In Deep learning, data augmentation techniques and transforms are essential to improve the quality and quantity of data used to train models. In the case of the CIFAR10 dataset, which consists of 60,000 color images of 32x32 pixels, these techniques are particularly important.

To augment the data, we use two techniques - Random Crop and Random Horizontal Flip. Random Crop selects a random subset of the original image, while Random Horizontal Flip flips an image horizontally with a certain probability. Both of these techniques help to introduce variations in the dataset, making the model more capable of recognizing similar images with different compositions.

After applying the data augmentation techniques, we use the To Tensor transform, which converts the images into PyTorch tensors and scales them by 255. This transformation is essential because PyTorch works with tensors, and scaling the images helps to normalize the pixel values.

Lastly, we apply the Normalize transform to adjust the mean and standard deviation of the image pixels, making the images more standardized. The values of the pixels become 0.0 and 1.0, respectively.

To ensure consistency and reproducibility, we download the CIFAR10 dataset in the root directory ./data and set PyTorch's random number generator to a seed value of 17. By doing this, we get the same validation set each time, which helps us to evaluate the model's performance accurately.

Overall, applying data augmentation techniques and transforms to the CIFAR10 dataset helps to improve the quality of the data and enhance the model's performance. These techniques can also be applied to other datasets, making it an essential part of machine learning workflows.

```
from google.colab import drive
drive.mount('/content/gdrive')
```

```
Mounted at /content/gdrive
```

```
import multiprocessing
import torchvision
import torchvision.transforms as transforms
import numpy as np
from torch.utils.data import DataLoader
import torch
torch.manual_seed(17)

from torchsummary import summary
from tqdm import tqdm
import matplotlib.pyplot as plt

class FetchDataset:
```

```
    def __init__(self, dataset="CIFAR10", batch_size=64):
        print("Initializing fetching %s dataset using torchvision"%
(dataset))
        # check if the dataset exists in torchvision
        self.datasetObject =
torchvision.datasets.__dict__.get(dataset, None)
        if self.datasetObject == None:
            raise Exception("Dataset %s not available in
torchvision."%(dataset))
        self.batch_size = batch_size
        self.transformers_training = []
        self.transformers_testing = []
        # set number of workers available for multiprocessing
        self.workersAvailable = min(multiprocessing.cpu_count(), 14)

    def dataAugmentation(self, size=32, padding=3):
        # add data augmentation transforms to the training set

self.transformers_training.append(transforms.RandomHorizontalFlip())

self.transformers_training.append(transforms.RandomCrop(size=size,
padding=padding))

self.transformers_training.append(transforms.functional.equalize)

self.transformers_testing.append(transforms.functional.equalize)

    def __addToTensor(self):
        # add ToTensor transform to the training and testing sets
        self.transformers_training.append(transforms.ToTensor())
        self.transformers_testing.append(transforms.ToTensor())

    def addNormalizer(self):
        self.__addToTensor()
        # load training set to compute mean and standard deviation
        dataset_training = self.datasetObject(root="./data",
train=True, download=True)
        data_train = dataset_training.data/255.0
        mean = data_train.mean(axis=(0, 1, 2))
        std = data_train.std(axis=(0, 1, 2))
        # add Normalize transform to the training and testing sets

self.transformers_training.append(transforms.Normalize(mean=mean,
std=std))

self.transformers_testing.append(transforms.Normalize(mean=mean,
std=std))


    def getLoaders(self):
```

```
        if len(self.transformers_training) == 0:
            self.__addToTensor()
        # create data loaders with the defined batch size,
transformers and number of workers
        dataset_training = self.datasetObject(root="./data",
train=True, download=True,
transform=transforms.Compose(self.transformers_training))
        dataset_testing = self.datasetObject(root="./data",
train=False, download=True,
transform=transforms.Compose(self.transformers_testing))
        load_train = DataLoader(dataset_training,
batch_size=self.batch_size, shuffle=True,
num_workers=self.workersAvailable)
        load_test = DataLoader(dataset_testing,
batch_size=self.batch_size, shuffle=False,
num_workers=self.workersAvailable)
        # return the training and testing data loaders
        return load_train, load_test


# create a new instance of FetchDataset for the CIFAR10 dataset with
batch size of 128
df = FetchDataset(dataset="CIFAR10", batch_size=128)
# add data augmentation transforms to the training set with size 32
and padding 4
df.dataAugmentation(size=32, padding=4)
# add normalizing transforms to the training and testing sets
df.addNormalizer()
# get the training and testing data loaders
trainLoader, testLoader = df.getLoaders()
```

```
Initializing fetching CIFAR10 dataset using torchvision
Downloading https://www.cs.toronto.edu/~kriz/cifar-10-python.tar.gz to
./data/cifar-10-python.tar.gz

100%|██████████| 170498071/170498071 [00:05<00:00, 29108490.36it/s]

Extracting ./data/cifar-10-python.tar.gz to ./data
Files already downloaded and verified
Files already downloaded and verified
```

Modified the basic resnet model from
https://github.com/kuangliu/pytorch-cifar/blob/master/models/resnet.py

• Ci, the number of channels in the ith layer. • Fi, the filter size in the ith layer • Ki, the kernel size in the ith skip connection • P, the pool size in the average pool layer

Using the following values for the Hyperparameters (design variables) in our architectures :

```
C=[64,128,128,256]
F=[3,3,3,3]
K=[1,1,1,1]
P=4

# Import necessary PyTorch modules
import torch.nn as nn
import torch.nn.functional as F

# Define the BasicBlock class, which is used to construct the layers
in the ResNet architecture
class BasicBlock(nn.Module):

    # Initialize the BasicBlock class
    def __init__(self, in_planes, planes, kernel_size, skip_kernel,
stride=1):
        super(BasicBlock, self).__init__()

        # Define the first convolutional layer
        self.conv1 = nn.Conv2d(in_planes, planes,
kernel_size=kernel_size, stride=stride, padding=1, bias=False)
        self.bn1 = nn.BatchNorm2d(planes)

        # Define the second convolutional layer
        self.conv2 = nn.Conv2d(planes, planes,
kernel_size=kernel_size, stride=1, padding=1, bias=False)
        self.bn2 = nn.BatchNorm2d(planes)

        # Define the shortcut connection, which is used to add the
output of the convolutional layers to the input
        self.shortcut = nn.Sequential()

        # If the stride is not 1 or the number of input planes is not
equal to the number of output planes,
        # define a convolutional layer and a batch normalization layer
for the shortcut connection
        if stride != 1 or in_planes != planes:
            self.shortcut = nn.Sequential(
                nn.Conv2d(in_planes, planes, kernel_size=skip_kernel,
stride=stride, bias=False),
                nn.BatchNorm2d(planes)
            )

    # Define the forward pass for the BasicBlock class
    def forward(self, x):
        # Apply the first convolutional layer, batch normalization,
and ReLU activation
        out = F.relu(self.bn1(self.conv1(x)))

        # Apply the second convolutional layer and batch normalization
```

```
        out = self.bn2(self.conv2(out))

        # Add the shortcut connection to the output of the
convolutional layers
        out += self.shortcut(x)

        # Apply the ReLU activation
        out = F.relu(out)

        return out

# Define the ResNet class, which is used to construct the ResNet
architecture
class ResNet(nn.Module):

    # Initialize the ResNet class
    def __init__(self,N:int, B:list, C:list, F:list, K:list, P:int,
num_classes=10):
        super(ResNet, self).__init__()

        # Initialize the number of input planes
        self.in_planes = C[0]

        # Set the block to the BasicBlock class
        self.block = BasicBlock

        # Store the values of N, B, C, F, K, and P
        self.N, self.B, self.C, self.F, self.K, self.P= N, B, C, F, K,
P

        # Initialize a container for the layers
        self.layers = []

        # Set the stride for each layer
        self.S = [2] * N
        self.S[0] = 1

        # Calculate the input dimension for the output linear layer
        self.outLayerInSize = C[N-1]*(32//(P*2**(N-1)))*(32//(P*2**(N-
1)))

        # Print Model Config
        print("\n\nModel Config: "
            "\n-------------------------------------"
            "\nN (# Layers)\t:",self.N,
            "\nB (# Blocks)\t:",self.B,
            "\nC (# Channels)\t:",C,
            "\nF (Conv Kernel)\t:",F,
            "\nK (Skip Kernel)\t:",K,
```

```
            "\nP (Pool Kernel)\t:",P,)

        # Define the first convolution layer with 3 input channels,
C[0] output channels, F[0] kernel size,
        # stride of 1, padding of 1, and no bias
        self.conv1 = nn.Conv2d(3, C[0], kernel_size=F[0], stride=1,
padding=1, bias=False)
        # Define a batch normalization layer with C[0] channels
        self.bn1 = nn.BatchNorm2d(C[0])

        # Define N residual blocks
        for i in range(N):
          # Dynamically create variable names for each residual block
using the exec() function
            exec("self.layer{} = self._make_layer(self.block,
self.C[{}], self.B[{}], self.F[{}], self.K[{}], self.S[{}])"\
                .format(i+1,i,i,i,i,i))
            # Append the residual block to the layers ModuleList
            exec("self.layers.append(self.layer{})".format(i+1))
            # Define the final linear layer with input size of
outLayerInSize and output size of num_classes
        self.linear = nn.Linear(self.outLayerInSize, num_classes)


    def _make_layer(self, block, planes, num_blocks, kernel_size,
skip_kernel, stride):
      # Set stride for each block in the layer
        strides = [stride] + [1]*(num_blocks-1)
        layers = []
        for stride in strides:
            layers.append(block(self.in_planes, planes, kernel_size,
skip_kernel, stride)) # Append each block to the layer with given
arguments
            self.in_planes = planes  # Update the number of input
planes for the next block
        return nn.Sequential(*layers)  # Return a sequential module
containing all the blocks in the layer

    def forward(self, x):
        # Apply the first convolutional layer followed by batch
normalization and ReLU activation
        out = F.relu(self.bn1(self.conv1(x)))
        # Apply all the blocks in the layer
        for layer in self.layers:
            out = layer(out)
        out = F.avg_pool2d(out, self.P) # Apply average pooling with
kernel size self.P
        out = out.view(out.size(0), -1)  # Flatten the output tensor
        out = self.linear(out)  # Apply the fully connected linear
layer
```

```python
        return out # Return the final output

def resnet_model():
# Define the parameters for the ResNet architecture
    B=[3,3,2,3]  # number of blocks in each layer
    C=[64,128,128,256]  # number of output channels in each layer
    F=[3,3,3,3]  # kernel size for each layer
    K=[1,1,1,1] # skip kernel size for each layer
    P=4       # average pooling kernel size
    N=len(B)  # number of layers in the network
# Return a new ResNet model with the defined parameters
    return ResNet(N, B, C, F, K, P)


device = torch.device("cuda" if torch.cuda.is_available() else "cpu")
print(device)
```

```
cuda
```

```python
model = resnet_model()
model = model.to(device)
```

```
Model Config:
-------------------------------------
N (# Layers)     : 4
B (# Blocks)     : [3, 3, 2, 3]
C (# Channels)   : [64, 128, 128, 256]
F (Conv Kernel)  : [3, 3, 3, 3]
K (Skip Kernel)  : [1, 1, 1, 1]
P (Pool Kernel)  : 4
```

We run our model for 300 epochs, to find out the best possible accuracy. The accuracy becomes near about constant after it. We define our:

learning rate, weightDecay, type of optimizer to be used (we tried with Adam, Adagrad, AdaDelta), with Adadelta giving out the best accuracy.

