To prepare our CIFAR10 dataset for training, we apply data augmentation techniques and transforms. Specifically, we use the following techniques:

Random Crop: This technique creates a random subset of an original image. We use this to randomly crop 32x32-pixel patches from the original images, which helps our model learn to recognize objects that might appear anywhere in the image.

Random Horizontal Flip: This technique flips an image horizontally with a probability p. We use this to further augment our dataset and make our model more robust to variations in the orientation of objects.

To Tensor: We use the To Tensor transform to convert our images to PyTorch tensors and scale the pixel values by 255.

Normalize: We apply the Normalize transform to the tensor images so that their values have a mean of 0.0 and a standard deviation of 1.0. This helps our model learn from the input data more effectively.

We download the CIFAR10 dataset to the root directory ./data. To ensure that we get the same validation set each time we run the code, we set PyTorch's random number generator to a seed value of 17. We also import the datasets and convert the images into PyTorch tensors.

```
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 might not be in torchvision."%
(dataset))
        self.batch_size = batch_size
        self.transformers_training = []
        self.transformers_testing = []
```

```python
        # 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 [00:21<00:00, 8043368.25it/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 laye

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


    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)
        # Apply average pooling with kernel size self.P
        out = F.avg_pool2d(out, self.P)
        # Flatten the output tensor
        out = out.view(out.size(0), -1)
        # Apply the fully connected linear layer
        out = self.linear(out)
        # Return the final output
        return out

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)
```

Checking Device - If GPU is available, GPU will be used.

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

```
cuda
```

```
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

```
EPOCHS=300
globalBestAccuracy = 0.0  # initialize the global best accuracy to 0.0
train_loss = []  # list to store train loss
test_loss = []  # list to store test loss
train_accuracy = []  # list to store train accuracy
test_accuracy = []  # list to store test accuracy

# define the loss function as Cross Entropy Loss with sum reduction
loss_function = torch.nn.CrossEntropyLoss(reduction='sum')

learningRate = 0.1  # set the learning rate to 0.1
weightDecay = 0.0001  # set the weight decay to 0.0001
```

```
# define the optimizer as Adadelta with the above defined learning
rate and weight decay
optimizer = torch.optim.Adadelta(model.parameters(), lr=learningRate,
weight_decay=weightDecay)

# define the learning rate scheduler as Cosine Annealing LR with the
above defined optimizer, number of epochs, and minimum learning rate
scheduler = torch.optim.lr_scheduler.CosineAnnealingLR(optimizer,
EPOCHS, eta_min=learningRate/10.0)

# print the model's evaluation mode
print(model.eval())

# calculate and print the total trainable parameters of the model
trainable_parameters = sum(p.numel() for p in model.parameters() if
p.requires_grad)
print("Total Trainable Parameters : %s"%(trainable_parameters))

# if the total number of trainable parameters exceeds 5 million, raise
an exception
if trainable_parameters > 5*(10**6):
    raise Exception("The total number of parameters exceeds 5
million")
```

```
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.

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

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

# Define the function to calculate the loss and accuracy for a given
loader and model
def getLoss(loader, model, optimizer, phase):
    # Initialize the running loss and correct count
```

```
    running_loss = 0.0
    running_correct = 0
    # Iterate through the loader
    for images, labels in loader:
        # Move the images and labels to the device
        images = images.to(device)
        labels = labels.to(device)
        # Forward pass
        output = model(images)
        # Calculate the loss
        loss = loss_function(output, labels)
        # Calculate the predicted labels
        predicted_labels = torch.argmax(output, dim=1)
        # Update the running loss and correct count
        running_loss += loss.item()
        running_correct += torch.sum(predicted_labels ==
labels).float().item()
        # If the phase is "train", backpropagate the loss and update
the optimizer
        if phase == "train":
            loss.backward()
            optimizer.step()
            optimizer.zero_grad()
    # Calculate the epoch loss and accuracy
    epoch_loss = running_loss / len(loader.dataset)
    epoch_acc = running_correct / len(loader.dataset)
    # Return the epoch loss and accuracy
    return epoch_loss, epoch_acc

# Iterate through the epochs
for i in tqdm(range(EPOCHS)):
    # Iterate through the phases (train and test)
    for phase in ['train', 'test']:
        # If the phase is "train", set the loader and call the train
function
        if phase == "train":
            loader = trainLoader
            model, optimizer = train(model, loader, optimizer)
        # If the phase is "test", set the loader and call the test
function
        else:
            loader = testLoader
            model = test(model, loader)
        # Calculate the loss and accuracy for the current phase
        epoch_loss, epoch_acc = getLoss(loader, model, optimizer,
phase)
        # If the phase is "train", update the scheduler and append the
results to the train lists
        if phase == "train":
            scheduler.step()
```

```
            train_loss.append(epoch_loss)
            train_accuracy.append(epoch_acc)
        # If the phase is "test", append the results to the test lists
and update the global best accuracy
        else:
            test_loss.append(epoch_loss)
            test_accuracy.append(epoch_acc)
            globalBestAccuracy = max(globalBestAccuracy, epoch_acc)
    # Print the results for the current epoch
    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 [00:57<4:45:32, 57.30s/it]

Training Loss : 1.5321812477111816, Testing Loss : 1.38441522731781,
Training Accuracy : 0.45114, Testing Accuracy : 0.5425

  1%|          | 2/300 [01:47<4:24:59, 53.35s/it]

Training Loss : 0.9913743310546875, Testing Loss : 1.0104526123046875,
Training Accuracy : 0.64922, Testing Accuracy : 0.6513

  1%|          | 3/300 [02:38<4:18:47, 52.28s/it]

Training Loss : 0.7940330379486084, Testing Loss : 0.9900145526885986,
Training Accuracy : 0.72356, Testing Accuracy : 0.6657

  1%|▏         | 4/300 [03:29<4:15:11, 51.73s/it]

Training Loss : 0.6825790651702881, Testing Loss : 0.8113426049232483,
Training Accuracy : 0.76248, Testing Accuracy : 0.7288

  2%|▏         | 5/300 [04:20<4:13:13, 51.50s/it]

Training Loss : 0.6143196478271484, Testing Loss : 0.7914480124950409,
Training Accuracy : 0.7885, Testing Accuracy : 0.7411

  2%|▏         | 6/300 [05:12<4:11:46, 51.38s/it]

Training Loss : 0.5602758818817138, Testing Loss : 0.6864444598674774,
Training Accuracy : 0.80654, Testing Accuracy : 0.7731

  2%|▏         | 7/300 [06:03<4:10:48, 51.36s/it]

Training Loss : 0.5087110773849487, Testing Loss : 0.6567102580070495,
Training Accuracy : 0.82434, Testing Accuracy : 0.7834

  3%|▎         | 8/300 [06:54<4:10:05, 51.39s/it]

Training Loss : 0.4722833909606934, Testing Loss : 0.6502844595909119,
Training Accuracy : 0.83584, Testing Accuracy : 0.7821
```

```
  3%|▎         | 9/300 [07:46<4:09:16, 51.40s/it]

Training Loss : 0.44495972106933596, Testing Loss :
0.6790051836490631, Training Accuracy : 0.84568, Testing Accuracy :
0.775

  3%|▎         | 10/300 [08:37<4:08:30, 51.41s/it]

Training Loss : 0.41485365539550784, Testing Loss :
0.6545009528160095, Training Accuracy : 0.85712, Testing Accuracy :
0.7821

  4%|▎         | 11/300 [09:29<4:07:46, 51.44s/it]

Training Loss : 0.38772287948608397, Testing Loss :
0.5817032989501953, Training Accuracy : 0.86472, Testing Accuracy :
0.8161

  4%|▍         | 12/300 [10:20<4:06:54, 51.44s/it]

Training Loss : 0.36930232139587404, Testing Loss :
0.6278904083251953, Training Accuracy : 0.87098, Testing Accuracy :
0.7996

  4%|▍         | 13/300 [11:12<4:06:11, 51.47s/it]

Training Loss : 0.3444925454711914, Testing Loss : 0.5530678780555726,
Training Accuracy : 0.88016, Testing Accuracy : 0.8263

  5%|▍         | 14/300 [12:03<4:05:11, 51.44s/it]

