID: 120		Loss: 2.29297
Epoch ID: 18	Set ID: 3	Batch ID: 140		Loss: 3.03003
1				
Epoch ID: 18	Set ID: 1	Batch ID: 160		Loss: 2.84192
Epoch ID: 18	Set ID: 1	Batch ID: 180		Loss: 2.52631
Epoch ID: 18	Set ID: 1	Batch ID: 200		Loss: 2.51996
Epoch ID: 18	Set ID: 1	Batch ID: 220		Loss: 2.47911
4				
Epoch ID: 19	Set ID: 4	Batch ID: 20		Loss: 2.49695
Epoch ID: 19	Set ID: 4	Batch ID: 40		Loss: 2.38764
Epoch ID: 19	Set ID: 4	Batch ID: 60		Loss: 2.62644
3				
Epoch ID: 19	Set ID: 3	Batch ID: 80		Loss: 2.80671
Epoch ID: 19	Set ID: 3	Batch ID: 100		Loss: 2.50186
Epoch ID: 19	Set ID: 3	Batch ID: 120		Loss: 3.31801
Epoch ID: 19	Set ID: 3	Batch ID: 140		Loss: 2.69251
1				
Epoch ID: 19	Set ID: 1	Batch ID: 160		Loss: 2.69965
Epoch ID: 19	Set ID: 1	Batch ID: 180		Loss: 2.62792
Epoch ID: 19	Set ID: 1	Batch ID: 200		Loss: 2.34351
Epoch ID: 19	Set ID: 1	Batch ID: 220		Loss: 2.02299
4				
Epoch ID: 20	Set ID: 4	Batch ID: 20		Loss: 2.46168
Epoch ID: 20	Set ID: 4	Batch ID: 40		Loss: 2.45694
Epoch ID: 20	Set ID: 4	Batch ID: 60		Loss: 2.50754
3				
Epoch ID: 20	Set ID: 3	Batch ID: 80		Loss: 2.70822

Epoch ID: 20	Set ID: 3	Batch ID: 100	Loss: 2.65813
Epoch ID: 20	Set ID: 3	Batch ID: 120	Loss: 2.43263
Epoch ID: 20	Set ID: 3	Batch ID: 140	Loss: 3.12262
1			
Epoch ID: 20	Set ID: 1	Batch ID: 160	Loss: 2.48159
Epoch ID: 20	Set ID: 1	Batch ID: 180	Loss: 3.20594
Epoch ID: 20	Set ID: 1	Batch ID: 200	Loss: 2.38144
Epoch ID: 20	Set ID: 1	Batch ID: 220	Loss: 2.93313
4			
Epoch ID: 21	Set ID: 4	Batch ID: 20	Loss: 3.37705
Epoch ID: 21	Set ID: 4	Batch ID: 40	Loss: 2.69059
Epoch ID: 21	Set ID: 4	Batch ID: 60	Loss: 2.94540
3			
Epoch ID: 21	Set ID: 3	Batch ID: 80	Loss: 2.52536
Epoch ID: 21	Set ID: 3	Batch ID: 100	Loss: 2.62622
Epoch ID: 21	Set ID: 3	Batch ID: 120	Loss: 2.54112
Epoch ID: 21	Set ID: 3	Batch ID: 140	Loss: 2.42975
1			
Epoch ID: 21	Set ID: 1	Batch ID: 160	Loss: 3.58922
Epoch ID: 21	Set ID: 1	Batch ID: 180	Loss: 2.67514
Epoch ID: 21	Set ID: 1	Batch ID: 200	Loss: 2.51278
Epoch ID: 21	Set ID: 1	Batch ID: 220	Loss: 2.01295
4			
Epoch ID: 22	Set ID: 4	Batch ID: 20	Loss: 2.67144
Epoch ID: 22	Set ID: 4	Batch ID: 40	Loss: 2.60526
Epoch ID: 22	Set ID: 4	Batch ID: 60	Loss: 2.43607
3			
Epoch ID: 22	Set ID: 3	Batch ID: 80	Loss: 2.36535
Epoch ID: 22	Set ID: 3	Batch ID: 100	Loss: 2.45119
Epoch ID: 22	Set ID: 3	Batch ID: 120	Loss: 3.34166
Epoch ID: 22	Set ID: 3	Batch ID: 140	Loss: 2.06930
1			
Epoch ID: 22	Set ID: 1	Batch ID: 160	Loss: 2.53150
Epoch ID: 22	Set ID: 1	Batch ID: 180	Loss: 2.63665
Epoch ID: 22	Set ID: 1	Batch ID: 200	Loss: 2.45117
Epoch ID: 22	Set ID: 1	Batch ID: 220	Loss: 3.26491
4			
Epoch ID: 23	Set ID: 4	Batch ID: 20	Loss: 2.34438
Epoch ID: 23	Set ID: 4	Batch ID: 40	Loss: 2.79841
Epoch ID: 23	Set ID: 4	Batch ID: 60	Loss: 2.35190
3			
Epoch ID: 23	Set ID: 3	Batch ID: 80	Loss: 2.97472
Epoch ID: 23	Set ID: 3	Batch ID: 100	Loss: 2.37853
Epoch ID: 23	Set ID: 3	Batch ID: 120	Loss: 3.07232
Epoch ID: 23	Set ID: 3	Batch ID: 140	Loss: 2.59099
1			
Epoch ID: 23	Set ID: 1	Batch ID: 160	Loss: 2.44467
Epoch ID: 23	Set ID: 1	Batch ID: 180	Loss: 3.26554
Epoch ID: 23	Set ID: 1	Batch ID: 200	Loss: 2.96207
Epoch ID: 23	Set ID: 1	Batch ID: 220	Loss: 2.74675