The scheduler set the learning rate of each parameter group using a cosine annealing schedule

###**ADAM Optimizer**

```python
EPOCHS=300
globalBestAccuracy = 0.0
train_loss = []
test_loss = []
train_accuracy = []
test_accuracy = []
```

```
loss_function = torch.nn.CrossEntropyLoss(reduction='sum')
learningRate = 0.001
weightDecay = 0.0001
optimizer = torch.optim.Adam(model.parameters(), lr=learningRate,
weight_decay=weightDecay)
scheduler = torch.optim.lr_scheduler.CosineAnnealingLR(optimizer,
EPOCHS, eta_min=learningRate/10.0)
print(model.eval())
trainable_parameters = sum(p.numel() for p in model.parameters() if
p.requires_grad)
print("Total Trainable Parameters : %s"%(trainable_parameters))
if trainable_parameters > 5*(10**6):
    raise Exception("Model not under budget!")
```

```
ResNet(
  (conv1): Conv2d(3, 64, kernel_size=(3, 3), stride=(1, 1),
padding=(1, 1), bias=False)
  (bn1): BatchNorm2d(64, eps=1e-05, momentum=0.1, affine=True,
track_running_stats=True)
  (layer1): Sequential(
    (0): BasicBlock(
      (conv1): Conv2d(64, 64, kernel_size=(3, 3), stride=(1, 1),
padding=(1, 1), bias=False)
      (bn1): BatchNorm2d(64, eps=1e-05, momentum=0.1, affine=True,
track_running_stats=True)
      (conv2): Conv2d(64, 64, kernel_size=(3, 3), stride=(1, 1),
padding=(1, 1), bias=False)
      (bn2): BatchNorm2d(64, eps=1e-05, momentum=0.1, affine=True,
track_running_stats=True)
      (shortcut): Sequential()
    )
    (1): BasicBlock(
      (conv1): Conv2d(64, 64, kernel_size=(3, 3), stride=(1, 1),
padding=(1, 1), bias=False)
      (bn1): BatchNorm2d(64, eps=1e-05, momentum=0.1, affine=True,
track_running_stats=True)
      (conv2): Conv2d(64, 64, kernel_size=(3, 3), stride=(1, 1),
padding=(1, 1), bias=False)
      (bn2): BatchNorm2d(64, eps=1e-05, momentum=0.1, affine=True,
track_running_stats=True)
      (shortcut): Sequential()
    )
    (2): BasicBlock(
      (conv1): Conv2d(64, 64, kernel_size=(3, 3), stride=(1, 1),
padding=(1, 1), bias=False)
      (bn1): BatchNorm2d(64, eps=1e-05, momentum=0.1, affine=True,
track_running_stats=True)
      (conv2): Conv2d(64, 64, kernel_size=(3, 3), stride=(1, 1),
padding=(1, 1), bias=False)
      (bn2): BatchNorm2d(64, eps=1e-05, momentum=0.1, affine=True,
```

```
track_running_stats=True)
      (shortcut): Sequential()
    )
  )
  (layer2): Sequential(
    (0): BasicBlock(
      (conv1): Conv2d(64, 128, kernel_size=(3, 3), stride=(2, 2),
padding=(1, 1), bias=False)
      (bn1): BatchNorm2d(128, eps=1e-05, momentum=0.1, affine=True,
track_running_stats=True)
      (conv2): Conv2d(128, 128, kernel_size=(3, 3), stride=(1, 1),
padding=(1, 1), bias=False)
      (bn2): BatchNorm2d(128, eps=1e-05, momentum=0.1, affine=True,
track_running_stats=True)
      (shortcut): Sequential(
        (0): Conv2d(64, 128, kernel_size=(1, 1), stride=(2, 2),
bias=False)
        (1): BatchNorm2d(128, eps=1e-05, momentum=0.1, affine=True,
track_running_stats=True)
      )
    )
    (1): BasicBlock(
      (conv1): Conv2d(128, 128, kernel_size=(3, 3), stride=(1, 1),
padding=(1, 1), bias=False)
      (bn1): BatchNorm2d(128, eps=1e-05, momentum=0.1, affine=True,
track_running_stats=True)
      (conv2): Conv2d(128, 128, kernel_size=(3, 3), stride=(1, 1),
padding=(1, 1), bias=False)
      (bn2): BatchNorm2d(128, eps=1e-05, momentum=0.1, affine=True,
track_running_stats=True)
      (shortcut): Sequential()
    )
    (2): BasicBlock(
      (conv1): Conv2d(128, 128, kernel_size=(3, 3), stride=(1, 1),
padding=(1, 1), bias=False)
      (bn1): BatchNorm2d(128, eps=1e-05, momentum=0.1, affine=True,
track_running_stats=True)
      (conv2): Conv2d(128, 128, kernel_size=(3, 3), stride=(1, 1),
padding=(1, 1), bias=False)
      (bn2): BatchNorm2d(128, eps=1e-05, momentum=0.1, affine=True,
track_running_stats=True)
      (shortcut): Sequential()
    )
  )
  (layer3): Sequential(
    (0): BasicBlock(
      (conv1): Conv2d(128, 128, kernel_size=(3, 3), stride=(2, 2),
padding=(1, 1), bias=False)
      (bn1): BatchNorm2d(128, eps=1e-05, momentum=0.1, affine=True,
track_running_stats=True)
```

```
      (conv2): Conv2d(128, 128, kernel_size=(3, 3), stride=(1, 1),
padding=(1, 1), bias=False)
      (bn2): BatchNorm2d(128, eps=1e-05, momentum=0.1, affine=True,
track_running_stats=True)
      (shortcut): Sequential(
        (0): Conv2d(128, 128, kernel_size=(1, 1), stride=(2, 2),
bias=False)
        (1): BatchNorm2d(128, eps=1e-05, momentum=0.1, affine=True,
track_running_stats=True)
      )
    )
    (1): BasicBlock(
      (conv1): Conv2d(128, 128, kernel_size=(3, 3), stride=(1, 1),
padding=(1, 1), bias=False)
      (bn1): BatchNorm2d(128, eps=1e-05, momentum=0.1, affine=True,
track_running_stats=True)
      (conv2): Conv2d(128, 128, kernel_size=(3, 3), stride=(1, 1),
padding=(1, 1), bias=False)
      (bn2): BatchNorm2d(128, eps=1e-05, momentum=0.1, affine=True,
track_running_stats=True)
      (shortcut): Sequential()
    )
  )
  (layer4): Sequential(
    (0): BasicBlock(
      (conv1): Conv2d(128, 256, kernel_size=(3, 3), stride=(2, 2),
padding=(1, 1), bias=False)
      (bn1): BatchNorm2d(256, eps=1e-05, momentum=0.1, affine=True,
track_running_stats=True)
      (conv2): Conv2d(256, 256, kernel_size=(3, 3), stride=(1, 1),
padding=(1, 1), bias=False)
      (bn2): BatchNorm2d(256, eps=1e-05, momentum=0.1, affine=True,
track_running_stats=True)
      (shortcut): Sequential(
        (0): Conv2d(128, 256, kernel_size=(1, 1), stride=(2, 2),
bias=False)
        (1): BatchNorm2d(256, eps=1e-05, momentum=0.1, affine=True,
track_running_stats=True)
      )
    )
    (1): BasicBlock(
      (conv1): Conv2d(256, 256, kernel_size=(3, 3), stride=(1, 1),
padding=(1, 1), bias=False)
      (bn1): BatchNorm2d(256, eps=1e-05, momentum=0.1, affine=True,
track_running_stats=True)
      (conv2): Conv2d(256, 256, kernel_size=(3, 3), stride=(1, 1),
padding=(1, 1), bias=False)
      (bn2): BatchNorm2d(256, eps=1e-05, momentum=0.1, affine=True,
track_running_stats=True)
      (shortcut): Sequential()
```

```
    )
    (2): BasicBlock(
      (conv1): Conv2d(256, 256, kernel_size=(3, 3), stride=(1, 1), 
padding=(1, 1), bias=False)
      (bn1): BatchNorm2d(256, eps=1e-05, momentum=0.1, affine=True, 
track_running_stats=True)
      (conv2): Conv2d(256, 256, kernel_size=(3, 3), stride=(1, 1), 
padding=(1, 1), bias=False)
      (bn2): BatchNorm2d(256, eps=1e-05, momentum=0.1, affine=True, 
track_running_stats=True)
      (shortcut): Sequential()
    )
  )
  (linear): Linear(in_features=256, out_features=10, bias=True)
)
Total Trainable Parameters : 4935242
```