Training Loss : 0.3219567440032959, Testing Loss : 0.5989711959123611,
Training Accuracy : 0.8886, Testing Accuracy : 0.8067

  5%|▌         | 15/300 [12:54<4:04:06, 51.39s/it]

Training Loss : 0.31022959285736085, Testing Loss :
0.6582690554618835, Training Accuracy : 0.8918, Testing Accuracy :
0.7909

  5%|▌         | 16/300 [13:46<4:03:12, 51.38s/it]

Training Loss : 0.29201185642242433, Testing Loss :
0.5166320552110673, Training Accuracy : 0.89712, Testing Accuracy :
0.8397

  6%|▌         | 17/300 [14:37<4:02:32, 51.42s/it]

Training Loss : 0.2796937840270996, Testing Loss : 0.4549471567630768,
Training Accuracy : 0.90244, Testing Accuracy : 0.8553

  6%|▌         | 18/300 [15:29<4:01:41, 51.43s/it]
```

```
Training Loss : 0.2629735727119446, Testing Loss : 0.5896089834213257,
Training Accuracy : 0.90672, Testing Accuracy : 0.8215

   6%|▋         | 19/300 [16:20<4:00:49, 51.42s/it]

Training Loss : 0.25026196002960205, Testing Loss :
0.5668065811634063, Training Accuracy : 0.91248, Testing Accuracy :
0.8235

   7%|▋         | 20/300 [17:11<3:59:56, 51.42s/it]

Training Loss : 0.23946592039108278, Testing Loss :
0.5190220224380493, Training Accuracy : 0.91546, Testing Accuracy :
0.8472

   7%|▋         | 21/300 [18:03<3:59:27, 51.50s/it]

Training Loss : 0.22477199588775634, Testing Loss :
0.43867022666931155, Training Accuracy : 0.921, Testing Accuracy :
0.8635

   7%|▋         | 22/300 [18:55<3:58:56, 51.57s/it]

Training Loss : 0.21641054517745972, Testing Loss :
0.47793544130325316, Training Accuracy : 0.92588, Testing Accuracy :
0.8571

   8%|▊         | 23/300 [19:47<3:58:16, 51.61s/it]

Training Loss : 0.21038138185501098, Testing Loss :
0.4781536428451538, Training Accuracy : 0.9261, Testing Accuracy :
0.8577

   8%|▊         | 24/300 [20:38<3:57:35, 51.65s/it]

Training Loss : 0.19590554439544677, Testing Loss :
0.47503332624435424, Training Accuracy : 0.93102, Testing Accuracy :
0.8602

   8%|▊         | 25/300 [21:30<3:56:24, 51.58s/it]

Training Loss : 0.18744171758651734, Testing Loss :
0.4973634225845337, Training Accuracy : 0.9345, Testing Accuracy :
0.8518

   9%|▊         | 26/300 [22:21<3:55:16, 51.52s/it]

Training Loss : 0.1823141994670532, Testing Loss :
0.46851616430282594, Training Accuracy : 0.9362, Testing Accuracy :
0.8608

   9%|▉         | 27/300 [23:12<3:54:03, 51.44s/it]
```

```
Training Loss : 0.16980959353923797, Testing Loss :
0.47615689296722413, Training Accuracy : 0.94048, Testing Accuracy :
0.8609

  9%|▉         | 28/300 [24:04<3:52:55, 51.38s/it]

Training Loss : 0.16180518572807312, Testing Loss :
0.5090831837654114, Training Accuracy : 0.9415, Testing Accuracy :
0.8586

 10%|▉         | 29/300 [24:55<3:51:52, 51.34s/it]

Training Loss : 0.15665493733406066, Testing Loss :
0.5665778273820877, Training Accuracy : 0.94514, Testing Accuracy :
0.8514

 10%|█         | 30/300 [25:46<3:50:28, 51.22s/it]

Training Loss : 0.14826128638267516, Testing Loss : 0.482275698184967,
Training Accuracy : 0.94756, Testing Accuracy : 0.8686

 10%|█         | 31/300 [26:37<3:50:02, 51.31s/it]

Training Loss : 0.1399690029525757, Testing Loss : 0.5048041082382202,
Training Accuracy : 0.95122, Testing Accuracy : 0.8559

 11%|█         | 32/300 [27:28<3:48:35, 51.18s/it]

Training Loss : 0.13616144538402558, Testing Loss :
0.5042014767169952, Training Accuracy : 0.951, Testing Accuracy :
0.8623

 11%|█         | 33/300 [28:19<3:47:52, 51.21s/it]

Training Loss : 0.12876773893356322, Testing Loss :
0.5634690524101257, Training Accuracy : 0.9551, Testing Accuracy :
0.8625

 11%|█▏        | 34/300 [29:10<3:46:49, 51.16s/it]

Training Loss : 0.12625204139709473, Testing Loss :
0.47628097219467164, Training Accuracy : 0.95562, Testing Accuracy :
0.8712

 12%|█▏        | 35/300 [30:02<3:45:49, 51.13s/it]

Training Loss : 0.1223305892276764, Testing Loss :
0.47546088724136354, Training Accuracy : 0.95712, Testing Accuracy :
0.8738

 12%|█▏        | 36/300 [30:53<3:44:58, 51.13s/it]
```

```
Training Loss : 0.11742690576553345, Testing Loss :
0.5249898477554321, Training Accuracy : 0.95862, Testing Accuracy :
0.8673

  12%|█▏        | 37/300 [31:44<3:44:13, 51.15s/it]

Training Loss : 0.10897887698411941, Testing Loss :
0.5401241346359253, Training Accuracy : 0.9617, Testing Accuracy :
0.869

  13%|█▎        | 38/300 [32:35<3:43:30, 51.18s/it]

Training Loss : 0.10530381396770477, Testing Loss :
0.46932416791915893, Training Accuracy : 0.96216, Testing Accuracy :
0.8789

  13%|█▎        | 39/300 [33:26<3:42:30, 51.15s/it]

Training Loss : 0.10499712850093841, Testing Loss :
0.5165596014022827, Training Accuracy : 0.9623, Testing Accuracy :
0.869

  13%|█▎        | 40/300 [34:17<3:41:43, 51.17s/it]

Training Loss : 0.10090051799297332, Testing Loss : 0.544973289346695,
Training Accuracy : 0.96466, Testing Accuracy : 0.8683

  14%|█▎        | 41/300 [35:08<3:40:09, 51.00s/it]

Training Loss : 0.09585958884000778, Testing Loss :
0.5151421879768372, Training Accuracy : 0.96616, Testing Accuracy :
0.8721

  14%|█▍        | 42/300 [35:59<3:39:22, 51.02s/it]

Training Loss : 0.09135445573806762, Testing Loss :
0.5187268095493317, Training Accuracy : 0.96794, Testing Accuracy :
0.8713

  14%|█▍        | 43/300 [36:50<3:38:28, 51.01s/it]

Training Loss : 0.08644772215843201, Testing Loss :
0.5170773961544037, Training Accuracy : 0.96934, Testing Accuracy :
0.8767

  15%|█▍        | 44/300 [37:41<3:37:23, 50.95s/it]

Training Loss : 0.0836797123336792, Testing Loss :
0.48963731780052183, Training Accuracy : 0.97028, Testing Accuracy :
0.8812

  15%|█▌        | 45/300 [38:32<3:36:45, 51.00s/it]
```

```
Training Loss : 0.08034440512418747, Testing Loss : 0.526244846868515,
Training Accuracy : 0.97148, Testing Accuracy : 0.8784

 15%|█         | 46/300 [39:23<3:35:55, 51.01s/it]

Training Loss : 0.0775559540963173, Testing Loss : 0.5231988222122193,
Training Accuracy : 0.97246, Testing Accuracy : 0.8821

 16%|█         | 47/300 [40:14<3:34:42, 50.92s/it]

Training Loss : 0.07830288128137589, Testing Loss :
0.5736048476219178, Training Accuracy : 0.9718, Testing Accuracy :
0.8759

 16%|█         | 48/300 [41:04<3:33:37, 50.86s/it]

Training Loss : 0.07907370038986206, Testing Loss :
0.5330638222694397, Training Accuracy : 0.9714, Testing Accuracy :
0.877