4

Epoch ID: 24	Set ID: 4	Batch ID: 20	Loss: 2.71926
Epoch ID: 24	Set ID: 4	Batch ID: 40	Loss: 2.72296
Epoch ID: 24	Set ID: 4	Batch ID: 60	Loss: 3.22835

3

Epoch ID: 24	Set ID: 3	Batch ID: 80	Loss: 2.53336
Epoch ID: 24	Set ID: 3	Batch ID: 100	Loss: 3.21656
Epoch ID: 24	Set ID: 3	Batch ID: 120	Loss: 2.33514
Epoch ID: 24	Set ID: 3	Batch ID: 140	Loss: 2.27547

1

Epoch ID: 24	Set ID: 1	Batch ID: 160	Loss: 2.67910
Epoch ID: 24	Set ID: 1	Batch ID: 180	Loss: 2.39160
Epoch ID: 24	Set ID: 1	Batch ID: 200	Loss: 2.73824
Epoch ID: 24	Set ID: 1	Batch ID: 220	Loss: 2.81276

4

Epoch ID: 25	Set ID: 4	Batch ID: 20	Loss: 2.45857
Epoch ID: 25	Set ID: 4	Batch ID: 40	Loss: 2.40249
Epoch ID: 25	Set ID: 4	Batch ID: 60	Loss: 2.21918

3

Epoch ID: 25	Set ID: 3	Batch ID: 80	Loss: 3.09885
Epoch ID: 25	Set ID: 3	Batch ID: 100	Loss: 2.35769
Epoch ID: 25	Set ID: 3	Batch ID: 120	Loss: 2.70188
Epoch ID: 25	Set ID: 3	Batch ID: 140	Loss: 2.41660

1

Epoch ID: 25	Set ID: 1	Batch ID: 160	Loss: 2.78111
Epoch ID: 25	Set ID: 1	Batch ID: 180	Loss: 2.86016
Epoch ID: 25	Set ID: 1	Batch ID: 200	Loss: 2.84650
Epoch ID: 25	Set ID: 1	Batch ID: 220	Loss: 2.51977

4

Epoch ID: 26	Set ID: 4	Batch ID: 20	Loss: 3.46195
Epoch ID: 26	Set ID: 4	Batch ID: 40	Loss: 2.21512
Epoch ID: 26	Set ID: 4	Batch ID: 60	Loss: 2.15717

3

Epoch ID: 26	Set ID: 3	Batch ID: 80	Loss: 2.70950
Epoch ID: 26	Set ID: 3	Batch ID: 100	Loss: 2.23782
Epoch ID: 26	Set ID: 3	Batch ID: 120	Loss: 2.78916
Epoch ID: 26	Set ID: 3	Batch ID: 140	Loss: 2.49948