Model Training and Testing. Here we are training our model over 300 epochs and trying to find out the best accuracy our model provides for the CIFAR dataset.

```
def train(model,loader, optimizer): # Define the function to train the 
model and return the updated model and optimizer
    model.train()                   # Set the model to train mode
    optimizer.zero_grad()            # Clear the gradients of the 
optimizer
    return model, optimizer         # Return the updated model and 
optimizer

def test(model,loader):          # Define the function to evaluate the 
model on the test set
    return model.eval()          # Set the model to evaluation mode

def getLoss(loader,model,optimizer):        # Define the function to 
calculate the loss and accuracy for a given loader and model
    running_loss = 0.0                      # Initialize the running 
loss and correct count
    running_correct = 0
    for images, labels in loader:            # Iterate through the 
loader
        images = images.to(device)           # Move the images and 
labels to the device
        labels = labels.to(device)
        output = model(images)               # Forward pass
        loss = loss_function(output, labels) # Calculate the loss
        predicted_labels = torch.argmax(output, dim=1)  # Calculate 
the predicted labels
        running_loss += loss.item()     # Update the running loss and 
correct count
        running_correct += torch.sum(predicted_labels == 
labels).float().item()
```

```
        if phase == "train":           # If the phase is "train",
backpropagate the loss and update the optimizer
            loss.backward()
            optimizer.step()
    return running_loss,running_correct

for i in tqdm(range(EPOCHS)):        # Iterate through the epochs
    for phase in ['train', 'test']:   # Iterate through the phases
(train and test)
        if phase == "train":          # If the phase is "train", set
the loader and call the train function
            loader = trainLoader
            model,optimzier= train(model,loader,optimizer)
        else:                       # If the phase is "test", set the
loader and call the test function
            loader = testLoader
            model=test(model,loader)
        running_loss,running_correct = getLoss(loader,model,optimizer)
        epoch_loss = running_loss/len(loader.dataset)      # Calculate
the epoch loss and accuracy
        epoch_acc = running_correct/len(loader.dataset)
        if phase == "train":          # If the phase is "train",
update the scheduler and append the results to the train lists
            scheduler.step()
            train_loss.append(epoch_loss)
            train_accuracy.append(epoch_acc)
        else:                         # If the phase is "test", append
the results to the test lists and update the global best accuracy
            test_loss.append(epoch_loss)
            test_accuracy.append(epoch_acc)
            globalBestAccuracy = max(globalBestAccuracy, epoch_acc)

        torch.save({
                    'epoch': i,
                    'model_state_dict': model.state_dict(),
                    'optimizer_state_dict': optimizer.state_dict(),
                    'train_accuracy': train_accuracy,
                    'test_accuracy': test_accuracy,
                    }, '/content/gdrive/MyDrive/model2.pt')

    print("Training Loss : %s, Testing Loss : %s, Training Accuracy :
%s, Testing Accuracy : %s"\
          %(train_loss[-1], test_loss[-1], train_accuracy[-1],
test_accuracy[-1]))
```

```
  0%|          | 1/300 [00:59<4:56:03, 59.41s/it]

Training Loss : 3.040477334899902, Testing Loss : 2.3654392826080324,
Training Accuracy : 0.10874, Testing Accuracy : 0.102

   1%|          | 2/300 [01:51<4:32:19, 54.83s/it]
```

```
Training Loss : 2.3038612701416015, Testing Loss : 2.2989723239898683,
Training Accuracy : 0.10228, Testing Accuracy : 0.1072

   1%|          | 3/300 [02:42<4:24:34, 53.45s/it]

Training Loss : 2.293503948059082, Testing Loss : 2.2840940391540525,
Training Accuracy : 0.1086, Testing Accuracy : 0.1369

   1%|▏         | 4/300 [03:34<4:21:03, 52.92s/it]

Training Loss : 2.267441561279297, Testing Loss : 2.217975033569336,
Training Accuracy : 0.13878, Testing Accuracy : 0.1644

   2%|▏         | 5/300 [04:25<4:16:52, 52.24s/it]

Training Loss : 2.2086803552246095, Testing Loss : 2.21544686088562,
Training Accuracy : 0.16682, Testing Accuracy : 0.1813

   2%|▏         | 6/300 [05:18<4:16:31, 52.35s/it]

Training Loss : 2.178263030090332, Testing Loss : 2.1646126220703126,
Training Accuracy : 0.17864, Testing Accuracy : 0.1919

   2%|▏         | 7/300 [06:11<4:16:12, 52.47s/it]

Training Loss : 2.1224982446289062, Testing Loss : 2.0741688999176024,
Training Accuracy : 0.2058, Testing Accuracy : 0.2218

   3%|▎         | 8/300 [07:02<4:13:05, 52.00s/it]

Training Loss : 2.066834791564941, Testing Loss : 2.10957873840332,
Training Accuracy : 0.22902, Testing Accuracy : 0.2183

   3%|▎         | 9/300 [07:54<4:12:12, 52.00s/it]

Training Loss : 2.0495605657958986, Testing Loss : 2.0470040449142455,
Training Accuracy : 0.22436, Testing Accuracy : 0.2339

   3%|▎         | 10/300 [08:47<4:12:31, 52.25s/it]

Training Loss : 1.9869314395141602, Testing Loss : 1.9861693307876587,
Training Accuracy : 0.25748, Testing Accuracy : 0.286

   4%|▎         | 11/300 [09:38<4:09:52, 51.88s/it]

Training Loss : 1.9153333166503905, Testing Loss : 1.9111702453613282,
Training Accuracy : 0.2915, Testing Accuracy : 0.293

   4%|▍         | 12/300 [10:30<4:09:55, 52.07s/it]

Training Loss : 1.8301637860107423, Testing Loss : 1.8105827753067016,
Training Accuracy : 0.32954, Testing Accuracy : 0.3355

   4%|▍         | 13/300 [11:23<4:10:15, 52.32s/it]
```

```
Training Loss : 1.9262871551513672, Testing Loss : 2.0820013282775878,
Training Accuracy : 0.2946, Testing Accuracy : 0.2522

   5%|▌         | 14/300 [12:14<4:07:43, 51.97s/it]

Training Loss : 1.8249395672607422, Testing Loss : 1.7500729038238525,
Training Accuracy : 0.33462, Testing Accuracy : 0.3584

   5%|▌         | 15/300 [13:06<4:07:13, 52.05s/it]

Training Loss : 1.7172845196533204, Testing Loss : 1.6869613286972045,
Training Accuracy : 0.37238, Testing Accuracy : 0.3838

   5%|▌         | 16/300 [13:58<4:06:05, 51.99s/it]

Training Loss : 1.6171406977844238, Testing Loss : 1.63085269241333,
Training Accuracy : 0.41228, Testing Accuracy : 0.4093

   6%|▌         | 17/300 [14:50<4:05:10, 51.98s/it]

Training Loss : 1.6081773406982423, Testing Loss : 1.6490357036590577,
Training Accuracy : 0.4124, Testing Accuracy : 0.3895

   6%|▌         | 18/300 [15:43<4:05:35, 52.25s/it]

Training Loss : 1.528115509338379, Testing Loss : 1.6355360820770264,
Training Accuracy : 0.44322, Testing Accuracy : 0.4114

   6%|▋         | 19/300 [16:36<4:05:05, 52.33s/it]

Training Loss : 1.52790111328125, Testing Loss : 1.592645585823059,
Training Accuracy : 0.44734, Testing Accuracy : 0.4079

   7%|▋         | 20/300 [17:27<4:03:06, 52.09s/it]

Training Loss : 1.4567992202758788, Testing Loss : 1.4529387903213502,
Training Accuracy : 0.47216, Testing Accuracy : 0.4817

   7%|▋         | 21/300 [18:19<4:02:29, 52.15s/it]

Training Loss : 1.3632754580688478, Testing Loss : 1.4219790185928345,
Training Accuracy : 0.50566, Testing Accuracy : 0.4714

   7%|▋         | 22/300 [19:12<4:01:45, 52.18s/it]

Training Loss : 1.33311150390625, Testing Loss : 1.3663141510009766,
Training Accuracy : 0.51778, Testing Accuracy : 0.5245

   8%|▊         | 23/300 [20:03<3:59:09, 51.80s/it]

Training Loss : 1.2716945362854004, Testing Loss : 1.3872776012420653,
Training Accuracy : 0.53774, Testing Accuracy : 0.5113

   8%|▊         | 24/300 [20:55<3:59:24, 52.05s/it]
```

```
Training Loss : 1.3157277365112305, Testing Loss : 1.5145623401641846,
Training Accuracy : 0.52526, Testing Accuracy : 0.4794

  8%|▊         | 25/300 [21:48<3:59:14, 52.20s/it]

Training Loss : 1.2927462673950196, Testing Loss : 1.4418871723175049,
Training Accuracy : 0.53424, Testing Accuracy : 0.4872

  9%|▊         | 26/300 [22:39<3:57:16, 51.96s/it]

Training Loss : 1.232786886291504, Testing Loss : 1.2121151950836182,
Training Accuracy : 0.55962, Testing Accuracy : 0.5734

  9%|▉         | 27/300 [23:32<3:57:08, 52.12s/it]

Training Loss : 1.1657681312561035, Testing Loss : 1.2306890056610107,
Training Accuracy : 0.57774, Testing Accuracy : 0.5551

  9%|▉         | 28/300 [24:24<3:56:50, 52.25s/it]

Training Loss : 1.136023704071045, Testing Loss : 1.2152677713394164,
Training Accuracy : 0.59078, Testing Accuracy : 0.5739

 10%|▉         | 29/300 [25:16<3:55:09, 52.06s/it]

Training Loss : 1.11293922164917, Testing Loss : 1.1332134756088257,
Training Accuracy : 0.60318, Testing Accuracy : 0.5964

 10%|█         | 30/300 [26:09<3:55:25, 52.32s/it]

Training Loss : 1.042664870300293, Testing Loss : 1.1570975610733032,
Training Accuracy : 0.62698, Testing Accuracy : 0.5981

 10%|█         | 31/300 [27:00<3:53:27, 52.07s/it]

Training Loss : 1.057642749938965, Testing Loss : 1.1831123032569886,
Training Accuracy : 0.62474, Testing Accuracy : 0.5834

 11%|█         | 32/300 [27:52<3:52:13, 51.99s/it]

Training Loss : 1.0929962100219726, Testing Loss : 1.2954337413787842,
Training Accuracy : 0.61168, Testing Accuracy : 0.5665

 11%|█         | 33/300 [28:45<3:52:37, 52.27s/it]

Training Loss : 1.0644264453125, Testing Loss : 1.1090251737594605,
Training Accuracy : 0.62326, Testing Accuracy : 0.6171

 11%|█▏        | 34/300 [29:37<3:51:47, 52.28s/it]

Training Loss : 0.9608574070739746, Testing Loss : 1.027026951599121,
Training Accuracy : 0.65876, Testing Accuracy : 0.6387

 12%|█▏        | 35/300 [30:29<3:49:47, 52.03s/it]
```

```
Training Loss : 0.9521490635681152, Testing Loss : 1.0161861503601075,
Training Accuracy : 0.66856, Testing Accuracy : 0.6494

 12%|█▏        | 36/300 [31:22<3:49:57, 52.27s/it]

Training Loss : 0.9237684713745117, Testing Loss : 0.9885845622062683,
Training Accuracy : 0.67818, Testing Accuracy : 0.6563

 12%|█▏        | 37/300 [32:15<3:50:00, 52.47s/it]

Training Loss : 0.8849657557678222, Testing Loss : 1.0059080806732177,
Training Accuracy : 0.69442, Testing Accuracy : 0.6584

 13%|█▎        | 38/300 [33:06<3:47:47, 52.17s/it]

Training Loss : 0.9006251690673828, Testing Loss : 1.0567565240859986,
Training Accuracy : 0.6847, Testing Accuracy : 0.6507

 13%|█▎        | 39/300 [33:58<3:47:05, 52.21s/it]

Training Loss : 0.8648384266662598, Testing Loss : 0.9309069948196411,
Training Accuracy : 0.69944, Testing Accuracy : 0.676

 13%|█▎        | 40/300 [34:51<3:47:16, 52.45s/it]

Training Loss : 0.8283550094604493, Testing Loss : 0.9778568189620972,
Training Accuracy : 0.7124, Testing Accuracy : 0.6723

 14%|█▎        | 41/300 [35:42<3:44:23, 51.98s/it]

Training Loss : 0.8136877059936524, Testing Loss : 0.9123391713142395,
Training Accuracy : 0.7171, Testing Accuracy : 0.6911

 14%|█▍        | 42/300 [36:34<3:43:38, 52.01s/it]

Training Loss : 0.7901667227172852, Testing Loss : 0.9456481977462768,
Training Accuracy : 0.72902, Testing Accuracy : 0.6794

 14%|█▍        | 43/300 [37:27<3:44:06, 52.32s/it]

Training Loss : 0.7864564428710937, Testing Loss : 0.8623360485076904,
Training Accuracy : 0.72858, Testing Accuracy : 0.7087

 15%|█▍        | 44/300 [38:19<3:42:02, 52.04s/it]

Training Loss : 0.7377571859741211, Testing Loss : 0.8763502285003663,
Training Accuracy : 0.74844, Testing Accuracy : 0.7082

 15%|█▌        | 45/300 [39:11<3:41:05, 52.02s/it]

Training Loss : 0.7591000415039062, Testing Loss : 0.891659614276886,
Training Accuracy : 0.73796, Testing Accuracy : 0.7019

 15%|█▌        | 46/300 [40:04<3:41:20, 52.28s/it]
```

```
Training Loss : 0.7577508746337891, Testing Loss : 0.9109302216529847,
Training Accuracy : 0.73886, Testing Accuracy : 0.7017

 16%|█▋        | 47/300 [40:55<3:39:05, 51.96s/it]

Training Loss : 0.7201833734130859, Testing Loss : 0.7841699857711792,
Training Accuracy : 0.75094, Testing Accuracy : 0.7298

 16%|█▋        | 48/300 [41:47<3:38:48, 52.10s/it]

Training Loss : 0.6817779058074951, Testing Loss : 0.7977500310897827,
Training Accuracy : 0.76844, Testing Accuracy : 0.7382

 16%|█▋        | 49/300 [42:40<3:38:59, 52.35s/it]

Training Loss : 0.6627466999053955, Testing Loss : 0.8881770483016967,
Training Accuracy : 0.7706, Testing Accuracy : 0.7062

 17%|█▋        | 50/300 [43:31<3:36:30, 51.96s/it]

Training Loss : 0.6565868521881103, Testing Loss : 0.7636564882278443,
Training Accuracy : 0.77342, Testing Accuracy : 0.7466

 17%|█▋        | 51/300 [44:23<3:35:37, 51.96s/it]

Training Loss : 0.6365746844482422, Testing Loss : 0.7550782583236695,
Training Accuracy : 0.78142, Testing Accuracy : 0.75

 17%|█▋        | 52/300 [45:16<3:36:10, 52.30s/it]

Training Loss : 0.6199806398010254, Testing Loss : 0.7776124447822571,
Training Accuracy : 0.78574, Testing Accuracy : 0.7404

 18%|█▊        | 53/300 [46:07<3:33:38, 51.90s/it]

Training Loss : 0.6265088467407226, Testing Loss : 0.7525361236572266,
Training Accuracy : 0.78488, Testing Accuracy : 0.7509

 18%|█▊        | 54/300 [46:59<3:32:48, 51.90s/it]

Training Loss : 0.6007805879211425, Testing Loss : 0.7035778009414673,
Training Accuracy : 0.7947, Testing Accuracy : 0.7606

 18%|█▊        | 55/300 [47:52<3:33:28, 52.28s/it]

Training Loss : 0.5766421165466309, Testing Loss : 0.7104990009784699,
Training Accuracy : 0.80384, Testing Accuracy : 0.7665

 19%|█▊        | 56/300 [48:43<3:30:50, 51.85s/it]

Training Loss : 0.587382260055542, Testing Loss : 0.759045260810852,
Training Accuracy : 0.79746, Testing Accuracy : 0.7457

 19%|█▉        | 57/300 [49:35<3:30:31, 51.98s/it]
```

```
Training Loss : 0.5693657843780517, Testing Loss : 0.659137753200531,
Training Accuracy : 0.8056, Testing Accuracy : 0.7853

 19%|█▉        | 58/300 [50:28<3:29:59, 52.06s/it]

Training Loss : 0.5359519850158692, Testing Loss : 0.6458829364299774,
Training Accuracy : 0.81474, Testing Accuracy : 0.7814

 20%|█▉        | 59/300 [51:19<3:28:22, 51.88s/it]

Training Loss : 0.5278092768859863, Testing Loss : 0.6936449554443359,
Training Accuracy : 0.8192, Testing Accuracy : 0.7723

 20%|██        | 60/300 [52:12<3:28:34, 52.14s/it]

Training Loss : 0.5443849993896485, Testing Loss : 0.7611982281684876,
Training Accuracy : 0.81266, Testing Accuracy : 0.7514

 20%|██        | 61/300 [53:04<3:27:09, 52.01s/it]

Training Loss : 0.5395208056640625, Testing Loss : 0.6712686748027802,
Training Accuracy : 0.81534, Testing Accuracy : 0.784

 21%|██        | 62/300 [53:55<3:25:24, 51.79s/it]

Training Loss : 0.5094904895019531, Testing Loss : 0.6548356217384338,
Training Accuracy : 0.82602, Testing Accuracy : 0.7809

 21%|██        | 63/300 [54:48<3:25:48, 52.10s/it]

Training Loss : 0.5230239221954346, Testing Loss : 0.7445484984397888,
Training Accuracy : 0.82, Testing Accuracy : 0.7684

 21%|██▏       | 64/300 [55:39<3:24:08, 51.90s/it]

Training Loss : 0.5506098834991455, Testing Loss : 0.6707405712127685,
Training Accuracy : 0.81362, Testing Accuracy : 0.7718

 22%|██▏       | 65/300 [56:31<3:22:47, 51.77s/it]

Training Loss : 0.4932825612640381, Testing Loss : 0.6355350370883942,
Training Accuracy : 0.8335, Testing Accuracy : 0.7967

 22%|██▏       | 66/300 [57:23<3:22:57, 52.04s/it]

Training Loss : 0.47257165710449217, Testing Loss :
0.6352918027877807, Training Accuracy : 0.83854, Testing Accuracy :
0.7918

 22%|██▏       | 67/300 [58:15<3:21:29, 51.89s/it]

Training Loss : 0.4737112617874146, Testing Loss : 0.6865278893947602,
Training Accuracy : 0.83896, Testing Accuracy : 0.7829

 23%|██▎       | 68/300 [59:06<3:20:23, 51.83s/it]
```

```
Training Loss : 0.4894220316696167, Testing Loss : 0.6561392995834351,
Training Accuracy : 0.8322, Testing Accuracy : 0.7949

  23%|██▎       | 69/300 [59:59<3:20:44, 52.14s/it]

Training Loss : 0.4578525908279419, Testing Loss : 0.5963338526725769,
Training Accuracy : 0.84452, Testing Accuracy : 0.8068

  23%|██▎       | 70/300 [1:00:51<3:18:50, 51.87s/it]

Training Loss : 0.4323540022277832, Testing Loss : 0.6229514634132385,
Training Accuracy : 0.85226, Testing Accuracy : 0.801

  24%|██▎       | 71/300 [1:01:42<3:18:03, 51.89s/it]

Training Loss : 0.4362680121231079, Testing Loss : 0.5865170797348023,
Training Accuracy : 0.8509, Testing Accuracy : 0.8091

  24%|██▍       | 72/300 [1:02:35<3:17:57, 52.09s/it]

Training Loss : 0.4174925082015991, Testing Loss : 0.6144611146450043,
Training Accuracy : 0.85618, Testing Accuracy : 0.8093

  24%|██▍       | 73/300 [1:03:26<3:15:46, 51.75s/it]

Training Loss : 0.41008814472198485, Testing Loss :
0.5644459607124329, Training Accuracy : 0.86052, Testing Accuracy :
0.822

  25%|██▍       | 74/300 [1:04:18<3:14:53, 51.74s/it]

Training Loss : 0.3804009250259399, Testing Loss : 0.5664148763179779,
Training Accuracy : 0.86956, Testing Accuracy : 0.8249

  25%|██▌       | 75/300 [1:05:11<3:15:20, 52.09s/it]

Training Loss : 0.3853142932510376, Testing Loss : 0.5919647830963135,
Training Accuracy : 0.86702, Testing Accuracy : 0.8054

  25%|██▌       | 76/300 [1:06:01<3:13:03, 51.71s/it]

Training Loss : 0.4011781410598755, Testing Loss : 0.5914278257846832,
Training Accuracy : 0.86262, Testing Accuracy : 0.8133

  26%|██▌       | 77/300 [1:06:53<3:12:20, 51.75s/it]

Training Loss : 0.37595720050811765, Testing Loss : 0.563031677722931,
Training Accuracy : 0.87336, Testing Accuracy : 0.8242

  26%|██▌       | 78/300 [1:07:46<3:12:00, 51.89s/it]

Training Loss : 0.349027751121521, Testing Loss : 0.5501432678699494,
Training Accuracy : 0.88072, Testing Accuracy : 0.8267

  26%|██▋       | 79/300 [1:08:36<3:10:01, 51.59s/it]
```