 16%|█         | 49/300 [41:56<3:33:15, 50.98s/it]

Training Loss : 0.0697736975312233, Testing Loss : 0.5991611444711685,
Training Accuracy : 0.97462, Testing Accuracy : 0.8694

 17%|█         | 50/300 [42:47<3:32:17, 50.95s/it]

Training Loss : 0.06936438469409943, Testing Loss :
0.5504249582052231, Training Accuracy : 0.97538, Testing Accuracy :
0.88

 17%|█         | 51/300 [43:37<3:31:17, 50.91s/it]

Training Loss : 0.0668135494542122, Testing Loss : 0.5346528522491455,
Training Accuracy : 0.97654, Testing Accuracy : 0.8764

 17%|█         | 52/300 [44:28<3:30:09, 50.85s/it]

Training Loss : 0.06483776148438454, Testing Loss :
0.5993085133552551, Training Accuracy : 0.97768, Testing Accuracy :
0.8725

 18%|█         | 53/300 [45:19<3:29:30, 50.89s/it]

Training Loss : 0.06255664771318435, Testing Loss : 0.601748046207428,
Training Accuracy : 0.97808, Testing Accuracy : 0.8716

 18%|█         | 54/300 [46:10<3:28:48, 50.93s/it]

Training Loss : 0.0614415113568306, Testing Loss : 0.5875978476524353,
Training Accuracy : 0.97902, Testing Accuracy : 0.8799

 18%|█         | 55/300 [47:01<3:28:26, 51.05s/it]
```

Training Loss : 0.05940215361833572, Testing Loss : 0.5431055638313294, Training Accuracy : 0.9788, Testing Accuracy : 0.888

19%|█▊ | 56/300 [47:52<3:27:31, 51.03s/it]

Training Loss : 0.05887268106818199, Testing Loss : 0.5098847833633423, Training Accuracy : 0.97894, Testing Accuracy : 0.8861

19%|█▉ | 57/300 [48:43<3:26:30, 50.99s/it]

Training Loss : 0.054779763225317, Testing Loss : 0.5350673515319824, Training Accuracy : 0.98086, Testing Accuracy : 0.8834

19%|█▉ | 58/300 [49:34<3:25:45, 51.01s/it]

Training Loss : 0.05469132903814316, Testing Loss : 0.5574260381698608, Training Accuracy : 0.98042, Testing Accuracy : 0.8819

20%|█▉ | 59/300 [50:25<3:24:36, 50.94s/it]

Training Loss : 0.05161130867958069, Testing Loss : 0.5983942405700684, Training Accuracy : 0.98176, Testing Accuracy : 0.8791

20%|██ | 60/300 [51:16<3:23:39, 50.92s/it]

Training Loss : 0.050522313548326495, Testing Loss : 0.6057796353340149, Training Accuracy : 0.98206, Testing Accuracy : 0.8832

20%|██ | 61/300 [52:07<3:22:25, 50.82s/it]

Training Loss : 0.05120078508496285, Testing Loss : 0.5315001607656479, Training Accuracy : 0.98184, Testing Accuracy : 0.8884

21%|██ | 62/300 [52:57<3:21:21, 50.76s/it]

Training Loss : 0.04869477096438408, Testing Loss : 0.6838070251464844, Training Accuracy : 0.98312, Testing Accuracy : 0.8725

21%|██ | 63/300 [53:48<3:20:44, 50.82s/it]

Training Loss : 0.04561827613472939, Testing Loss : 0.6109756366729736, Training Accuracy : 0.98426, Testing Accuracy : 0.8819

21%|██▏ | 64/300 [54:39<3:20:20, 50.93s/it]

Training Loss : 0.04492497940421104, Testing Loss : 0.60906331615448, Training Accuracy : 0.98396, Testing Accuracy : 0.8801

 22%|██▏ | 65/300 [55:30<3:19:36, 50.96s/it]

Training Loss : 0.04396965974330902, Testing Loss : 0.6459773015022278, Training Accuracy : 0.98448, Testing Accuracy : 0.8811

 22%|██▏ | 66/300 [56:22<3:18:57, 51.02s/it]

Training Loss : 0.04622341087460518, Testing Loss : 0.6066991604566574, Training Accuracy : 0.98354, Testing Accuracy : 0.8802

 22%|██▏ | 67/300 [57:13<3:18:30, 51.12s/it]

Training Loss : 0.040036254731416705, Testing Loss : 0.5541158459663391, Training Accuracy : 0.98616, Testing Accuracy : 0.8837

 23%|██▎ | 68/300 [58:04<3:17:17, 51.02s/it]

Training Loss : 0.04162170440196991, Testing Loss : 0.6012771626472473, Training Accuracy : 0.98534, Testing Accuracy : 0.8846

 23%|██▎ | 69/300 [58:55<3:16:39, 51.08s/it]

Training Loss : 0.03891427711725235, Testing Loss : 0.5820833311080933, Training Accuracy : 0.9864, Testing Accuracy : 0.8916

 23%|██▎ | 70/300 [59:46<3:15:42, 51.05s/it]

Training Loss : 0.03874125699937343, Testing Loss : 0.6168948073387146, Training Accuracy : 0.98632, Testing Accuracy : 0.8844

 24%|██▍ | 71/300 [1:00:37<3:14:58, 51.09s/it]

Training Loss : 0.03998308353543282, Testing Loss : 0.6238294616937637, Training Accuracy : 0.98576, Testing Accuracy : 0.8846

 24%|██▍ | 72/300 [1:01:28<3:14:04, 51.07s/it]

Training Loss : 0.03519811057507992, Testing Loss : 0.6130645434975625, Training Accuracy : 0.98788, Testing Accuracy : 0.8874

 24%|██▍ | 73/300 [1:02:19<3:13:22, 51.11s/it]

Training Loss : 0.03664382406115532, Testing Loss : 0.5919793818473816, Training Accuracy : 0.98716, Testing Accuracy : 0.8863

 25%|██ | 74/300 [1:03:10<3:12:31, 51.11s/it]

Training Loss : 0.036306137529611586, Testing Loss : 0.6424818083524704, Training Accuracy : 0.98726, Testing Accuracy : 0.8875

 25%|██ | 75/300 [1:04:02<3:11:56, 51.19s/it]

Training Loss : 0.035782348347902296, Testing Loss : 0.5946098744392395, Training Accuracy : 0.98756, Testing Accuracy : 0.8909

 25%|██ | 76/300 [1:04:53<3:10:59, 51.16s/it]

Training Loss : 0.03339342588916421, Testing Loss : 0.6215399408340454, Training Accuracy : 0.98798, Testing Accuracy : 0.8891

 26%|██ | 77/300 [1:05:44<3:09:47, 51.07s/it]

Training Loss : 0.033018950677812096, Testing Loss : 0.5916770663261414, Training Accuracy : 0.98858, Testing Accuracy : 0.8903

 26%|██ | 78/300 [1:06:34<3:08:32, 50.96s/it]

Training Loss : 0.030297233997434378, Testing Loss : 0.6655219058513642, Training Accuracy : 0.98946, Testing Accuracy : 0.8866

 26%|██ | 79/300 [1:07:25<3:07:30, 50.91s/it]

Training Loss : 0.03229361725360155, Testing Loss : 0.6601486651420593, Training Accuracy : 0.98818, Testing Accuracy : 0.8841

 27%|██ | 80/300 [1:08:16<3:06:34, 50.88s/it]

Training Loss : 0.02954849617779255, Testing Loss : 0.624935177898407, Training Accuracy : 0.9897, Testing Accuracy : 0.889

 27%|██ | 81/300 [1:09:07<3:06:04, 50.98s/it]

Training Loss : 0.030063651885390282, Testing Loss : 0.6015191900253296, Training Accuracy : 0.98974, Testing Accuracy : 0.8915

 27%|██ | 82/300 [1:09:58<3:05:05, 50.94s/it]

Training Loss : 0.02913548004254699, Testing Loss : 0.6416658411026, Training Accuracy : 0.99026, Testing Accuracy : 0.8853

 28%|███ | 83/300 [1:10:49<3:04:01, 50.88s/it]

Training Loss : 0.027899765347242356, Testing Loss : 0.7227521136283874, Training Accuracy : 0.99028, Testing Accuracy : 0.8803

 28%|███ | 84/300 [1:11:40<3:03:21, 50.93s/it]

Training Loss : 0.027907102071791888, Testing Loss : 0.6354302892684937, Training Accuracy : 0.9903, Testing Accuracy : 0.894

 28%|███ | 85/300 [1:12:31<3:03:00, 51.07s/it]

Training Loss : 0.026656615850180386, Testing Loss : 0.7068797983169556, Training Accuracy : 0.99122, Testing Accuracy : 0.8869

 29%|███ | 86/300 [1:13:23<3:02:24, 51.14s/it]

Training Loss : 0.027655742506831886, Testing Loss : 0.6311942403793335, Training Accuracy : 0.99032, Testing Accuracy : 0.8933

 29%|███ | 87/300 [1:14:14<3:01:53, 51.24s/it]

Training Loss : 0.025520560839176178, Testing Loss : 0.642461139011383, Training Accuracy : 0.99104, Testing Accuracy : 0.8887

 29%|███ | 88/300 [1:15:06<3:01:25, 51.35s/it]

Training Loss : 0.02504539775788784, Testing Loss : 0.6327558838844299, Training Accuracy : 0.99178, Testing Accuracy : 0.8927

 30%|███ | 89/300 [1:15:57<3:00:27, 51.32s/it]

Training Loss : 0.025186175532191993, Testing Loss : 0.6500242281913757, Training Accuracy : 0.99122, Testing Accuracy : 0.8939

 30%|███ | 90/300 [1:16:48<2:59:33, 51.30s/it]

Training Loss : 0.022120399484932423, Testing Loss : 0.694081125164032, Training Accuracy : 0.99274, Testing Accuracy : 0.8889

 30%|███ | 91/300 [1:17:39<2:58:35, 51.27s/it]