1

Epoch ID: 26	Set ID: 1	Batch ID: 160	Loss: 2.96131
Epoch ID: 26	Set ID: 1	Batch ID: 180	Loss: 2.57748
Epoch ID: 26	Set ID: 1	Batch ID: 200	Loss: 2.46876
Epoch ID: 26	Set ID: 1	Batch ID: 220	Loss: 2.64758

4

Epoch ID: 27	Set ID: 4	Batch ID: 20	Loss: 2.42076
Epoch ID: 27	Set ID: 4	Batch ID: 40	Loss: 2.44691
Epoch ID: 27	Set ID: 4	Batch ID: 60	Loss: 2.69710

3

Epoch ID: 27	Set ID: 3	Batch ID: 80	Loss: 2.71903
Epoch ID: 27	Set ID: 3	Batch ID: 100	Loss: 2.81835
Epoch ID: 27	Set ID: 3	Batch ID: 120	Loss: 2.27752

Epoch ID: 27	Set ID: 3	Batch ID: 140		Loss: 2.85455
1				
Epoch ID: 27	Set ID: 1	Batch ID: 160		Loss: 2.86237
Epoch ID: 27	Set ID: 1	Batch ID: 180		Loss: 2.67415
Epoch ID: 27	Set ID: 1	Batch ID: 200		Loss: 2.29483
Epoch ID: 27	Set ID: 1	Batch ID: 220		Loss: 2.93100
4				
Epoch ID: 28	Set ID: 4	Batch ID: 20		Loss: 2.91867
Epoch ID: 28	Set ID: 4	Batch ID: 40		Loss: 2.44139
Epoch ID: 28	Set ID: 4	Batch ID: 60		Loss: 2.70101
3				
Epoch ID: 28	Set ID: 3	Batch ID: 80		Loss: 2.54931
Epoch ID: 28	Set ID: 3	Batch ID: 100		Loss: 2.36484
Epoch ID: 28	Set ID: 3	Batch ID: 120		Loss: 2.36831
Epoch ID: 28	Set ID: 3	Batch ID: 140		Loss: 3.07738
1				
Epoch ID: 28	Set ID: 1	Batch ID: 160		Loss: 2.32804
Epoch ID: 28	Set ID: 1	Batch ID: 180		Loss: 2.09355
Epoch ID: 28	Set ID: 1	Batch ID: 200		Loss: 2.95649
Epoch ID: 28	Set ID: 1	Batch ID: 220		Loss: 2.55516
4				
Epoch ID: 29	Set ID: 4	Batch ID: 20		Loss: 2.16313
Epoch ID: 29	Set ID: 4	Batch ID: 40		Loss: 2.86126
Epoch ID: 29	Set ID: 4	Batch ID: 60		Loss: 2.42539
3				
Epoch ID: 29	Set ID: 3	Batch ID: 80		Loss: 2.37224
Epoch ID: 29	Set ID: 3	Batch ID: 100		Loss: 2.48211
Epoch ID: 29	Set ID: 3	Batch ID: 120		Loss: 2.87649
Epoch ID: 29	Set ID: 3	Batch ID: 140		Loss: 2.58677
1				
Epoch ID: 29	Set ID: 1	Batch ID: 160		Loss: 2.93486
Epoch ID: 29	Set ID: 1	Batch ID: 180		Loss: 2.50051
Epoch ID: 29	Set ID: 1	Batch ID: 200		Loss: 2.38619
Epoch ID: 29	Set ID: 1	Batch ID: 220		Loss: 2.27293
4				
Epoch ID: 30	Set ID: 4	Batch ID: 20		Loss: 2.40890
Epoch ID: 30	Set ID: 4	Batch ID: 40		Loss: 2.38402
Epoch ID: 30	Set ID: 4	Batch ID: 60		Loss: 3.12359
3				
Epoch ID: 30	Set ID: 3	Batch ID: 80		Loss: 2.66971
Epoch ID: 30	Set ID: 3	Batch ID: 100		Loss: 2.24938
Epoch ID: 30	Set ID: 3	Batch ID: 120		Loss: 2.23804
Epoch ID: 30	Set ID: 3	Batch ID: 140		Loss: 3.28474
1				
Epoch ID: 30	Set ID: 1	Batch ID: 160		Loss: 3.09195
Epoch ID: 30	Set ID: 1	Batch ID: 180		Loss: 2.76499
Epoch ID: 30	Set ID: 1	Batch ID: 200		Loss: 2.31559
Epoch ID: 30	Set ID: 1	Batch ID: 220		Loss: 2.55589
4				
Epoch ID: 31	Set ID: 4	Batch ID: 20		Loss: 3.23672