Training Loss : 0.34441721412658693, Testing Loss : 0.5636053917884827, Training Accuracy : 0.8822, Testing Accuracy : 0.8292

27%|███ | 80/300 [1:09:29<3:10:04, 51.84s/it]

Training Loss : 0.3369490478515625, Testing Loss : 0.5208243165016174, Training Accuracy : 0.88396, Testing Accuracy : 0.8374

27%|███ | 81/300 [1:10:21<3:09:32, 51.93s/it]

Training Loss : 0.33014562908172607, Testing Loss : 0.6036005543708801, Training Accuracy : 0.88652, Testing Accuracy : 0.8157

27%|███ | 82/300 [1:11:12<3:07:34, 51.63s/it]

Training Loss : 0.34403953968048095, Testing Loss : 0.5452320188045502, Training Accuracy : 0.88228, Testing Accuracy : 0.827

28%|███ | 83/300 [1:12:04<3:07:34, 51.87s/it]

Training Loss : 0.3323574193382263, Testing Loss : 0.5611922464370728, Training Accuracy : 0.88528, Testing Accuracy : 0.8278

28%|███ | 84/300 [1:12:57<3:07:05, 51.97s/it]

Training Loss : 0.3248664468383789, Testing Loss : 0.5716676003932953, Training Accuracy : 0.88986, Testing Accuracy : 0.8283

28%|███ | 85/300 [1:13:48<3:05:15, 51.70s/it]

Training Loss : 0.32087641273498535, Testing Loss : 0.5424906992912293, Training Accuracy : 0.88994, Testing Accuracy : 0.8316

29%|███ | 86/300 [1:14:40<3:05:28, 52.00s/it]

Training Loss : 0.30072694282531737, Testing Loss : 0.5483991892814636, Training Accuracy : 0.89702, Testing Accuracy : 0.8353

29%|███ | 87/300 [1:15:31<3:03:19, 51.64s/it]

Training Loss : 0.2851763526344299, Testing Loss : 0.5094790359973908, Training Accuracy : 0.89998, Testing Accuracy : 0.8412

29%|███ | 88/300 [1:16:22<3:02:11, 51.56s/it]

Training Loss : 0.2843474586677551, Testing Loss : 0.5401431439399719, Training Accuracy : 0.9019, Testing Accuracy : 0.8402

30%|███ | 89/300 [1:17:15<3:01:58, 51.75s/it]

```
Training Loss : 0.2835604640197754, Testing Loss : 0.5431049371719361,
Training Accuracy : 0.90136, Testing Accuracy : 0.8394

 30%|███       | 90/300 [1:18:06<3:00:34, 51.59s/it]

Training Loss : 0.2850117283630371, Testing Loss : 0.579753199005127,
Training Accuracy : 0.90186, Testing Accuracy : 0.8314

 30%|███       | 91/300 [1:18:58<3:00:03, 51.69s/it]

Training Loss : 0.2871037866973877, Testing Loss : 0.5911512453079224,
Training Accuracy : 0.90164, Testing Accuracy : 0.8284

 31%|███       | 92/300 [1:19:50<2:59:49, 51.87s/it]

Training Loss : 0.2875220613861084, Testing Loss : 0.601536489200592,
Training Accuracy : 0.90174, Testing Accuracy : 0.8253

 31%|███       | 93/300 [1:20:41<2:57:44, 51.52s/it]

Training Loss : 0.30138470623016356, Testing Loss : 0.636225426197052,
Training Accuracy : 0.896, Testing Accuracy : 0.8256

 31%|███       | 94/300 [1:21:33<2:57:24, 51.67s/it]

Training Loss : 0.2883908291625977, Testing Loss : 0.5372241239547729,
Training Accuracy : 0.90062, Testing Accuracy : 0.8411

 32%|███       | 95/300 [1:22:25<2:57:26, 51.94s/it]

Training Loss : 0.2587716493225098, Testing Loss : 0.5580817160606384,
Training Accuracy : 0.91212, Testing Accuracy : 0.8446

 32%|███       | 96/300 [1:23:16<2:55:34, 51.64s/it]

Training Loss : 0.25440756225585937, Testing Loss :
0.5494353984355926, Training Accuracy : 0.91144, Testing Accuracy :
0.8417

 32%|███       | 97/300 [1:24:08<2:54:56, 51.71s/it]

Training Loss : 0.2735079112815857, Testing Loss : 0.540552669620514,
Training Accuracy : 0.90566, Testing Accuracy : 0.8375

 33%|███       | 98/300 [1:25:01<2:54:46, 51.92s/it]

Training Loss : 0.23185433114051818, Testing Loss :
0.5348044953346253, Training Accuracy : 0.9204, Testing Accuracy :
0.8469

 33%|███       | 99/300 [1:25:52<2:53:30, 51.79s/it]

Training Loss : 0.2328632031059265, Testing Loss : 0.5672849143028259,
Training Accuracy : 0.91926, Testing Accuracy : 0.8385
```

```
 33%|███▎      | 100/300 [1:26:44<2:52:55, 51.88s/it]
Training Loss : 0.2526484450531006, Testing Loss : 0.5871208250999451, Training Accuracy : 0.91186, Testing Accuracy : 0.8374
 34%|███▎      | 101/300 [1:27:37<2:53:19, 52.26s/it]
Training Loss : 0.22616616680145263, Testing Loss : 0.5138769383430482, Training Accuracy : 0.92244, Testing Accuracy : 0.8541
 34%|███▍      | 102/300 [1:28:29<2:51:35, 52.00s/it]
Training Loss : 0.23120768642425538, Testing Loss : 0.5401109149932861, Training Accuracy : 0.92032, Testing Accuracy : 0.8421
 34%|███▍      | 103/300 [1:29:21<2:51:01, 52.09s/it]
Training Loss : 0.2437646175956726, Testing Loss : 0.5659031592369079, Training Accuracy : 0.91654, Testing Accuracy : 0.8363
 35%|███▍      | 104/300 [1:30:14<2:51:07, 52.38s/it]
Training Loss : 0.24725421661376953, Testing Loss : 0.589471946144104, Training Accuracy : 0.91388, Testing Accuracy : 0.8362
 35%|███▌      | 105/300 [1:31:05<2:49:04, 52.02s/it]
Training Loss : 0.2398864653778076, Testing Loss : 0.5533527708053589, Training Accuracy : 0.91562, Testing Accuracy : 0.8373
 35%|███▌      | 106/300 [1:31:58<2:48:31, 52.12s/it]
Training Loss : 0.21856676530838012, Testing Loss : 0.692152766418457, Training Accuracy : 0.9241, Testing Accuracy : 0.8304
 36%|███▌      | 107/300 [1:32:51<2:48:38, 52.43s/it]
Training Loss : 0.21859686161041259, Testing Loss : 0.5254175010204315, Training Accuracy : 0.92478, Testing Accuracy : 0.8486
 36%|███▌      | 108/300 [1:33:42<2:46:31, 52.04s/it]
Training Loss : 0.20928917362213134, Testing Loss : 0.5714577647686004, Training Accuracy : 0.92838, Testing Accuracy : 0.8506
 36%|███▋      | 109/300 [1:34:35<2:46:34, 52.33s/it]
Training Loss : 0.20854517773628234, Testing Loss : 0.583338268756866, Training Accuracy : 0.92776, Testing Accuracy : 0.8456
```

```
 37%|███▋      | 110/300 [1:35:28<2:46:45, 52.66s/it]

Training Loss : 0.21984257816314698, Testing Loss :
0.5406110382080078, Training Accuracy : 0.92476, Testing Accuracy :
0.8524

 37%|███▋      | 111/300 [1:36:20<2:44:36, 52.26s/it]

Training Loss : 0.19382905281066895, Testing Loss :
0.5180677987098694, Training Accuracy : 0.93342, Testing Accuracy :
0.8549

 37%|███▋      | 112/300 [1:37:12<2:44:11, 52.40s/it]

Training Loss : 0.1882871179008484, Testing Loss : 0.5639840201616287,
Training Accuracy : 0.93458, Testing Accuracy : 0.8547

 38%|███▊      | 113/300 [1:38:06<2:44:20, 52.73s/it]

Training Loss : 0.1876185226535797, Testing Loss : 0.5217254068374634,
Training Accuracy : 0.9344, Testing Accuracy : 0.8513

 38%|███▊      | 114/300 [1:38:58<2:42:41, 52.48s/it]

Training Loss : 0.18146647165298463, Testing Loss :
0.5738716035366058, Training Accuracy : 0.93646, Testing Accuracy :
0.8536

 38%|███▊      | 115/300 [1:39:51<2:42:05, 52.57s/it]

Training Loss : 0.18944423651695252, Testing Loss :
0.5826384021759033, Training Accuracy : 0.93488, Testing Accuracy :
0.8409

 39%|███▊      | 116/300 [1:40:44<2:41:57, 52.81s/it]

Training Loss : 0.18614550834655763, Testing Loss :
0.5536996793746948, Training Accuracy : 0.93576, Testing Accuracy :
0.8555

 39%|███▉      | 117/300 [1:41:37<2:40:53, 52.75s/it]

Training Loss : 0.18098264713287354, Testing Loss : 0.512828848361969,
Training Accuracy : 0.93602, Testing Accuracy : 0.8552

 39%|███▉      | 118/300 [1:42:29<2:39:58, 52.74s/it]

Training Loss : 0.16776131314277648, Testing Loss :
0.6037014668464661, Training Accuracy : 0.94176, Testing Accuracy :
0.8485

 40%|███▉      | 119/300 [1:43:23<2:39:35, 52.90s/it]
```