```
Training Loss : 0.023210414481163025, Testing Loss :
0.6673750095367431, Training Accuracy : 0.9919, Testing Accuracy :
0.8901

  31%|███       | 92/300 [1:18:30<2:57:28, 51.19s/it]

Training Loss : 0.021341568420007825, Testing Loss :
0.7494588317871094, Training Accuracy : 0.99238, Testing Accuracy :
0.8805

  31%|███       | 93/300 [1:19:22<2:56:32, 51.17s/it]

Training Loss : 0.023550153890699147, Testing Loss :
0.6312136264801025, Training Accuracy : 0.99194, Testing Accuracy :
0.8907

  31%|███       | 94/300 [1:20:13<2:56:07, 51.30s/it]

Training Loss : 0.022505708359330894, Testing Loss :
0.6552283744812012, Training Accuracy : 0.99242, Testing Accuracy :
0.8919

  32%|███       | 95/300 [1:21:05<2:55:34, 51.39s/it]

Training Loss : 0.021241019246578216, Testing Loss :
0.6432226828575134, Training Accuracy : 0.9926, Testing Accuracy :
0.8936

  32%|███       | 96/300 [1:21:56<2:54:52, 51.43s/it]

Training Loss : 0.02124142828643322, Testing Loss :
0.7040673019409179, Training Accuracy : 0.99278, Testing Accuracy :
0.8894

  32%|███       | 97/300 [1:22:48<2:53:49, 51.38s/it]

Training Loss : 0.020744068436473608, Testing Loss :
0.6977302017211914, Training Accuracy : 0.9931, Testing Accuracy :
0.8882

  33%|███       | 98/300 [1:23:39<2:53:03, 51.40s/it]

Training Loss : 0.01981533726274967, Testing Loss :
0.6784332486152649, Training Accuracy : 0.9933, Testing Accuracy :
0.8962

  33%|███       | 99/300 [1:24:30<2:52:17, 51.43s/it]

Training Loss : 0.019809285411685706, Testing Loss :
0.6621306781768799, Training Accuracy : 0.99342, Testing Accuracy :
0.894

  33%|███       | 100/300 [1:25:22<2:51:25, 51.43s/it]
```

```
Training Loss : 0.018913502119630575, Testing Loss :
0.6390115888595581, Training Accuracy : 0.99322, Testing Accuracy :
0.8986

  34%|███▍      | 101/300 [1:26:14<2:50:59, 51.55s/it]

Training Loss : 0.019806862883865833, Testing Loss :
0.6841381505966186, Training Accuracy : 0.99268, Testing Accuracy :
0.885

  34%|███▍      | 102/300 [1:27:05<2:50:06, 51.55s/it]

Training Loss : 0.01710481799520552, Testing Loss : 0.693592649936676,
Training Accuracy : 0.99438, Testing Accuracy : 0.8914

  34%|███▍      | 103/300 [1:27:57<2:49:07, 51.51s/it]

Training Loss : 0.01934551066875458, Testing Loss :
0.6657918717384338, Training Accuracy : 0.9928, Testing Accuracy :
0.8933

  35%|███▍      | 104/300 [1:28:48<2:48:07, 51.47s/it]

Training Loss : 0.01862752145305276, Testing Loss :
0.7028424716949463, Training Accuracy : 0.99354, Testing Accuracy :
0.8911

  35%|███▌      | 105/300 [1:29:39<2:47:06, 51.42s/it]

Training Loss : 0.016462598825842143, Testing Loss :
0.6749847858428956, Training Accuracy : 0.9942, Testing Accuracy :
0.895

  35%|███▌      | 106/300 [1:30:31<2:46:19, 51.44s/it]

Training Loss : 0.015820494390279053, Testing Loss :
0.7084124086380005, Training Accuracy : 0.99428, Testing Accuracy :
0.8921

  36%|███▌      | 107/300 [1:31:22<2:45:34, 51.48s/it]

Training Loss : 0.01635224557802081, Testing Loss :
0.6685559185028076, Training Accuracy : 0.9942, Testing Accuracy :
0.8939

  36%|███▌      | 108/300 [1:32:14<2:44:31, 51.41s/it]

Training Loss : 0.01429078760293125, Testing Loss :
0.6709833000183105, Training Accuracy : 0.99526, Testing Accuracy :
0.8964