Epoch ID: 31	Set ID: 4	Batch ID: 40		Loss: 2.25575
Epoch ID: 31	Set ID: 4	Batch ID: 60		Loss: 2.75144
3				
Epoch ID: 31	Set ID: 3	Batch ID: 80		Loss: 2.47766
Epoch ID: 31	Set ID: 3	Batch ID: 100		Loss: 2.73157
Epoch ID: 31	Set ID: 3	Batch ID: 120		Loss: 2.47489
Epoch ID: 31	Set ID: 3	Batch ID: 140		Loss: 2.72828
1				
Epoch ID: 31	Set ID: 1	Batch ID: 160		Loss: 3.17343
Epoch ID: 31	Set ID: 1	Batch ID: 180		Loss: 2.66177
Epoch ID: 31	Set ID: 1	Batch ID: 200		Loss: 2.64902
Epoch ID: 31	Set ID: 1	Batch ID: 220		Loss: 3.12724
4				
Epoch ID: 32	Set ID: 4	Batch ID: 20		Loss: 2.95383
Epoch ID: 32	Set ID: 4	Batch ID: 40		Loss: 2.42798
Epoch ID: 32	Set ID: 4	Batch ID: 60		Loss: 2.36006
3				
Epoch ID: 32	Set ID: 3	Batch ID: 80		Loss: 3.13297
Epoch ID: 32	Set ID: 3	Batch ID: 100		Loss: 2.30811
Epoch ID: 32	Set ID: 3	Batch ID: 120		Loss: 2.68048
Epoch ID: 32	Set ID: 3	Batch ID: 140		Loss: 3.08443
1				
Epoch ID: 32	Set ID: 1	Batch ID: 160		Loss: 3.23902
Epoch ID: 32	Set ID: 1	Batch ID: 180		Loss: 2.26764
Epoch ID: 32	Set ID: 1	Batch ID: 200		Loss: 2.52165
Epoch ID: 32	Set ID: 1	Batch ID: 220		Loss: 2.50273
4				
Epoch ID: 33	Set ID: 4	Batch ID: 20		Loss: 2.36545
Epoch ID: 33	Set ID: 4	Batch ID: 40		Loss: 2.53573
Epoch ID: 33	Set ID: 4	Batch ID: 60		Loss: 2.31250
3				
Epoch ID: 33	Set ID: 3	Batch ID: 80		Loss: 2.18626
Epoch ID: 33	Set ID: 3	Batch ID: 100		Loss: 2.42087
Epoch ID: 33	Set ID: 3	Batch ID: 120		Loss: 2.35729
Epoch ID: 33	Set ID: 3	Batch ID: 140		Loss: 3.45348
1				
Epoch ID: 33	Set ID: 1	Batch ID: 160		Loss: 2.62560
Epoch ID: 33	Set ID: 1	Batch ID: 180		Loss: 2.93531
Epoch ID: 33	Set ID: 1	Batch ID: 200		Loss: 2.44296
Epoch ID: 33	Set ID: 1	Batch ID: 220		Loss: 2.41340
4				
Epoch ID: 34	Set ID: 4	Batch ID: 20		Loss: 2.87463
Epoch ID: 34	Set ID: 4	Batch ID: 40		Loss: 2.41562
Epoch ID: 34	Set ID: 4	Batch ID: 60		Loss: 2.45524
3				
Epoch ID: 34	Set ID: 3	Batch ID: 80		Loss: 2.50524
Epoch ID: 34	Set ID: 3	Batch ID: 100		Loss: 2.86875
Epoch ID: 34	Set ID: 3	Batch ID: 120		Loss: 3.23154
Epoch ID: 34	Set ID: 3	Batch ID: 140		Loss: 2.27635
1				