Training Loss : 0.17376325778961182, Testing Loss : 0.5609861413955688, Training Accuracy : 0.93968, Testing Accuracy : 0.8494

 40%|████ | 120/300 [1:44:16<2:39:24, 53.14s/it]

Training Loss : 0.17238184874534607, Testing Loss : 0.5903479648590088, Training Accuracy : 0.94136, Testing Accuracy : 0.8461

 40%|████ | 121/300 [1:45:08<2:37:24, 52.76s/it]

Training Loss : 0.16896113779067992, Testing Loss : 0.5446904422760009, Training Accuracy : 0.94134, Testing Accuracy : 0.8522

 41%|████ | 122/300 [1:46:01<2:36:44, 52.83s/it]

Training Loss : 0.1539027607345581, Testing Loss : 0.6049517831802368, Training Accuracy : 0.9473, Testing Accuracy : 0.8571

 41%|████ | 123/300 [1:46:54<2:36:20, 53.00s/it]

Training Loss : 0.16641296392440796, Testing Loss : 0.5778964750289917, Training Accuracy : 0.94262, Testing Accuracy : 0.8404

 41%|████▏ | 124/300 [1:47:46<2:34:06, 52.54s/it]

Training Loss : 0.16840840534210205, Testing Loss : 0.5604728754997254, Training Accuracy : 0.94162, Testing Accuracy : 0.8594

 42%|████▏ | 125/300 [1:48:38<2:32:50, 52.40s/it]

Training Loss : 0.1624196762561798, Testing Loss : 0.5563769657135009, Training Accuracy : 0.94428, Testing Accuracy : 0.8478

 42%|████▏ | 126/300 [1:49:31<2:32:50, 52.70s/it]

Training Loss : 0.1617839985895157, Testing Loss : 0.5596351661682128, Training Accuracy : 0.94422, Testing Accuracy : 0.8587

 42%|████▏ | 127/300 [1:50:23<2:31:04, 52.40s/it]

Training Loss : 0.15187181085586549, Testing Loss : 0.5566288110733032, Training Accuracy : 0.9473, Testing Accuracy : 0.8637

 43%|████▎ | 128/300 [1:51:15<2:30:11, 52.39s/it]

Training Loss : 0.14431127457618714, Testing Loss : 0.6017106413841248, Training Accuracy : 0.94934, Testing Accuracy : 0.8551

43%|████▎ | 129/300 [1:52:09<2:30:10, 52.69s/it]

Training Loss : 0.14357974033355714, Testing Loss : 0.5699993178367615, Training Accuracy : 0.94972, Testing Accuracy : 0.8578

43%|████▎ | 130/300 [1:53:01<2:28:24, 52.38s/it]

Training Loss : 0.14263066942214966, Testing Loss : 0.5930564723968506, Training Accuracy : 0.9496, Testing Accuracy : 0.8558

44%|████▎ | 131/300 [1:53:53<2:27:34, 52.39s/it]

Training Loss : 0.14190663360595704, Testing Loss : 0.5587100114822388, Training Accuracy : 0.95122, Testing Accuracy : 0.8599

44%|████▍ | 132/300 [1:54:47<2:27:41, 52.75s/it]

Training Loss : 0.13911599553108214, Testing Loss : 0.5922068553924561, Training Accuracy : 0.95096, Testing Accuracy : 0.855

44%|████▍ | 133/300 [1:55:38<2:25:48, 52.39s/it]

Training Loss : 0.12564142221450805, Testing Loss : 0.5780497374534607, Training Accuracy : 0.95592, Testing Accuracy : 0.8547

45%|████▍ | 134/300 [1:56:30<2:24:45, 52.32s/it]

Training Loss : 0.12648712993621827, Testing Loss : 0.5750483186721802, Training Accuracy : 0.95608, Testing Accuracy : 0.8649

45%|████▌ | 135/300 [1:57:23<2:24:14, 52.45s/it]

Training Loss : 0.12881634679794313, Testing Loss : 0.6006238375663757, Training Accuracy : 0.9546, Testing Accuracy : 0.8538

45%|████▌ | 136/300 [1:58:14<2:22:22, 52.09s/it]

Training Loss : 0.1261375835609436, Testing Loss : 0.574606997680664, Training Accuracy : 0.95532, Testing Accuracy : 0.861

46%|████▌ | 137/300 [1:59:06<2:21:10, 51.97s/it]

Training Loss : 0.12579451974391936, Testing Loss : 0.6344752332687378, Training Accuracy : 0.95742, Testing Accuracy : 0.849

46%|████▌ | 138/300 [1:59:59<2:21:02, 52.24s/it]

Training Loss : 0.1319206858253479, Testing Loss : 0.5916331315040588, Training Accuracy : 0.95446, Testing Accuracy : 0.86

46%|█████ | 139/300 [2:00:50<2:19:07, 51.85s/it]

Training Loss : 0.12608962620735167, Testing Loss : 0.558958251953125, Training Accuracy : 0.95642, Testing Accuracy : 0.8613

47%|█████ | 140/300 [2:01:42<2:18:12, 51.83s/it]

Training Loss : 0.12361469029903412, Testing Loss : 0.6307684017181396, Training Accuracy : 0.95686, Testing Accuracy : 0.8545

47%|█████ | 141/300 [2:02:35<2:18:19, 52.20s/it]

Training Loss : 0.10918408113479615, Testing Loss : 0.5861707778930664, Training Accuracy : 0.96248, Testing Accuracy : 0.8648

47%|█████ | 142/300 [2:03:25<2:16:24, 51.80s/it]

Training Loss : 0.1142870234632492, Testing Loss : 0.6060452823638915, Training Accuracy : 0.96056, Testing Accuracy : 0.8643

48%|█████ | 143/300 [2:04:17<2:15:34, 51.81s/it]

Training Loss : 0.11507271099090575, Testing Loss : 0.5751953134536744, Training Accuracy : 0.96076, Testing Accuracy : 0.8628

48%|█████ | 144/300 [2:05:10<2:15:28, 52.10s/it]

Training Loss : 0.107763492269516, Testing Loss : 0.5934710927963257, Training Accuracy : 0.96242, Testing Accuracy : 0.8631

48%|█████ | 145/300 [2:06:01<2:13:42, 51.76s/it]

Training Loss : 0.11138463694095611, Testing Loss : 0.5838894707679748, Training Accuracy : 0.96136, Testing Accuracy : 0.8692

49%|█████ | 146/300 [2:06:53<2:13:15, 51.92s/it]

Training Loss : 0.10352464534759521, Testing Loss : 0.5614982483863831, Training Accuracy : 0.96466, Testing Accuracy : 0.8707

49%|█████ | 147/300 [2:07:46<2:12:57, 52.14s/it]

Training Loss : 0.09869278703212737, Testing Loss : 0.5572640455245972, Training Accuracy : 0.9651, Testing Accuracy : 0.8671

```
 49%|█████     | 148/300 [2:08:37<2:11:12, 51.79s/it]

Training Loss : 0.10132307035446167, Testing Loss :
0.5897233761787415, Training Accuracy : 0.965, Testing Accuracy :
0.8664

 50%|█████     | 149/300 [2:09:29<2:10:37, 51.90s/it]

Training Loss : 0.09371348640441894, Testing Loss :
0.6302735767364502, Training Accuracy : 0.96802, Testing Accuracy :
0.8623

 50%|█████     | 150/300 [2:10:22<2:10:21, 52.14s/it]

Training Loss : 0.10010125300884247, Testing Loss :
0.6177718538284301, Training Accuracy : 0.96496, Testing Accuracy :
0.8617

 50%|█████     | 151/300 [2:11:13<2:08:48, 51.87s/it]

Training Loss : 0.10826071318387985, Testing Loss :
0.5638251735687256, Training Accuracy : 0.9621, Testing Accuracy :
0.8664

 51%|█████     | 152/300 [2:12:05<2:08:12, 51.97s/it]

Training Loss : 0.08431002297878265, Testing Loss :
0.6112293913841248, Training Accuracy : 0.97154, Testing Accuracy :
0.8635

 51%|█████     | 153/300 [2:12:58<2:08:07, 52.30s/it]

Training Loss : 0.07789672491312027, Testing Loss :
0.5917482492923737, Training Accuracy : 0.9725, Testing Accuracy :
0.8709

 51%|█████▏    | 154/300 [2:13:49<2:06:22, 51.93s/it]

Training Loss : 0.10109767451047898, Testing Loss :
0.6030457710266113, Training Accuracy : 0.96542, Testing Accuracy :
0.8636

 52%|█████▏    | 155/300 [2:14:42<2:05:40, 52.00s/it]

Training Loss : 0.08607132721424103, Testing Loss :
0.6090799443244934, Training Accuracy : 0.97002, Testing Accuracy :
0.8737

 52%|█████▏    | 156/300 [2:15:35<2:05:30, 52.30s/it]

Training Loss : 0.07925624742746352, Testing Loss :
0.6062487672805786, Training Accuracy : 0.97292, Testing Accuracy :
0.8716
```

52%|█████ | 157/300 [2:16:25<2:03:35, 51.85s/it]

Training Loss : 0.08465871408462525, Testing Loss : 0.6459182134628296, Training Accuracy : 0.97064, Testing Accuracy : 0.8682

53%|█████ | 158/300 [2:17:17<2:02:49, 51.90s/it]

Training Loss : 0.09771982926368714, Testing Loss : 0.5949342430114746, Training Accuracy : 0.96552, Testing Accuracy : 0.8685

53%|█████ | 159/300 [2:18:10<2:02:32, 52.14s/it]

Training Loss : 0.07904638628721238, Testing Loss : 0.6409567833900451, Training Accuracy : 0.97226, Testing Accuracy : 0.874

53%|█████ | 160/300 [2:19:01<2:00:47, 51.77s/it]

Training Loss : 0.07549523300766944, Testing Loss : 0.6074151815414429, Training Accuracy : 0.973, Testing Accuracy : 0.8707

54%|█████ | 161/300 [2:19:53<2:00:06, 51.84s/it]

Training Loss : 0.07915815630674362, Testing Loss : 0.6326002497673034, Training Accuracy : 0.97218, Testing Accuracy : 0.8675

54%|█████ | 162/300 [2:20:46<1:59:57, 52.15s/it]

Training Loss : 0.07494537738800049, Testing Loss : 0.6129924454689026, Training Accuracy : 0.97386, Testing Accuracy : 0.8692