  36%|███▋      | 109/300 [1:33:05<2:43:31, 51.37s/it]
```

Training Loss : 0.015262826588451862, Testing Loss : 0.7103044346809387, Training Accuracy : 0.99468, Testing Accuracy : 0.8947

 37%|████ | 110/300 [1:33:56<2:42:44, 51.39s/it]

Training Loss : 0.016196153771877729, Testing Loss : 0.659954830646515, Training Accuracy : 0.994, Testing Accuracy : 0.8988

 37%|████ | 111/300 [1:34:48<2:41:43, 51.34s/it]

Training Loss : 0.015300929630622268, Testing Loss : 0.675855784034729, Training Accuracy : 0.99494, Testing Accuracy : 0.8975

 37%|████ | 112/300 [1:35:39<2:40:56, 51.37s/it]

Training Loss : 0.0148716811574623, Testing Loss : 0.6914717533111572, Training Accuracy : 0.99492, Testing Accuracy : 0.8962

 38%|████ | 113/300 [1:36:30<2:39:55, 51.31s/it]

Training Loss : 0.012505830047205091, Testing Loss : 0.6687726564407349, Training Accuracy : 0.99592, Testing Accuracy : 0.8985

 38%|████ | 114/300 [1:37:21<2:39:00, 51.29s/it]

Training Loss : 0.01472342040386051, Testing Loss : 0.7094142702102662, Training Accuracy : 0.99486, Testing Accuracy : 0.8949

 38%|████ | 115/300 [1:38:13<2:38:11, 51.30s/it]

Training Loss : 0.014375252198278904, Testing Loss : 0.7139181502342224, Training Accuracy : 0.99498, Testing Accuracy : 0.8964

 39%|████ | 116/300 [1:39:04<2:37:20, 51.31s/it]

Training Loss : 0.013073755031302571, Testing Loss : 0.7192343861579895, Training Accuracy : 0.99556, Testing Accuracy : 0.8944

 39%|████ | 117/300 [1:39:55<2:36:29, 51.31s/it]

Training Loss : 0.012833371850550175, Testing Loss : 0.726269529647827, Training Accuracy : 0.9957, Testing Accuracy : 0.8942

 39%|████ | 118/300 [1:40:47<2:35:44, 51.34s/it]

Training Loss : 0.011781303316075355, Testing Loss : 0.7031216184616089, Training Accuracy : 0.99586, Testing Accuracy : 0.8958

40%|████ | 119/300 [1:41:38<2:34:52, 51.34s/it]

Training Loss : 0.011999808100312948, Testing Loss : 0.7440444101333619, Training Accuracy : 0.99602, Testing Accuracy : 0.8937

40%|████ | 120/300 [1:42:29<2:33:45, 51.25s/it]

Training Loss : 0.012691735240407289, Testing Loss : 0.7091971855163575, Training Accuracy : 0.99572, Testing Accuracy : 0.8968

40%|████ | 121/300 [1:43:21<2:33:12, 51.35s/it]

Training Loss : 0.012490525835305452, Testing Loss : 0.7245451713562012, Training Accuracy : 0.9956, Testing Accuracy : 0.9

41%|████ | 122/300 [1:44:12<2:32:20, 51.35s/it]

Training Loss : 0.011437707177195697, Testing Loss : 0.7302606099128723, Training Accuracy : 0.99608, Testing Accuracy : 0.8972

41%|████ | 123/300 [1:45:04<2:31:30, 51.36s/it]

Training Loss : 0.01141612109899521, Testing Loss : 0.7116207488059998, Training Accuracy : 0.99592, Testing Accuracy : 0.8968

41%|████ | 124/300 [1:45:55<2:30:41, 51.37s/it]

Training Loss : 0.011794934658035636, Testing Loss : 0.7538925006866455, Training Accuracy : 0.99608, Testing Accuracy : 0.8965

42%|████▏ | 125/300 [1:46:46<2:29:47, 51.36s/it]

Training Loss : 0.010175582160707563, Testing Loss : 0.7295643619537353, Training Accuracy : 0.99658, Testing Accuracy : 0.8982

42%|████▏ | 126/300 [1:47:38<2:28:50, 51.32s/it]

Training Loss : 0.011119909168425948, Testing Loss : 0.73951548204422, Training Accuracy : 0.99638, Testing Accuracy : 0.8952

42%|████▏ | 127/300 [1:48:29<2:28:08, 51.38s/it]

```
Training Loss : 0.009329862243458628, Testing Loss :
0.7186466941833496, Training Accuracy : 0.99676, Testing Accuracy :
0.8964

  43%|████▎     | 128/300 [1:49:20<2:27:20, 51.40s/it]

Training Loss : 0.009924960723239928, Testing Loss :
0.7661976564407349, Training Accuracy : 0.9968, Testing Accuracy :
0.8945

  43%|████▎     | 129/300 [1:50:12<2:26:24, 51.37s/it]

Training Loss : 0.008861438830215484, Testing Loss :
0.7364922894477844, Training Accuracy : 0.99692, Testing Accuracy :
0.9002

  43%|████▎     | 130/300 [1:51:03<2:25:31, 51.36s/it]

Training Loss : 0.00948290684564039, Testing Loss :
0.7402029082298279, Training Accuracy : 0.99654, Testing Accuracy :
0.8974

  44%|████▎     | 131/300 [1:51:54<2:24:34, 51.33s/it]

Training Loss : 0.009070487888762727, Testing Loss :
0.7340672541618347, Training Accuracy : 0.99692, Testing Accuracy :
0.902

  44%|████▍     | 132/300 [1:52:46<2:23:32, 51.27s/it]

Training Loss : 0.009885746127828025, Testing Loss :
0.7396088474273682, Training Accuracy : 0.99656, Testing Accuracy :
0.8981

  44%|████▍     | 133/300 [1:53:37<2:22:31, 51.21s/it]

Training Loss : 0.009256349740289152, Testing Loss :
0.7218270693778992, Training Accuracy : 0.99684, Testing Accuracy :
0.8993

  45%|████▍     | 134/300 [1:54:27<2:21:14, 51.05s/it]

Training Loss : 0.008545328094270081, Testing Loss :
0.7842230464816093, Training Accuracy : 0.99688, Testing Accuracy :
0.8981

  45%|████▌     | 135/300 [1:55:18<2:20:28, 51.08s/it]

Training Loss : 0.008301653313562274, Testing Loss :
0.750996826505661, Training Accuracy : 0.99708, Testing Accuracy :
0.8994

  45%|████▌     | 136/300 [1:56:09<2:19:31, 51.04s/it]
```

Training Loss : 0.008654076178632676, Testing Loss : 0.7622821130752564, Training Accuracy : 0.99692, Testing Accuracy : 0.8986

46%|█████ | 137/300 [1:57:00<2:18:35, 51.01s/it]

Training Loss : 0.007975111678787507, Testing Loss : 0.7335576042175292, Training Accuracy : 0.99736, Testing Accuracy : 0.8988

46%|█████ | 138/300 [1:57:51<2:17:34, 50.95s/it]

Training Loss : 0.007238348477855325, Testing Loss : 0.762246012210846, Training Accuracy : 0.9974, Testing Accuracy : 0.8983

46%|█████ | 139/300 [1:58:42<2:16:41, 50.94s/it]

Training Loss : 0.0071514416081644595, Testing Loss : 0.7603213632583619, Training Accuracy : 0.99746, Testing Accuracy : 0.9007

47%|█████ | 140/300 [1:59:33<2:15:52, 50.95s/it]

Training Loss : 0.007535243830606341, Testing Loss : 0.7677506605148315, Training Accuracy : 0.9975, Testing Accuracy : 0.8989

47%|█████ | 141/300 [2:00:24<2:14:58, 50.93s/it]

Training Loss : 0.007638416074737906, Testing Loss : 0.71813586063385, Training Accuracy : 0.9973, Testing Accuracy : 0.9

47%|█████ | 142/300 [2:01:15<2:14:01, 50.90s/it]

Training Loss : 0.006648691984014586, Testing Loss : 0.7541157403945923, Training Accuracy : 0.99766, Testing Accuracy : 0.9014

48%|█████ | 143/300 [2:02:06<2:13:10, 50.89s/it]

Training Loss : 0.007045125340907834, Testing Loss : 0.778240612411499, Training Accuracy : 0.9977, Testing Accuracy : 0.8971

48%|█████ | 144/300 [2:02:57<2:12:21, 50.91s/it]

Training Loss : 0.006536999885104596, Testing Loss : 0.7660483654022217, Training Accuracy : 0.9977, Testing Accuracy : 0.8989

48%|█████ | 145/300 [2:03:48<2:11:35, 50.94s/it]

Training Loss : 0.006557570331888273, Testing Loss : 0.8366389339447021, Training Accuracy : 0.9977, Testing Accuracy : 0.8955

49%|█████ | 146/300 [2:04:39<2:10:51, 50.98s/it]

Training Loss : 0.005721345570315607, Testing Loss : 0.7738912120819091, Training Accuracy : 0.9982, Testing Accuracy : 0.9023

49%|█████ | 147/300 [2:05:30<2:10:18, 51.10s/it]

Training Loss : 0.0052745569428475575, Testing Loss : 0.7922752582550049, Training Accuracy : 0.99818, Testing Accuracy : 0.8967

49%|█████ | 148/300 [2:06:21<2:09:19, 51.05s/it]

Training Loss : 0.004822353251469322, Testing Loss : 0.8123661096572876, Training Accuracy : 0.99838, Testing Accuracy : 0.8997

50%|█████ | 149/300 [2:07:12<2:08:36, 51.10s/it]

Training Loss : 0.005985525365942158, Testing Loss : 0.7832311052322388, Training Accuracy : 0.99816, Testing Accuracy : 0.9026

50%|█████ | 150/300 [2:08:03<2:07:35, 51.04s/it]

Training Loss : 0.005310409227909986, Testing Loss : 0.7843945171356201, Training Accuracy : 0.99808, Testing Accuracy : 0.8996

50%|█████ | 151/300 [2:08:54<2:06:49, 51.07s/it]

Training Loss : 0.005569782283506356, Testing Loss : 0.7602889671325683, Training Accuracy : 0.99822, Testing Accuracy : 0.9022

51%|█████ | 152/300 [2:09:45<2:05:57, 51.06s/it]

Training Loss : 0.005463294614632614, Testing Loss : 0.7895027269363404, Training Accuracy : 0.9981, Testing Accuracy : 0.9012

51%|█████ | 153/300 [2:10:36<2:05:03, 51.04s/it]

Training Loss : 0.005012550362194888, Testing Loss : 0.8083988697052001, Training Accuracy : 0.99832, Testing Accuracy : 0.8993

51%|█████ | 154/300 [2:11:27<2:04:08, 51.02s/it]

Training Loss : 0.00502632760839304, Testing Loss : 0.7963323894500732, Training Accuracy : 0.99832, Testing Accuracy : 0.9033

52%|█████ | 155/300 [2:12:18<2:03:07, 50.95s/it]

Training Loss : 0.005798228752934374, Testing Loss : 0.7966297534942627, Training Accuracy : 0.99824, Testing Accuracy : 0.901

52%|█████ | 156/300 [2:13:09<2:02:12, 50.92s/it]

Training Loss : 0.004722984798866092, Testing Loss : 0.795755913734436, Training Accuracy : 0.99844, Testing Accuracy : 0.902

52%|█████ | 157/300 [2:14:00<2:01:20, 50.92s/it]

Training Loss : 0.00498528031625785, Testing Loss : 0.8178332298278809, Training Accuracy : 0.99824, Testing Accuracy : 0.9001

53%|█████ | 158/300 [2:14:51<2:00:31, 50.93s/it]

Training Loss : 0.003918500004427042, Testing Loss : 0.8089822244644165, Training Accuracy : 0.99866, Testing Accuracy : 0.9017

53%|█████ | 159/300 [2:15:42<1:59:36, 50.90s/it]

Training Loss : 0.00477141812969232, Testing Loss : 0.8031827348709106, Training Accuracy : 0.99852, Testing Accuracy : 0.9022

53%|█████ | 160/300 [2:16:33<1:58:49, 50.93s/it]

Training Loss : 0.0038386171166808346, Testing Loss : 0.8071995328903199, Training Accuracy : 0.99858, Testing Accuracy : 0.9033

54%|█████ | 161/300 [2:17:24<1:58:07, 50.99s/it]

Training Loss : 0.0032164782875822857, Testing Loss : 0.7878219114303588, Training Accuracy : 0.99886, Testing Accuracy : 0.8997

54%|█████ | 162/300 [2:18:15<1:57:16, 50.99s/it]

Training Loss : 0.0030464987052371724, Testing Loss : 0.823957995223999, Training Accuracy : 0.99906, Testing Accuracy : 0.9005

54%|█████ | 163/300 [2:19:06<1:56:34, 51.05s/it]