Epoch ID: 34	Set ID: 1	Batch ID: 160	Loss: 2.33074
Epoch ID: 34	Set ID: 1	Batch ID: 180	Loss: 2.25328
Epoch ID: 34	Set ID: 1	Batch ID: 200	Loss: 2.68877
Epoch ID: 34	Set ID: 1	Batch ID: 220	Loss: 2.82154
4			
Epoch ID: 35	Set ID: 4	Batch ID: 20	Loss: 2.43820
Epoch ID: 35	Set ID: 4	Batch ID: 40	Loss: 2.38334
Epoch ID: 35	Set ID: 4	Batch ID: 60	Loss: 2.47028
3			
Epoch ID: 35	Set ID: 3	Batch ID: 80	Loss: 2.70411
Epoch ID: 35	Set ID: 3	Batch ID: 100	Loss: 2.43720
Epoch ID: 35	Set ID: 3	Batch ID: 120	Loss: 3.03449
Epoch ID: 35	Set ID: 3	Batch ID: 140	Loss: 2.61167
1			
Epoch ID: 35	Set ID: 1	Batch ID: 160	Loss: 3.26193
Epoch ID: 35	Set ID: 1	Batch ID: 180	Loss: 3.22011
Epoch ID: 35	Set ID: 1	Batch ID: 200	Loss: 2.23764
Epoch ID: 35	Set ID: 1	Batch ID: 220	Loss: 2.95880
4			
Epoch ID: 36	Set ID: 4	Batch ID: 20	Loss: 2.29373
Epoch ID: 36	Set ID: 4	Batch ID: 40	Loss: 2.51489
Epoch ID: 36	Set ID: 4	Batch ID: 60	Loss: 3.28646
3			
Epoch ID: 36	Set ID: 3	Batch ID: 80	Loss: 2.49034
Epoch ID: 36	Set ID: 3	Batch ID: 100	Loss: 2.40946
Epoch ID: 36	Set ID: 3	Batch ID: 120	Loss: 3.27846
Epoch ID: 36	Set ID: 3	Batch ID: 140	Loss: 2.75956
1			
Epoch ID: 36	Set ID: 1	Batch ID: 160	Loss: 2.16555
Epoch ID: 36	Set ID: 1	Batch ID: 180	Loss: 2.60626
Epoch ID: 36	Set ID: 1	Batch ID: 200	Loss: 2.38625
Epoch ID: 36	Set ID: 1	Batch ID: 220	Loss: 2.10942
4			
Epoch ID: 37	Set ID: 4	Batch ID: 20	Loss: 2.80745
Epoch ID: 37	Set ID: 4	Batch ID: 40	Loss: 2.71201
Epoch ID: 37	Set ID: 4	Batch ID: 60	Loss: 2.14796
3			
Epoch ID: 37	Set ID: 3	Batch ID: 80	Loss: 2.69837
Epoch ID: 37	Set ID: 3	Batch ID: 100	Loss: 2.30488
Epoch ID: 37	Set ID: 3	Batch ID: 120	Loss: 2.76818
Epoch ID: 37	Set ID: 3	Batch ID: 140	Loss: 2.77255
1			
Epoch ID: 37	Set ID: 1	Batch ID: 160	Loss: 2.43743
Epoch ID: 37	Set ID: 1	Batch ID: 180	Loss: 2.09200
Epoch ID: 37	Set ID: 1	Batch ID: 200	Loss: 2.78547
Epoch ID: 37	Set ID: 1	Batch ID: 220	Loss: 2.59514
4			
Epoch ID: 38	Set ID: 4	Batch ID: 20	Loss: 2.49592
Epoch ID: 38	Set ID: 4	Batch ID: 40	Loss: 2.93217
Epoch ID: 38	Set ID: 4	Batch ID: 60	Loss: 3.32877