54%|█████ | 163/300 [2:21:37<1:58:18, 51.82s/it]

Training Loss : 0.06975800793409348, Testing Loss : 0.6089213893890381, Training Accuracy : 0.976, Testing Accuracy : 0.8722

55%|█████ | 164/300 [2:22:29<1:57:35, 51.88s/it]

Training Loss : 0.06550236459255218, Testing Loss : 0.6265114585876465, Training Accuracy : 0.97718, Testing Accuracy : 0.8672

55%|█████ | 165/300 [2:23:22<1:57:14, 52.11s/it]

Training Loss : 0.06991851338148117, Testing Loss : 0.628180699634552, Training Accuracy : 0.97562, Testing Accuracy : 0.8693

55%|█████ | 166/300 [2:24:13<1:55:45, 51.83s/it]

Training Loss : 0.07077370747208596, Testing Loss : 0.6463189311981201, Training Accuracy : 0.97588, Testing Accuracy : 0.8695

56%|█████▌ | 167/300 [2:25:05<1:55:10, 51.96s/it]

Training Loss : 0.06421514497995377, Testing Loss : 0.6253858131408692, Training Accuracy : 0.97782, Testing Accuracy : 0.8754

56%|█████▌ | 168/300 [2:25:58<1:54:56, 52.24s/it]

Training Loss : 0.06632142170906066, Testing Loss : 0.60419365234375, Training Accuracy : 0.97704, Testing Accuracy : 0.8756

56%|█████▋ | 169/300 [2:26:49<1:53:15, 51.87s/it]

Training Loss : 0.06267905386924744, Testing Loss : 0.649147013092041, Training Accuracy : 0.97842, Testing Accuracy : 0.8748

57%|█████▋ | 170/300 [2:27:41<1:52:27, 51.90s/it]

Training Loss : 0.06371009481668473, Testing Loss : 0.6219107078552246, Training Accuracy : 0.97774, Testing Accuracy : 0.8713

57%|█████▋ | 171/300 [2:28:34<1:52:15, 52.21s/it]

Training Loss : 0.05885166430711746, Testing Loss : 0.6705063897132874, Training Accuracy : 0.97896, Testing Accuracy : 0.8681

57%|█████▋ | 172/300 [2:29:25<1:50:42, 51.89s/it]

Training Loss : 0.06443827414989471, Testing Loss : 0.6577882075309753, Training Accuracy : 0.97648, Testing Accuracy : 0.868

58%|█████▊ | 173/300 [2:30:17<1:50:06, 52.02s/it]

Training Loss : 0.0640354140150547, Testing Loss : 0.6234865599632263, Training Accuracy : 0.97764, Testing Accuracy : 0.8706

58%|█████▊ | 174/300 [2:31:10<1:49:49, 52.30s/it]

Training Loss : 0.05829583642721176, Testing Loss : 0.6338475745201111, Training Accuracy : 0.97964, Testing Accuracy : 0.8753

58%|█████▊ | 175/300 [2:32:02<1:48:24, 52.04s/it]

Training Loss : 0.06160616136550903, Testing Loss : 0.6280385521888733, Training Accuracy : 0.9776, Testing Accuracy : 0.8682

```
 59%|█████▊    | 176/300 [2:32:54<1:47:38, 52.08s/it]
```

Training Loss : 0.05467930398106575, Testing Loss : 0.6350761742591858, Training Accuracy : 0.98102, Testing Accuracy : 0.8739

```
 59%|█████▉    | 177/300 [2:33:47<1:47:11, 52.29s/it]
```

Training Loss : 0.05145837776660919, Testing Loss : 0.6627634335517884, Training Accuracy : 0.98198, Testing Accuracy : 0.875

```
 59%|█████▉    | 178/300 [2:34:38<1:45:31, 51.90s/it]
```

Training Loss : 0.05287923489928246, Testing Loss : 0.6611979186058045, Training Accuracy : 0.98164, Testing Accuracy : 0.8748

```
 60%|█████▉    | 179/300 [2:35:30<1:45:13, 52.18s/it]
```

Training Loss : 0.05342379153519869, Testing Loss : 0.6329100849151611, Training Accuracy : 0.98166, Testing Accuracy : 0.8743

```
 60%|██████    | 180/300 [2:36:24<1:44:56, 52.47s/it]
```

Training Loss : 0.05090056898236275, Testing Loss : 0.6667562163352966, Training Accuracy : 0.98202, Testing Accuracy : 0.8696

```
 60%|██████    | 181/300 [2:37:15<1:43:10, 52.02s/it]
```

Training Loss : 0.051905669338107106, Testing Loss : 0.6656756024360657, Training Accuracy : 0.98168, Testing Accuracy : 0.8732

```
 61%|██████    | 182/300 [2:38:07<1:42:17, 52.01s/it]
```

Training Loss : 0.05019324003815651, Testing Loss : 0.685235712814331, Training Accuracy : 0.9823, Testing Accuracy : 0.8677

```
 61%|██████    | 183/300 [2:38:59<1:41:54, 52.26s/it]
```

Training Loss : 0.0571420390278101, Testing Loss : 0.653733060836792, Training Accuracy : 0.98018, Testing Accuracy : 0.8741

```
 61%|██████▏   | 184/300 [2:39:50<1:40:19, 51.89s/it]
```

Training Loss : 0.049421148785352705, Testing Loss : 0.655431667137146, Training Accuracy : 0.98302, Testing Accuracy : 0.8737

```
 62%|██████▏   | 185/300 [2:40:43<1:39:33, 51.94s/it]
```

Training Loss : 0.042849149415194986, Testing Loss : 0.6652771020889282, Training Accuracy : 0.98476, Testing Accuracy : 0.8744

62%|██████ | 186/300 [2:41:36<1:39:19, 52.27s/it]

Training Loss : 0.04491772298574448, Testing Loss : 0.6848660310745239, Training Accuracy : 0.98422, Testing Accuracy : 0.8752

62%|██████ | 187/300 [2:42:26<1:37:39, 51.86s/it]

Training Loss : 0.04385238950610161, Testing Loss : 0.6794561210632324, Training Accuracy : 0.98454, Testing Accuracy : 0.8746

63%|██████ | 188/300 [2:43:18<1:36:53, 51.90s/it]

Training Loss : 0.047449840700626376, Testing Loss : 0.7011432281494141, Training Accuracy : 0.98324, Testing Accuracy : 0.8705

63%|██████ | 189/300 [2:44:11<1:36:33, 52.19s/it]

Training Loss : 0.04944104434072971, Testing Loss : 0.6696707578659058, Training Accuracy : 0.9832, Testing Accuracy : 0.8749

63%|██████ | 190/300 [2:45:02<1:35:02, 51.84s/it]

Training Loss : 0.044178419570922854, Testing Loss : 0.7269919797897338, Training Accuracy : 0.98474, Testing Accuracy : 0.872

64%|██████ | 191/300 [2:45:54<1:34:20, 51.93s/it]

Training Loss : 0.047179054094552995, Testing Loss : 0.7222236730575562, Training Accuracy : 0.98326, Testing Accuracy : 0.8719

64%|██████ | 192/300 [2:46:47<1:33:48, 52.12s/it]

Training Loss : 0.0443688343167305, Testing Loss : 0.7356487941741944, Training Accuracy : 0.9842, Testing Accuracy : 0.8755

64%|██████ | 193/300 [2:47:39<1:32:35, 51.92s/it]

Training Loss : 0.0528954667955637, Testing Loss : 0.7378423698425293, Training Accuracy : 0.98172, Testing Accuracy : 0.8663

65%|██████ | 194/300 [2:48:30<1:31:39, 51.88s/it]

```
Training Loss : 0.03986799161195755, Testing Loss :
0.7161584280014038, Training Accuracy : 0.98602, Testing Accuracy :
0.8758

 65%|██████▌   | 195/300 [2:49:23<1:31:06, 52.06s/it]

Training Loss : 0.0420259269875288, Testing Loss : 0.7135645198822022,
Training Accuracy : 0.98538, Testing Accuracy : 0.8748

 65%|██████▌   | 196/300 [2:50:14<1:29:52, 51.85s/it]

Training Loss : 0.038424045314639804, Testing Loss :
0.6853675679206848, Training Accuracy : 0.98666, Testing Accuracy :
0.8772

 66%|██████▌   | 197/300 [2:51:06<1:29:12, 51.97s/it]

Training Loss : 0.03760682475686073, Testing Loss :
0.7532443089485168, Training Accuracy : 0.98664, Testing Accuracy :
0.8677

 66%|██████▌   | 198/300 [2:51:59<1:28:53, 52.29s/it]

Training Loss : 0.0395852017223835, Testing Loss : 0.7049818967819214,
Training Accuracy : 0.98572, Testing Accuracy : 0.8771

 66%|██████▋   | 199/300 [2:52:51<1:27:32, 52.00s/it]

Training Loss : 0.04008640159904957, Testing Loss :
0.7051455086708068, Training Accuracy : 0.98644, Testing Accuracy :
0.8699

 67%|██████▋   | 200/300 [2:53:43<1:26:42, 52.03s/it]

Training Loss : 0.033828975198864936, Testing Loss :
0.6938845534324646, Training Accuracy : 0.98754, Testing Accuracy :
0.8782

 67%|██████▋   | 201/300 [2:54:36<1:26:21, 52.34s/it]

Training Loss : 0.03250938378214836, Testing Loss : 0.730461307811737,
Training Accuracy : 0.98866, Testing Accuracy : 0.8753

 67%|██████▋   | 202/300 [2:55:27<1:25:00, 52.04s/it]

Training Loss : 0.029167825464010238, Testing Loss :
0.7138412463188172, Training Accuracy : 0.98974, Testing Accuracy :
0.8788

 68%|██████▊   | 203/300 [2:56:20<1:24:17, 52.14s/it]

Training Loss : 0.031104644525051118, Testing Loss :
0.7157204369544983, Training Accuracy : 0.98894, Testing Accuracy :
0.8764
```

```
 68%|██████▊   | 204/300 [2:57:12<1:23:37, 52.26s/it]
```

Training Loss : 0.03316787770330906, Testing Loss : 0.7191218257904053, Training Accuracy : 0.98888, Testing Accuracy : 0.8766

```
 68%|██████▊   | 205/300 [2:58:03<1:22:16, 51.96s/it]
```

Training Loss : 0.0349178140771389, Testing Loss : 0.7263180925369263, Training Accuracy : 0.98786, Testing Accuracy : 0.8776

```
 69%|██████▊   | 206/300 [2:58:56<1:21:35, 52.08s/it]
```

Training Loss : 0.031429592923521994, Testing Loss : 0.7477172857284546, Training Accuracy : 0.9892, Testing Accuracy : 0.8799

```
 69%|██████▉   | 207/300 [2:59:48<1:21:00, 52.26s/it]
```

Training Loss : 0.03134023392811418, Testing Loss : 0.7391402791023255, Training Accuracy : 0.98908, Testing Accuracy : 0.877

```
 69%|██████▉   | 208/300 [3:00:40<1:19:39, 51.96s/it]
```

Training Loss : 0.029859424485862256, Testing Loss : 0.712691683959961, Training Accuracy : 0.98926, Testing Accuracy : 0.8792

```
 70%|██████▉   | 209/300 [3:01:32<1:18:51, 51.99s/it]
```

Training Loss : 0.0268630252841115, Testing Loss : 0.7470646571159363, Training Accuracy : 0.99052, Testing Accuracy : 0.8782

```
 70%|███████   | 210/300 [3:02:24<1:18:14, 52.17s/it]
```

Training Loss : 0.028725958064645528, Testing Loss : 0.7873275106430053, Training Accuracy : 0.9898, Testing Accuracy : 0.8759

```
 70%|███████   | 211/300 [3:03:15<1:16:55, 51.86s/it]
```

Training Loss : 0.034296698736846445, Testing Loss : 0.7677405892372131, Training Accuracy : 0.9883, Testing Accuracy : 0.8762

```
 71%|███████   | 212/300 [3:04:07<1:15:58, 51.80s/it]
```

Training Loss : 0.03535194280147552, Testing Loss : 0.7589779567718505, Training Accuracy : 0.98804, Testing Accuracy : 0.8753

```
 71%|███████   | 213/300 [3:05:00<1:15:41, 52.21s/it]
```