```
Training Loss : 0.0033836057395429816, Testing Loss :
0.8014932064056397, Training Accuracy : 0.99882, Testing Accuracy :
0.9009

  55%|█████▍    | 164/300 [2:19:57<1:55:44, 51.06s/it]

Training Loss : 0.0032618047516507795, Testing Loss :
0.8112586256027222, Training Accuracy : 0.9988, Testing Accuracy :
0.9022

  55%|█████▌    | 165/300 [2:20:48<1:54:47, 51.02s/it]

Training Loss : 0.003548431966792559, Testing Loss :
0.7818201166152954, Training Accuracy : 0.9987, Testing Accuracy :
0.9046

  55%|█████▌    | 166/300 [2:21:39<1:53:59, 51.04s/it]

Training Loss : 0.0041181645238783674, Testing Loss :
0.8446761102676391, Training Accuracy : 0.99866, Testing Accuracy :
0.9014

  56%|█████▌    | 167/300 [2:22:30<1:53:00, 50.98s/it]

Training Loss : 0.002983610574924387, Testing Loss :
0.8195399427413941, Training Accuracy : 0.99906, Testing Accuracy :
0.9054

  56%|█████▌    | 168/300 [2:23:21<1:52:15, 51.03s/it]

Training Loss : 0.003153784282951383, Testing Loss :
0.8170462337493897, Training Accuracy : 0.99896, Testing Accuracy :
0.9045

  56%|█████▋    | 169/300 [2:24:12<1:51:19, 50.99s/it]

Training Loss : 0.002136486003516475, Testing Loss :
0.8091119619369507, Training Accuracy : 0.99928, Testing Accuracy :
0.904

  57%|█████▋    | 170/300 [2:25:03<1:50:17, 50.90s/it]

Training Loss : 0.0028767390765447637, Testing Loss :
0.8156860592842102, Training Accuracy : 0.99904, Testing Accuracy :
0.9047

  57%|█████▋    | 171/300 [2:25:53<1:49:22, 50.87s/it]

Training Loss : 0.002559233480351977, Testing Loss :
0.8492470369338989, Training Accuracy : 0.99902, Testing Accuracy :
0.9026

  57%|█████▋    | 172/300 [2:26:44<1:48:39, 50.93s/it]
```

Training Loss : 0.003418964117845171, Testing Loss : 0.8522388998031616, Training Accuracy : 0.9988, Testing Accuracy : 0.9021

58%|█████▊ | 173/300 [2:27:35<1:47:41, 50.88s/it]

Training Loss : 0.0022764653942803853, Testing Loss : 0.8427023044586182, Training Accuracy : 0.99916, Testing Accuracy : 0.9054

58%|█████▊ | 174/300 [2:28:26<1:46:52, 50.90s/it]

Training Loss : 0.002499260561071569, Testing Loss : 0.8500173004150391, Training Accuracy : 0.99922, Testing Accuracy : 0.9058

58%|█████▊ | 175/300 [2:29:17<1:45:53, 50.83s/it]

Training Loss : 0.002477884211888304, Testing Loss : 0.8653850040435791, Training Accuracy : 0.99918, Testing Accuracy : 0.9029

59%|█████▊ | 176/300 [2:30:07<1:44:53, 50.75s/it]

Training Loss : 0.003174857552264002, Testing Loss : 0.8308139001846313, Training Accuracy : 0.99876, Testing Accuracy : 0.9044

59%|█████▉ | 177/300 [2:30:58<1:43:55, 50.70s/it]

Training Loss : 0.0025976306420675247, Testing Loss : 0.8470906871795655, Training Accuracy : 0.99902, Testing Accuracy : 0.9049

59%|█████▉ | 178/300 [2:31:48<1:42:58, 50.64s/it]

Training Loss : 0.00231049285216548, Testing Loss : 0.8276982587814331, Training Accuracy : 0.99934, Testing Accuracy : 0.9033

60%|█████▉ | 179/300 [2:32:39<1:42:06, 50.63s/it]

Training Loss : 0.002491321845506318, Testing Loss : 0.8444987884521484, Training Accuracy : 0.9991, Testing Accuracy : 0.9023

60%|██████ | 180/300 [2:33:30<1:41:23, 50.69s/it]

Training Loss : 0.002201857864788035, Testing Loss : 0.8339889083862305, Training Accuracy : 0.99924, Testing Accuracy : 0.9033

60%|██████ | 181/300 [2:34:21<1:40:40, 50.76s/it]

Training Loss : 0.0022242462680040626, Testing Loss : 0.8469061563491821, Training Accuracy : 0.99926, Testing Accuracy : 0.9017

61%|██████ | 182/300 [2:35:11<1:39:46, 50.73s/it]

Training Loss : 0.002140436285244068З, Testing Loss : 0.8639230482101441, Training Accuracy : 0.99936, Testing Accuracy : 0.9005

61%|██████ | 183/300 [2:36:02<1:39:00, 50.78s/it]

Training Loss : 0.0017831492005850305, Testing Loss : 0.8616066614151001, Training Accuracy : 0.99948, Testing Accuracy : 0.9016

61%|██████ | 184/300 [2:36:54<1:38:24, 50.90s/it]

Training Loss : 0.0019615114069943956, Testing Loss : 0.8470353394508362, Training Accuracy : 0.9993, Testing Accuracy : 0.9025

62%|██████ | 185/300 [2:37:44<1:37:32, 50.89s/it]

Training Loss : 0.0012707646010955795, Testing Loss : 0.8535498532295227, Training Accuracy : 0.9996, Testing Accuracy : 0.9031

62%|██████ | 186/300 [2:38:35<1:36:47, 50.94s/it]

Training Loss : 0.0016926959101803368, Testing Loss : 0.8697939449310302, Training Accuracy : 0.99946, Testing Accuracy : 0.9028

62%|██████ | 187/300 [2:39:26<1:35:59, 50.97s/it]

Training Loss : 0.0015276374933397164, Testing Loss : 0.854123497581482, Training Accuracy : 0.99944, Testing Accuracy : 0.9018

63%|██████ | 188/300 [2:40:18<1:35:13, 51.01s/it]

Training Loss : 0.0013817401086476456, Testing Loss : 0.8619166292190552, Training Accuracy : 0.99958, Testing Accuracy : 0.9033

63%|██████ | 189/300 [2:41:09<1:34:29, 51.08s/it]

Training Loss : 0.0014668849312787643, Testing Loss : 0.8878795812606811, Training Accuracy : 0.99952, Testing Accuracy : 0.9029

63%|██████ | 190/300 [2:42:00<1:33:40, 51.09s/it]

Training Loss : 0.001603145031001186, Testing Loss : 0.8870611333847046, Training Accuracy : 0.99936, Testing Accuracy : 0.9019

64%|██████ | 191/300 [2:42:51<1:32:36, 50.98s/it]

Training Loss : 0.0012872944354329957, Testing Loss : 0.8706885913848877, Training Accuracy : 0.99954, Testing Accuracy : 0.9046

64%|██████ | 192/300 [2:43:41<1:31:38, 50.91s/it]

Training Loss : 0.0011527497309463798, Testing Loss : 0.8908356689453125, Training Accuracy : 0.99956, Testing Accuracy : 0.9015

64%|██████ | 193/300 [2:44:32<1:30:42, 50.86s/it]

Training Loss : 0.001552067307835241, Testing Loss : 0.9000921714782715, Training Accuracy : 0.99938, Testing Accuracy : 0.9017

65%|██████ | 194/300 [2:45:23<1:29:43, 50.79s/it]

Training Loss : 0.0014868620837514754, Testing Loss : 0.8858149404525757, Training Accuracy : 0.99954, Testing Accuracy : 0.9025

65%|██████ | 195/300 [2:46:14<1:29:00, 50.86s/it]

Training Loss : 0.0013772405012429227, Testing Loss : 0.8823462217330933, Training Accuracy : 0.99958, Testing Accuracy : 0.9033

65%|██████ | 196/300 [2:47:05<1:28:11, 50.88s/it]

Training Loss : 0.0014457776544109947, Testing Loss : 0.8940965169906616, Training Accuracy : 0.99942, Testing Accuracy : 0.9038

66%|██████ | 197/300 [2:47:56<1:27:22, 50.90s/it]

Training Loss : 0.0011373009935196023, Testing Loss : 0.900211085319519, Training Accuracy : 0.99966, Testing Accuracy : 0.9011

66%|██████ | 198/300 [2:48:49<1:27:42, 51.60s/it]

Training Loss : 0.002050926998260402, Testing Loss : 0.8836528495788574, Training Accuracy : 0.9994, Testing Accuracy : 0.9035

66%|██████ | 199/300 [2:49:48<1:30:50, 53.96s/it]