3

Epoch ID: 38	Set ID: 3	Batch ID: 80	Loss: 2.86685
Epoch ID: 38	Set ID: 3	Batch ID: 100	Loss: 2.47033
Epoch ID: 38	Set ID: 3	Batch ID: 120	Loss: 2.62098
Epoch ID: 38	Set ID: 3	Batch ID: 140	Loss: 2.15447

1

Epoch ID: 38	Set ID: 1	Batch ID: 160	Loss: 3.13963
Epoch ID: 38	Set ID: 1	Batch ID: 180	Loss: 2.46288
Epoch ID: 38	Set ID: 1	Batch ID: 200	Loss: 2.55959
Epoch ID: 38	Set ID: 1	Batch ID: 220	Loss: 2.89721

4

Epoch ID: 39	Set ID: 4	Batch ID: 20	Loss: 2.26528
Epoch ID: 39	Set ID: 4	Batch ID: 40	Loss: 2.47999
Epoch ID: 39	Set ID: 4	Batch ID: 60	Loss: 3.22930

3

Epoch ID: 39	Set ID: 3	Batch ID: 80	Loss: 2.85911
Epoch ID: 39	Set ID: 3	Batch ID: 100	Loss: 2.65329
Epoch ID: 39	Set ID: 3	Batch ID: 120	Loss: 3.17665
Epoch ID: 39	Set ID: 3	Batch ID: 140	Loss: 2.80179

1

Epoch ID: 39	Set ID: 1	Batch ID: 160	Loss: 2.26570
Epoch ID: 39	Set ID: 1	Batch ID: 180	Loss: 2.71087
Epoch ID: 39	Set ID: 1	Batch ID: 200	Loss: 2.38454
Epoch ID: 39	Set ID: 1	Batch ID: 220	Loss: 2.68500

4

Epoch ID: 40	Set ID: 4	Batch ID: 20	Loss: 3.08148
Epoch ID: 40	Set ID: 4	Batch ID: 40	Loss: 2.61662
Epoch ID: 40	Set ID: 4	Batch ID: 60	Loss: 3.15321

3

Epoch ID: 40	Set ID: 3	Batch ID: 80	Loss: 2.66294
Epoch ID: 40	Set ID: 3	Batch ID: 100	Loss: 2.48821
Epoch ID: 40	Set ID: 3	Batch ID: 120	Loss: 2.30036
Epoch ID: 40	Set ID: 3	Batch ID: 140	Loss: 2.38409

1

Epoch ID: 40	Set ID: 1	Batch ID: 160	Loss: 2.61894
Epoch ID: 40	Set ID: 1	Batch ID: 180	Loss: 2.70856
Epoch ID: 40	Set ID: 1	Batch ID: 200	Loss: 2.69218
Epoch ID: 40	Set ID: 1	Batch ID: 220	Loss: 2.63678

4

Epoch ID: 41	Set ID: 4	Batch ID: 20	Loss: 2.33344
Epoch ID: 41	Set ID: 4	Batch ID: 40	Loss: 2.33902
Epoch ID: 41	Set ID: 4	Batch ID: 60	Loss: 2.42649

3

Epoch ID: 41	Set ID: 3	Batch ID: 80	Loss: 2.35697
Epoch ID: 41	Set ID: 3	Batch ID: 100	Loss: 3.10837
Epoch ID: 41	Set ID: 3	Batch ID: 120	Loss: 3.01756
Epoch ID: 41	Set ID: 3	Batch ID: 140	Loss: 2.25998

1

Epoch ID: 41	Set ID: 1	Batch ID: 160	Loss: 2.67678
Epoch ID: 41	Set ID: 1	Batch ID: 180	Loss: 3.08419