Training Loss : 0.034865008527189496, Testing Loss : 0.7606113863945008, Training Accuracy : 0.98802, Testing Accuracy : 0.8762

 71%|███████ | 214/300 [3:05:51<1:14:16, 51.82s/it]

Training Loss : 0.03600393573671579, Testing Loss : 0.7616212182998657, Training Accuracy : 0.98802, Testing Accuracy : 0.8716

 72%|███████ | 215/300 [3:06:43<1:13:29, 51.88s/it]

Training Loss : 0.03605095877975226, Testing Loss : 0.7176295543670654, Training Accuracy : 0.98778, Testing Accuracy : 0.8793

 72%|███████ | 216/300 [3:07:36<1:13:04, 52.20s/it]

Training Loss : 0.0239759802415967, Testing Loss : 0.7332359972000122, Training Accuracy : 0.99142, Testing Accuracy : 0.8794

 72%|███████ | 217/300 [3:08:27<1:11:39, 51.80s/it]

Training Loss : 0.022107418799996375, Testing Loss : 0.7464724349975586, Training Accuracy : 0.99246, Testing Accuracy : 0.8792

 73%|███████▎ | 218/300 [3:09:19<1:10:53, 51.87s/it]

Training Loss : 0.02151952967658639, Testing Loss : 0.7473578161239623, Training Accuracy : 0.99272, Testing Accuracy : 0.8787

 73%|███████▎ | 219/300 [3:10:12<1:10:22, 52.14s/it]

Training Loss : 0.022742123879641293, Testing Loss : 0.7640550799369812, Training Accuracy : 0.9926, Testing Accuracy : 0.8768

 73%|███████▎ | 220/300 [3:11:02<1:08:53, 51.67s/it]

Training Loss : 0.024411502785384655, Testing Loss : 0.7811133924484253, Training Accuracy : 0.99164, Testing Accuracy : 0.8781

 74%|███████▎ | 221/300 [3:11:54<1:08:04, 51.70s/it]

Training Loss : 0.026201257817298172, Testing Loss : 0.7702698843955994, Training Accuracy : 0.99098, Testing Accuracy : 0.8783

 74%|███████▍ | 222/300 [3:12:47<1:07:42, 52.09s/it]

Training Loss : 0.0267057549148798, Testing Loss : 0.7779468762397767, Training Accuracy : 0.9909, Testing Accuracy : 0.8777

 74%|███████▍ | 223/300 [3:13:39<1:06:33, 51.86s/it]

Training Loss : 0.025498200244903565, Testing Loss : 0.7653964526176452, Training Accuracy : 0.99128, Testing Accuracy : 0.881

 75%|███████▍ | 224/300 [3:14:31<1:05:45, 51.91s/it]

Training Loss : 0.02061262527137995, Testing Loss : 0.7508659404754638, Training Accuracy : 0.99254, Testing Accuracy : 0.8815

 75%|███████▌ | 225/300 [3:15:23<1:05:12, 52.16s/it]

Training Loss : 0.016797150930166243, Testing Loss : 0.7655153771400451, Training Accuracy : 0.99434, Testing Accuracy : 0.8815

 75%|███████▌ | 226/300 [3:16:14<1:03:52, 51.79s/it]

Training Loss : 0.018152305433377623, Testing Loss : 0.765030916595459, Training Accuracy : 0.99386, Testing Accuracy : 0.8812

 76%|███████▌ | 227/300 [3:17:06<1:03:02, 51.81s/it]

Training Loss : 0.01842097374394536, Testing Loss : 0.7536210766792297, Training Accuracy : 0.99338, Testing Accuracy : 0.8852

 76%|███████▌ | 228/300 [3:17:59<1:02:38, 52.21s/it]

Training Loss : 0.01587532094091177, Testing Loss : 0.7868806867599487, Training Accuracy : 0.99458, Testing Accuracy : 0.8818

 76%|███████▋ | 229/300 [3:18:50<1:01:21, 51.85s/it]

Training Loss : 0.02145131536398083, Testing Loss : 0.7925632385253907, Training Accuracy : 0.99238, Testing Accuracy : 0.8835

 77%|███████▋ | 230/300 [3:19:42<1:00:28, 51.84s/it]

Training Loss : 0.019161092701628805, Testing Loss : 0.7769012607574463, Training Accuracy : 0.9934, Testing Accuracy : 0.8831

 77%|███████▋ | 231/300 [3:20:34<59:45, 51.96s/it]

Training Loss : 0.02033279118269682, Testing Loss : 0.7773231451988221, Training Accuracy : 0.99268, Testing Accuracy : 0.8826

77%|████████ | 232/300 [3:21:25<58:33, 51.67s/it]

Training Loss : 0.01831854030199349, Testing Loss : 0.7793129426002502, Training Accuracy : 0.99362, Testing Accuracy : 0.8842

78%|████████ | 233/300 [3:22:17<57:47, 51.76s/it]

Training Loss : 0.019014529902413486, Testing Loss : 0.8004609683990479, Training Accuracy : 0.99384, Testing Accuracy : 0.8785

78%|████████ | 234/300 [3:23:10<57:19, 52.12s/it]

Training Loss : 0.0158665920009464, Testing Loss : 0.7770032363891601, Training Accuracy : 0.99432, Testing Accuracy : 0.888

78%|████████ | 235/300 [3:24:01<56:08, 51.82s/it]

Training Loss : 0.01733388917706907, Testing Loss : 0.779469692325592, Training Accuracy : 0.99396, Testing Accuracy : 0.8826

79%|████████ | 236/300 [3:24:53<55:18, 51.85s/it]

Training Loss : 0.01468392806239426, Testing Loss : 0.7729184797286988, Training Accuracy : 0.99468, Testing Accuracy : 0.8855

79%|████████ | 237/300 [3:25:46<54:41, 52.09s/it]

Training Loss : 0.013908502008616925, Testing Loss : 0.7948956786155701, Training Accuracy : 0.99514, Testing Accuracy : 0.8834

79%|████████ | 238/300 [3:26:37<53:28, 51.75s/it]

Training Loss : 0.014155465169213712, Testing Loss : 0.7943058109283447, Training Accuracy : 0.99506, Testing Accuracy : 0.8868

80%|████████ | 239/300 [3:27:29<52:42, 51.84s/it]

Training Loss : 0.015096806229911745, Testing Loss : 0.8212623955726623, Training Accuracy : 0.99498, Testing Accuracy : 0.8817

80%|████████ | 240/300 [3:28:22<52:04, 52.08s/it]

Training Loss : 0.013866770012266934, Testing Loss : 0.8235222257614135, Training Accuracy : 0.9953, Testing Accuracy : 0.8853

80%|████████ | 241/300 [3:29:12<50:49, 51.69s/it]

Training Loss : 0.014304411149136722, Testing Loss : 0.823302685546875, Training Accuracy : 0.99514, Testing Accuracy : 0.8837

81%|████████ | 242/300 [3:30:05<50:06, 51.84s/it]

Training Loss : 0.015398654965683817, Testing Loss : 0.798673828125, Training Accuracy : 0.99466, Testing Accuracy : 0.8879

81%|████████ | 243/300 [3:30:57<49:33, 52.17s/it]

Training Loss : 0.01591304068312049, Testing Loss : 0.8006442361831665, Training Accuracy : 0.99488, Testing Accuracy : 0.8838

81%|████████ | 244/300 [3:31:48<48:18, 51.76s/it]

Training Loss : 0.01276129544440657, Testing Loss : 0.7833927849769592, Training Accuracy : 0.99548, Testing Accuracy : 0.8879

82%|████████ | 245/300 [3:32:40<47:30, 51.83s/it]

Training Loss : 0.01191275746628642, Testing Loss : 0.8006816053390503, Training Accuracy : 0.99622, Testing Accuracy : 0.8886

82%|████████ | 246/300 [3:33:33<46:56, 52.16s/it]

Training Loss : 0.011358882961682975, Testing Loss : 0.8023129251480102, Training Accuracy : 0.9964, Testing Accuracy : 0.8888

82%|████████ | 247/300 [3:34:24<45:48, 51.86s/it]

Training Loss : 0.0104549250651896, Testing Loss : 0.834464518547058, Training Accuracy : 0.99644, Testing Accuracy : 0.8862

83%|████████ | 248/300 [3:35:17<45:01, 51.96s/it]

Training Loss : 0.010992768092378974, Testing Loss : 0.8672608684539795, Training Accuracy : 0.99604, Testing Accuracy : 0.8822

83%|████████ | 249/300 [3:36:09<44:20, 52.17s/it]

Training Loss : 0.011550591504871845, Testing Loss : 0.8466899496078492, Training Accuracy : 0.99598, Testing Accuracy : 0.8861

 83%|████████▎ | 250/300 [3:37:00<43:14, 51.90s/it]

Training Loss : 0.011340776443332434, Testing Loss : 0.8670093662261963, Training Accuracy : 0.99618, Testing Accuracy : 0.8854

 84%|████████▎ | 251/300 [3:37:52<42:22, 51.89s/it]

Training Loss : 0.0107897319842875, Testing Loss : 0.8447039360046387, Training Accuracy : 0.99634, Testing Accuracy : 0.8851

 84%|████████▍ | 252/300 [3:38:45<41:46, 52.21s/it]

Training Loss : 0.010565223276456818, Testing Loss : 0.855868695640564, Training Accuracy : 0.9964, Testing Accuracy : 0.8858

 84%|████████▍ | 253/300 [3:39:36<40:37, 51.85s/it]

Training Loss : 0.01103686951007694, Testing Loss : 0.8504337085723876, Training Accuracy : 0.9961, Testing Accuracy : 0.8861

 85%|████████▍ | 254/300 [3:40:29<39:50, 51.96s/it]

Training Loss : 0.010209197846725583, Testing Loss : 0.8970762287139893, Training Accuracy : 0.99636, Testing Accuracy : 0.8815

 85%|████████▌ | 255/300 [3:41:21<39:08, 52.18s/it]

Training Loss : 0.012221574539802969, Testing Loss : 0.8682160266876221, Training Accuracy : 0.99604, Testing Accuracy : 0.8864

 85%|████████▌ | 256/300 [3:42:12<37:57, 51.75s/it]

Training Loss : 0.010790620609782637, Testing Loss : 0.8654081604957581, Training Accuracy : 0.99622, Testing Accuracy : 0.8857

 86%|████████▌ | 257/300 [3:43:04<37:11, 51.89s/it]

Training Loss : 0.010779168216213584, Testing Loss : 0.851545000076294, Training Accuracy : 0.99634, Testing Accuracy : 0.8856

 86%|████████▌ | 258/300 [3:43:56<36:24, 52.00s/it]

Training Loss : 0.01057048813218251, Testing Loss : 0.8586524713516235, Training Accuracy : 0.99668, Testing Accuracy : 0.8844

 86%|████████▋ | 259/300 [3:44:48<35:26, 51.86s/it]

Training Loss : 0.010482511861287057, Testing Loss : 0.8449428142547607, Training Accuracy : 0.99676, Testing Accuracy : 0.8874

 87%|████████▋ | 260/300 [3:45:40<34:36, 51.90s/it]

Training Loss : 0.010350564597919583, Testing Loss : 0.8550822776794433, Training Accuracy : 0.99622, Testing Accuracy : 0.8854

 87%|████████▋ | 261/300 [3:46:33<33:53, 52.13s/it]

Training Loss : 0.009805285349190234, Testing Loss : 0.8520333299636841, Training Accuracy : 0.99654, Testing Accuracy : 0.8865

 87%|████████▋ | 262/300 [3:47:24<32:48, 51.80s/it]

Training Loss : 0.010158227705983446, Testing Loss : 0.8643546884536744, Training Accuracy : 0.99652, Testing Accuracy : 0.8842

 88%|████████▊ | 263/300 [3:48:16<32:01, 51.92s/it]

Training Loss : 0.008970661861896516, Testing Loss : 0.8556840110778808, Training Accuracy : 0.99698, Testing Accuracy : 0.8869

 88%|████████▊ | 264/300 [3:49:08<31:11, 51.98s/it]

Training Loss : 0.008078356338851154, Testing Loss : 0.868414015865326, Training Accuracy : 0.9974, Testing Accuracy : 0.8885

 88%|████████▊ | 265/300 [3:49:59<30:12, 51.79s/it]