```
Training Loss : 0.0011143070919612365, Testing Loss :
0.8816720867156982, Training Accuracy : 0.99962, Testing Accuracy :
0.9046

  67%|██████▋   | 200/300 [2:50:40<1:28:36, 53.16s/it]

Training Loss : 0.0007448410855572001, Testing Loss :
0.881587327003479, Training Accuracy : 0.9998, Testing Accuracy :
0.9059

  67%|██████▋   | 201/300 [2:51:31<1:26:42, 52.55s/it]

Training Loss : 0.0008048689009636291, Testing Loss :
0.8906183671951294, Training Accuracy : 0.99974, Testing Accuracy :
0.9031

  67%|██████▋   | 202/300 [2:52:22<1:25:02, 52.06s/it]

Training Loss : 0.001035868179868412, Testing Loss :
0.8893550983428955, Training Accuracy : 0.99974, Testing Accuracy :
0.9057

  68%|██████▊   | 203/300 [2:53:13<1:23:39, 51.75s/it]

Training Loss : 0.0009396091673980118, Testing Loss :
0.8847817403793335, Training Accuracy : 0.99966, Testing Accuracy :
0.9054

  68%|██████▊   | 204/300 [2:54:04<1:22:23, 51.50s/it]

Training Loss : 0.0008993289570731576, Testing Loss :
0.8899982124328614, Training Accuracy : 0.99976, Testing Accuracy :
0.9057

  68%|██████▊   | 205/300 [2:54:55<1:21:19, 51.37s/it]

Training Loss : 0.0008991531142067106, Testing Loss :
0.8877524303436279, Training Accuracy : 0.9997, Testing Accuracy :
0.9066

  69%|██████▊   | 206/300 [2:55:46<1:20:29, 51.38s/it]

Training Loss : 0.0009551707641070243, Testing Loss :
0.8858672128677368, Training Accuracy : 0.99976, Testing Accuracy :
0.9058

  69%|██████▉   | 207/300 [2:56:38<1:19:38, 51.38s/it]

Training Loss : 0.0006348084736864985, Testing Loss :
0.8917285196304321, Training Accuracy : 0.9998, Testing Accuracy :
0.9052

  69%|██████▉   | 208/300 [2:57:29<1:18:47, 51.39s/it]
```

```
Training Loss : 0.0007802345749520464, Testing Loss :
0.8947995538711548, Training Accuracy : 0.99978, Testing Accuracy :
0.9059

  70%|███████   | 209/300 [2:58:20<1:17:51, 51.34s/it]

Training Loss : 0.0005782808246492642, Testing Loss :
0.8881461557388306, Training Accuracy : 0.99988, Testing Accuracy :
0.9074

  70%|███████   | 210/300 [2:59:11<1:16:59, 51.33s/it]

Training Loss : 0.0006288890600615378, Testing Loss :
0.9109743284225464, Training Accuracy : 0.9998, Testing Accuracy :
0.9062

  70%|███████   | 211/300 [3:00:03<1:16:06, 51.31s/it]

Training Loss : 0.0006402160031773019, Testing Loss :
0.9021716806411744, Training Accuracy : 0.99984, Testing Accuracy :
0.9061

  71%|███████   | 212/300 [3:00:54<1:15:17, 51.33s/it]

Training Loss : 0.0007016081201886118, Testing Loss :
0.885417834854126, Training Accuracy : 0.99978, Testing Accuracy :
0.9046

  71%|███████   | 213/300 [3:01:45<1:14:19, 51.26s/it]

Training Loss : 0.0004082954041505218, Testing Loss :
0.8956965250015259, Training Accuracy : 0.99992, Testing Accuracy :
0.903

  71%|███████▏  | 214/300 [3:02:37<1:13:33, 51.32s/it]

Training Loss : 0.0006002946882021206, Testing Loss :
0.8842525207519532, Training Accuracy : 0.99984, Testing Accuracy :
0.9073

  72%|███████▏  | 215/300 [3:03:28<1:12:42, 51.33s/it]

Training Loss : 0.0004938728427952446, Testing Loss :
0.8913155504226684, Training Accuracy : 0.99986, Testing Accuracy :
0.9071

  72%|███████▏  | 216/300 [3:04:20<1:11:58, 51.41s/it]

Training Loss : 0.0007424291462257679, Testing Loss :
0.8803761440277099, Training Accuracy : 0.99982, Testing Accuracy :
0.908

  72%|███████▏  | 217/300 [3:05:11<1:10:59, 51.32s/it]
```

```
Training Loss : 0.0005144968446737767, Testing Loss :
0.8815626829147339, Training Accuracy : 0.99984, Testing Accuracy :
0.9076

 73%|███████▎  | 218/300 [3:06:02<1:10:13, 51.38s/it]

Training Loss : 0.0005941037845230312, Testing Loss :
0.8948750741958618, Training Accuracy : 0.99982, Testing Accuracy :
0.9068

 73%|███████▎  | 219/300 [3:06:53<1:09:13, 51.28s/it]

Training Loss : 0.0006246755056586699, Testing Loss :
0.9044326845169067, Training Accuracy : 0.99978, Testing Accuracy :
0.9058