Epoch ID: 41	Set ID: 1	Batch ID: 200	Loss: 2.26828
Epoch ID: 41	Set ID: 1	Batch ID: 220	Loss: 2.57716
4			
Epoch ID: 42	Set ID: 4	Batch ID: 20	Loss: 2.30331
Epoch ID: 42	Set ID: 4	Batch ID: 40	Loss: 2.15787
Epoch ID: 42	Set ID: 4	Batch ID: 60	Loss: 2.56263
3			
Epoch ID: 42	Set ID: 3	Batch ID: 80	Loss: 2.61829
Epoch ID: 42	Set ID: 3	Batch ID: 100	Loss: 2.57120
Epoch ID: 42	Set ID: 3	Batch ID: 120	Loss: 2.87508
Epoch ID: 42	Set ID: 3	Batch ID: 140	Loss: 2.66173
1			
Epoch ID: 42	Set ID: 1	Batch ID: 160	Loss: 2.43069
Epoch ID: 42	Set ID: 1	Batch ID: 180	Loss: 2.73815
Epoch ID: 42	Set ID: 1	Batch ID: 200	Loss: 2.61271
Epoch ID: 42	Set ID: 1	Batch ID: 220	Loss: 2.72823
4			
Epoch ID: 43	Set ID: 4	Batch ID: 20	Loss: 2.52693
Epoch ID: 43	Set ID: 4	Batch ID: 40	Loss: 2.61429
Epoch ID: 43	Set ID: 4	Batch ID: 60	Loss: 2.21604
3			
Epoch ID: 43	Set ID: 3	Batch ID: 80	Loss: 3.16007
Epoch ID: 43	Set ID: 3	Batch ID: 100	Loss: 2.49294
Epoch ID: 43	Set ID: 3	Batch ID: 120	Loss: 2.57540
Epoch ID: 43	Set ID: 3	Batch ID: 140	Loss: 2.47554
1			
Epoch ID: 43	Set ID: 1	Batch ID: 160	Loss: 2.31515
Epoch ID: 43	Set ID: 1	Batch ID: 180	Loss: 2.66190
Epoch ID: 43	Set ID: 1	Batch ID: 200	Loss: 2.33385
Epoch ID: 43	Set ID: 1	Batch ID: 220	Loss: 2.48769
4			
Epoch ID: 44	Set ID: 4	Batch ID: 20	Loss: 2.58856
Epoch ID: 44	Set ID: 4	Batch ID: 40	Loss: 2.47318
Epoch ID: 44	Set ID: 4	Batch ID: 60	Loss: 2.62072
3			
Epoch ID: 44	Set ID: 3	Batch ID: 80	Loss: 2.50766
Epoch ID: 44	Set ID: 3	Batch ID: 100	Loss: 2.28614
Epoch ID: 44	Set ID: 3	Batch ID: 120	Loss: 2.19393
Epoch ID: 44	Set ID: 3	Batch ID: 140	Loss: 3.10036
1			
Epoch ID: 44	Set ID: 1	Batch ID: 160	Loss: 2.64140
Epoch ID: 44	Set ID: 1	Batch ID: 180	Loss: 2.41447
Epoch ID: 44	Set ID: 1	Batch ID: 200	Loss: 2.75003
Epoch ID: 44	Set ID: 1	Batch ID: 220	Loss: 2.27890
4			
Epoch ID: 45	Set ID: 4	Batch ID: 20	Loss: 2.66752
Epoch ID: 45	Set ID: 4	Batch ID: 40	Loss: 2.75165
Epoch ID: 45	Set ID: 4	Batch ID: 60	Loss: 2.61422
3			
Epoch ID: 45	Set ID: 3	Batch ID: 80	Loss: 2.68846