Training Loss : 0.007971895137373357, Testing Loss : 0.8681308776855469, Training Accuracy : 0.99734, Testing Accuracy : 0.887

 89%|████████▊ | 266/300 [3:50:52<29:28, 52.01s/it]

Training Loss : 0.007791351436451075, Testing Loss : 0.8751647758483887, Training Accuracy : 0.99762, Testing Accuracy : 0.8893

 89%|████████▉ | 267/300 [3:51:44<28:41, 52.17s/it]

Training Loss : 0.009018657623576001, Testing Loss : 0.8872130447387695, Training Accuracy : 0.99714, Testing Accuracy : 0.8861

89%|█████████ | 268/300 [3:52:36<27:44, 52.02s/it]

Training Loss : 0.009210666686776094, Testing Loss : 0.9022297637939453, Training Accuracy : 0.99696, Testing Accuracy : 0.8866

90%|█████████ | 269/300 [3:53:29<26:58, 52.20s/it]

Training Loss : 0.009750908488444983, Testing Loss : 0.8846454938888549, Training Accuracy : 0.99672, Testing Accuracy : 0.887

90%|█████████ | 270/300 [3:54:22<26:12, 52.42s/it]

Training Loss : 0.0078494864362292, Testing Loss : 0.876147622680664, Training Accuracy : 0.99746, Testing Accuracy : 0.8883

90%|█████████ | 271/300 [3:55:13<25:09, 52.05s/it]

Training Loss : 0.007955347144138068, Testing Loss : 0.8848788534164429, Training Accuracy : 0.99708, Testing Accuracy : 0.8892

91%|█████████ | 272/300 [3:56:05<24:18, 52.10s/it]

Training Loss : 0.007896343574058265, Testing Loss : 0.9116338068008423, Training Accuracy : 0.9973, Testing Accuracy : 0.8811

91%|█████████ | 273/300 [3:56:58<23:31, 52.29s/it]

Training Loss : 0.009308834999911487, Testing Loss : 0.8834853620529175, Training Accuracy : 0.99676, Testing Accuracy : 0.8909

91%|█████████ | 274/300 [3:57:49<22:28, 51.86s/it]

Training Loss : 0.008391114496495575, Testing Loss : 0.9008206239700317, Training Accuracy : 0.99714, Testing Accuracy : 0.8869

92%|█████████ | 275/300 [3:58:40<21:36, 51.86s/it]

Training Loss : 0.007085704342015087, Testing Loss : 0.9015876728057861, Training Accuracy : 0.99758, Testing Accuracy : 0.8891

92%|█████████ | 276/300 [3:59:34<20:56, 52.34s/it]

Training Loss : 0.007232312730103731, Testing Loss : 0.8963164458274842, Training Accuracy : 0.99754, Testing Accuracy : 0.8856

 92%|█████████▏| 277/300 [4:00:25<19:53, 51.88s/it]

Training Loss : 0.007703077649897896, Testing Loss : 0.8744419931411743, Training Accuracy : 0.99732, Testing Accuracy : 0.8919

 93%|█████████▎| 278/300 [4:01:17<19:02, 51.91s/it]

Training Loss : 0.00674407497539185, Testing Loss : 0.8983216360092163, Training Accuracy : 0.9978, Testing Accuracy : 0.8865

 93%|█████████▎| 279/300 [4:02:10<18:16, 52.24s/it]

Training Loss : 0.00641288472387474, Testing Loss : 0.8831814191818237, Training Accuracy : 0.99782, Testing Accuracy : 0.8896

 93%|█████████▎| 280/300 [4:03:01<17:16, 51.84s/it]

Training Loss : 0.006258572917534039, Testing Loss : 0.9153376783370971, Training Accuracy : 0.9978, Testing Accuracy : 0.8877

 94%|█████████▎| 281/300 [4:03:53<16:27, 51.96s/it]

Training Loss : 0.007300915604559705, Testing Loss : 0.9092403415679932, Training Accuracy : 0.99768, Testing Accuracy : 0.8869

 94%|█████████▍| 282/300 [4:04:46<15:40, 52.28s/it]

Training Loss : 0.0071559337248886, Testing Loss : 0.9099398629188538, Training Accuracy : 0.9976, Testing Accuracy : 0.8854

 94%|█████████▍| 283/300 [4:05:37<14:41, 51.87s/it]

Training Loss : 0.00673386916551739, Testing Loss : 0.916182799911499, Training Accuracy : 0.99792, Testing Accuracy : 0.8889

 95%|█████████▍| 284/300 [4:06:29<13:52, 52.05s/it]

Training Loss : 0.007627667363565415, Testing Loss : 0.9586139001846313, Training Accuracy : 0.99724, Testing Accuracy : 0.8856

 95%|█████████▌| 285/300 [4:07:21<13:00, 52.04s/it]

Training Loss : 0.007709816566207446, Testing Loss : 0.9361588401794434, Training Accuracy : 0.9975, Testing Accuracy : 0.885

95%|█████████▌| 286/300 [4:08:13<12:05, 51.80s/it]

Training Loss : 0.009050547819836064, Testing Loss : 0.9907202978134155, Training Accuracy : 0.99696, Testing Accuracy : 0.8817

96%|█████████▌| 287/300 [4:09:05<11:16, 52.00s/it]

Training Loss : 0.009077767942752689, Testing Loss : 0.9173049045562744, Training Accuracy : 0.99724, Testing Accuracy : 0.887

96%|█████████▌| 288/300 [4:09:57<10:24, 52.07s/it]

Training Loss : 0.007019616812369786, Testing Loss : 0.9471826463699341, Training Accuracy : 0.99748, Testing Accuracy : 0.8858

96%|█████████▋| 289/300 [4:10:48<09:29, 51.81s/it]

Training Loss : 0.006940802854644134, Testing Loss : 0.9230123596191406, Training Accuracy : 0.99768, Testing Accuracy : 0.8874

97%|█████████▋| 290/300 [4:11:41<08:39, 51.95s/it]

Training Loss : 0.006988337524831295, Testing Loss : 0.9512888701438904, Training Accuracy : 0.99746, Testing Accuracy : 0.8882

97%|█████████▋| 291/300 [4:12:33<07:48, 52.01s/it]

Training Loss : 0.007050960770398378, Testing Loss : 0.9226055896759033, Training Accuracy : 0.99768, Testing Accuracy : 0.8878

97%|█████████▋| 292/300 [4:13:24<06:54, 51.82s/it]

Training Loss : 0.006228563702814281, Testing Loss : 0.9205829539299011, Training Accuracy : 0.998, Testing Accuracy : 0.8882

98%|█████████▊| 293/300 [4:14:16<06:03, 51.91s/it]

Training Loss : 0.006691418236773461, Testing Loss : 0.9269686006546021, Training Accuracy : 0.99796, Testing Accuracy : 0.8879

98%|█████████▊| 294/300 [4:15:09<05:12, 52.09s/it]

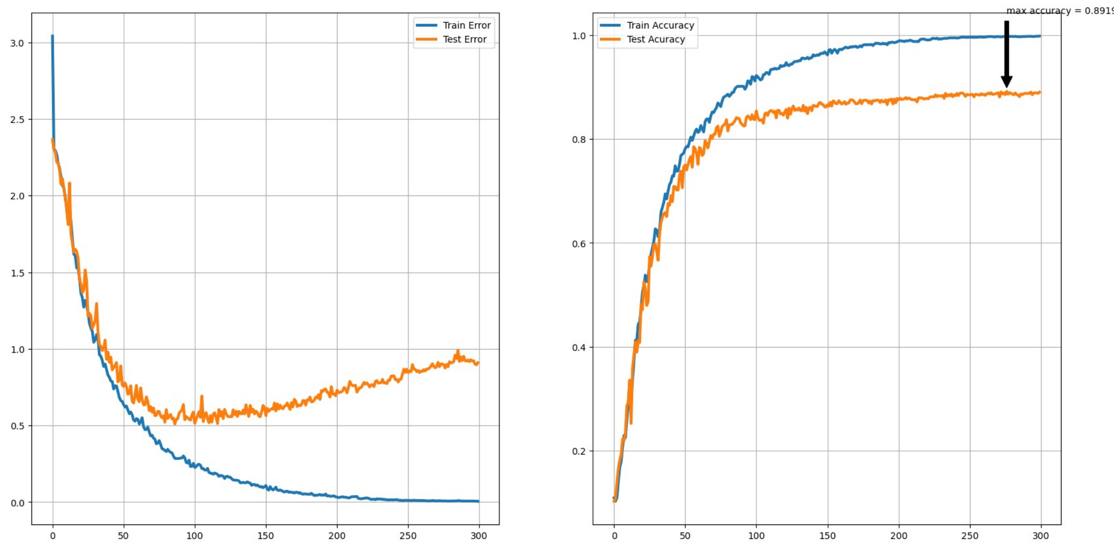
```
Training Loss : 0.006433657087588217, Testing Loss :
0.9164377250671387, Training Accuracy : 0.99788, Testing Accuracy :
0.8906

  98%|█████████▊| 295/300 [4:16:00<04:19, 51.91s/it]

Training Loss : 0.00613645555102732, Testing Loss : 0.92857640914917,
Training Accuracy : 0.99782, Testing Accuracy : 0.8855

  99%|█████████▊| 296/300 [4:16:53<03:28, 52.14s/it]

Training Loss : 0.00764048663772177, Testing Loss :
0.9205121721267701, Training Accuracy : 0.9974, Testing Accuracy :
0.8887

  99%|█████████▉| 297/300 [4:17:45<02:36, 52.10s/it]

Training Loss : 0.0057781342172343285, Testing Loss :
0.9222939058303833, Training Accuracy : 0.99808, Testing Accuracy :
0.8892

  99%|█████████▉| 298/300 [4:18:36<01:43, 51.89s/it]

Training Loss : 0.006029818275915459, Testing Loss :
0.9003629711151123, Training Accuracy : 0.99798, Testing Accuracy :
0.889

 100%|█████████▉| 299/300 [4:19:29<00:52, 52.20s/it]

Training Loss : 0.005728181719300337, Testing Loss :
0.8963684631347656, Training Accuracy : 0.99818, Testing Accuracy :
0.8879

100%|██████████| 300/300 [4:20:22<00:00, 52.07s/it]

Training Loss : 0.004938956240265397, Testing Loss :
0.9093671421051025, Training Accuracy : 0.99846, Testing Accuracy :
0.8903
```

```
torch.save({
            'epoch': i,
            'model_state_dict': model.state_dict(),
            'optimizer_state_dict': optimizer.state_dict(),
            'train_accuracy': train_accuracy,
            'test_accuracy': test_accuracy,
            }, '/content/gdrive/MyDrive/model2.pt')

print("Max Testing Accuracy: %s"%(max(test_accuracy)))
xmax = np.argmax(test_accuracy)
ymax = max(test_accuracy)
```

```
Max Testing Accuracy: 0.8919
```

Plotting the graph for train loss vs test loss and also for train accuracy vs test accuracy.

```
# Create a figure object with two subplots, with a size of 20 by 10.
f, (fig1, fig2) = plt.subplots(1, 2, figsize=(20, 10))

# Set the number of data points in the training data to n.
n = len(train_loss)

# Plot the training loss and testing loss against the number of epochs
on the first subplot.
fig1.plot(range(n), train_loss, '-', linewidth='3', label='Train
Error')
fig1.plot(range(n), test_loss, '-', linewidth='3', label='Test Error')

# Plot the training accuracy and testing accuracy against the number
of epochs on the second subplot.
fig2.plot(range(n), train_accuracy, '-', linewidth='3', label='Train
Accuracy')
fig2.plot(range(n), test_accuracy, '-', linewidth='3', label='Test
Acuracy')

# Annotate the maximum accuracy achieved with an arrow on the second
subplot.
fig2.annotate('max accuracy = %s'%(ymax), xy=(xmax, ymax),
xytext=(xmax, ymax+0.15), arrowprops=dict(facecolor='black',
shrink=0.05))

# Turn on the grid lines for both subplots.
fig1.grid(True)
fig2.grid(True)

# Add legends to both subplots.
fig1.legend()
fig2.legend()

# Save the figure to a file named "trainTestCurve.png".
f.savefig("./trainTestCurve.png")
```




```
torch.save(model.state_dict(), '/content/model2.pt')
```