Epoch ID: 45	Set ID: 3	Batch ID: 100	Loss: 2.33014
Epoch ID: 45	Set ID: 3	Batch ID: 120	Loss: 2.51459
Epoch ID: 45	Set ID: 3	Batch ID: 140	Loss: 2.46522
1			
Epoch ID: 45	Set ID: 1	Batch ID: 160	Loss: 2.40030
Epoch ID: 45	Set ID: 1	Batch ID: 180	Loss: 3.10957
Epoch ID: 45	Set ID: 1	Batch ID: 200	Loss: 2.32696
Epoch ID: 45	Set ID: 1	Batch ID: 220	Loss: 2.62812
4			
Epoch ID: 46	Set ID: 4	Batch ID: 20	Loss: 2.19797
Epoch ID: 46	Set ID: 4	Batch ID: 40	Loss: 2.23573
Epoch ID: 46	Set ID: 4	Batch ID: 60	Loss: 2.28857
3			
Epoch ID: 46	Set ID: 3	Batch ID: 80	Loss: 2.63064
Epoch ID: 46	Set ID: 3	Batch ID: 100	Loss: 2.10027
Epoch ID: 46	Set ID: 3	Batch ID: 120	Loss: 2.95072
Epoch ID: 46	Set ID: 3	Batch ID: 140	Loss: 2.33390
1			
Epoch ID: 46	Set ID: 1	Batch ID: 160	Loss: 2.25319
Epoch ID: 46	Set ID: 1	Batch ID: 180	Loss: 2.49136
Epoch ID: 46	Set ID: 1	Batch ID: 200	Loss: 2.17864
Epoch ID: 46	Set ID: 1	Batch ID: 220	Loss: 2.34507
4			
Epoch ID: 47	Set ID: 4	Batch ID: 20	Loss: 3.04127
Epoch ID: 47	Set ID: 4	Batch ID: 40	Loss: 2.65432
Epoch ID: 47	Set ID: 4	Batch ID: 60	Loss: 2.73918
3			
Epoch ID: 47	Set ID: 3	Batch ID: 80	Loss: 2.50820
Epoch ID: 47	Set ID: 3	Batch ID: 100	Loss: 2.14880
Epoch ID: 47	Set ID: 3	Batch ID: 120	Loss: 2.73321
Epoch ID: 47	Set ID: 3	Batch ID: 140	Loss: 2.47368
1			
Epoch ID: 47	Set ID: 1	Batch ID: 160	Loss: 3.13643
Epoch ID: 47	Set ID: 1	Batch ID: 180	Loss: 3.04393
Epoch ID: 47	Set ID: 1	Batch ID: 200	Loss: 2.13209
Epoch ID: 47	Set ID: 1	Batch ID: 220	Loss: 2.13386
4			
Epoch ID: 48	Set ID: 4	Batch ID: 20	Loss: 2.91470
Epoch ID: 48	Set ID: 4	Batch ID: 40	Loss: 2.04543
Epoch ID: 48	Set ID: 4	Batch ID: 60	Loss: 2.40059
3			
Epoch ID: 48	Set ID: 3	Batch ID: 80	Loss: 2.69806
Epoch ID: 48	Set ID: 3	Batch ID: 100	Loss: 2.88848
Epoch ID: 48	Set ID: 3	Batch ID: 120	Loss: 2.54974
Epoch ID: 48	Set ID: 3	Batch ID: 140	Loss: 2.38338
1			
Epoch ID: 48	Set ID: 1	Batch ID: 160	Loss: 3.13346
Epoch ID: 48	Set ID: 1	Batch ID: 180	Loss: 2.62264
Epoch ID: 48	Set ID: 1	Batch ID: 200	Loss: 3.10022
Epoch ID: 48	Set ID: 1	Batch ID: 220	Loss: 2.62346

4

Epoch ID: 49	Set ID: 4	Batch ID: 20		Loss: 2.55998
Epoch ID: 49	Set ID: 4	Batch ID: 40		Loss: 2.80346
Epoch ID: 49	Set ID: 4	Batch ID: 60		Loss: 2.03330

3

Epoch ID: 49	Set ID: 3	Batch ID: 80		Loss: 2.47983
Epoch ID: 49	Set ID: 3	Batch ID: 100		Loss: 2.37454
Epoch ID: 49	Set ID: 3	Batch ID: 120		Loss: 2.42154
Epoch ID: 49	Set ID: 3	Batch ID: 140		Loss: 2.51484

1

Epoch ID: 49	Set ID: 1	Batch ID: 160		Loss: 2.75370
Epoch ID: 49	Set ID: 1	Batch ID: 180		Loss: 3.15060
Epoch ID: 49	Set ID: 1	Batch ID: 200		Loss: 2.36591
Epoch ID: 49	Set ID: 1	Batch ID: 220		Loss: 2.12034

model.to(DEVICE)

loss_val, eff_rate, fp_rate = validate(model)

```
print(f"Loss: {loss_val}")
print(f"Eff: {eff_rate}")
print(f"FP: {fp_rate}")
```

Loss: 2.052672863006592
Eff: 0.8903634889036349
FP: 1.5336932613477305