 73%|███████▎  | 220/300 [3:07:45<1:08:21, 51.27s/it]

Training Loss : 0.0004459401000583603, Testing Loss :
0.9088032415390015, Training Accuracy : 0.99988, Testing Accuracy :
0.9059

 74%|███████▎  | 221/300 [3:08:36<1:07:25, 51.21s/it]

Training Loss : 0.0007110616277246663, Testing Loss :
0.8970952592849731, Training Accuracy : 0.9998, Testing Accuracy :
0.9045

 74%|███████▍  | 222/300 [3:09:27<1:06:35, 51.23s/it]

Training Loss : 0.00025482240501994963, Testing Loss :
0.8970874322891236, Training Accuracy : 0.99992, Testing Accuracy :
0.907

 74%|███████▍  | 223/300 [3:10:18<1:05:39, 51.16s/it]

Training Loss : 0.0003585912481438936, Testing Loss :
0.9028159708023071, Training Accuracy : 0.99988, Testing Accuracy :
0.9058

 75%|███████▍  | 224/300 [3:11:09<1:04:46, 51.14s/it]

Training Loss : 0.00034702125511736087, Testing Loss :
0.8870800918579101, Training Accuracy : 0.99982, Testing Accuracy :
0.9077

 75%|███████▌  | 225/300 [3:12:00<1:03:52, 51.10s/it]

Training Loss : 0.0006089687250959832, Testing Loss :
0.8993916067123413, Training Accuracy : 0.99978, Testing Accuracy :
0.9066

 75%|███████▌  | 226/300 [3:12:51<1:03:02, 51.12s/it]
```

Training Loss : 0.0004178913993193783, Testing Loss : 0.9015969837188721, Training Accuracy : 0.99988, Testing Accuracy : 0.908

76%|███████▋ | 227/300 [3:13:42<1:02:10, 51.10s/it]

Training Loss : 0.00048263626122679854, Testing Loss : 0.9069729877471924, Training Accuracy : 0.99982, Testing Accuracy : 0.9085

76%|███████▋ | 228/300 [3:14:33<1:01:17, 51.07s/it]

Training Loss : 0.00046590026175457753, Testing Loss : 0.9066013118743896, Training Accuracy : 0.99984, Testing Accuracy : 0.9077

76%|███████▋ | 229/300 [3:15:24<1:00:26, 51.08s/it]

Training Loss : 0.0007368614208076542, Testing Loss : 0.895356967163086, Training Accuracy : 0.99982, Testing Accuracy : 0.9085

77%|███████▋ | 230/300 [3:16:15<59:37, 51.11s/it]

Training Loss : 0.00046476834930899715, Testing Loss : 0.9011243082046508, Training Accuracy : 0.99986, Testing Accuracy : 0.9086

77%|███████▋ | 231/300 [3:17:07<58:48, 51.14s/it]

Training Loss : 0.000445351462991639, Testing Loss : 0.9009127960205078, Training Accuracy : 0.99978, Testing Accuracy : 0.9073

77%|███████▋ | 232/300 [3:17:58<57:57, 51.14s/it]

Training Loss : 0.0005127643899441319, Testing Loss : 0.9054116865158081, Training Accuracy : 0.99984, Testing Accuracy : 0.9077

78%|███████▊ | 233/300 [3:18:49<57:04, 51.10s/it]

Training Loss : 0.00031126609182589166, Testing Loss : 0.9031611358642578, Training Accuracy : 0.9999, Testing Accuracy : 0.9055

78%|███████▊ | 234/300 [3:19:40<56:12, 51.09s/it]

Training Loss : 0.0002684750138757772, Testing Loss : 0.9028611837387085, Training Accuracy : 0.99998, Testing Accuracy : 0.9072

78%|███████▊ | 235/300 [3:20:31<55:13, 50.97s/it]

```
Training Loss : 0.0003302029976220092, Testing Loss :
0.9077067028045654, Training Accuracy : 0.9999, Testing Accuracy :
0.907

  79%|███████▉  | 236/300 [3:21:21<54:18, 50.91s/it]

Training Loss : 0.00026065792688819784, Testing Loss :
0.905486516571045, Training Accuracy : 0.99998, Testing Accuracy :
0.9072

  79%|███████▉  | 237/300 [3:22:12<53:29, 50.95s/it]

Training Loss : 0.00025933491974818935, Testing Loss :
0.9028813423156739, Training Accuracy : 0.99992, Testing Accuracy :
0.9081

  79%|███████▉  | 238/300 [3:23:04<52:41, 51.00s/it]

Training Loss : 0.00024412092545997438, Testing Loss :
0.9020314725875854, Training Accuracy : 0.99992, Testing Accuracy :
0.9073

  80%|███████▉  | 239/300 [3:23:55<51:51, 51.02s/it]

Training Loss : 0.00028539183095314914, Testing Loss :
0.8932269176483154, Training Accuracy : 0.99992, Testing Accuracy :
0.9087

  80%|████████  | 240/300 [3:24:46<51:06, 51.10s/it]

Training Loss : 0.000284489125268301, Testing Loss :
0.8857171108245849, Training Accuracy : 0.99992, Testing Accuracy :
0.9092

  80%|████████  | 241/300 [3:25:37<50:14, 51.10s/it]

Training Loss : 0.0001923778518077961, Testing Loss :
0.8871955110549927, Training Accuracy : 0.99994, Testing Accuracy :
0.9091

  81%|████████  | 242/300 [3:26:28<49:18, 51.00s/it]

Training Loss : 9.266969063664874e-05, Testing Loss :
0.9012803981781006, Training Accuracy : 1.0, Testing Accuracy : 0.9087

  81%|████████  | 243/300 [3:27:19<48:27, 51.02s/it]

Training Loss : 0.0003472817742087682, Testing Loss :
0.9031142080307006, Training Accuracy : 0.99992, Testing Accuracy :
0.9086

  81%|████████▏ | 244/300 [3:28:10<47:34, 50.98s/it]
```

Training Loss : 0.00033432609525962107, Testing Loss : 0.9093371629714966, Training Accuracy : 0.99992, Testing Accuracy : 0.9087

82%|████████▏ | 245/300 [3:29:01<46:43, 50.97s/it]

Training Loss : 0.00024230618792236782, Testing Loss : 0.9136047626495362, Training Accuracy : 0.9999, Testing Accuracy : 0.9084

82%|████████▏ | 246/300 [3:29:51<45:47, 50.89s/it]

Training Loss : 7.413080795477982e-05, Testing Loss : 0.9056895925521851, Training Accuracy : 1.0, Testing Accuracy : 0.9073

82%|████████▏ | 247/300 [3:30:42<44:54, 50.84s/it]

Training Loss : 0.00017540839177658199, Testing Loss : 0.8986705682754517, Training Accuracy : 0.99994, Testing Accuracy : 0.9081

83%|████████▎ | 248/300 [3:31:33<44:02, 50.82s/it]

Training Loss : 0.00011798388695808171, Testing Loss : 0.9016917812347413, Training Accuracy : 0.99996, Testing Accuracy : 0.908

83%|████████▎ | 249/300 [3:32:24<43:14, 50.88s/it]

Training Loss : 9.785386035913689e-05, Testing Loss : 0.8848627403259277, Training Accuracy : 0.99998, Testing Accuracy : 0.9095

83%|████████▎ | 250/300 [3:33:15<42:24, 50.89s/it]

Training Loss : 0.00013232295248157244, Testing Loss : 0.8962960311889648, Training Accuracy : 0.99998, Testing Accuracy : 0.9088

84%|████████▎ | 251/300 [3:34:06<41:35, 50.92s/it]

Training Loss : 0.00016686588698647028, Testing Loss : 0.9010891695022583, Training Accuracy : 0.99996, Testing Accuracy : 0.9092

84%|████████▍ | 252/300 [3:34:57<40:45, 50.95s/it]

Training Loss : 0.00013017456238248996, Testing Loss : 0.8924423376083374, Training Accuracy : 0.99996, Testing Accuracy : 0.9098

84%|████████▍ | 253/300 [3:35:48<39:56, 50.99s/it]

Training Loss : 8.11861441588917e-05, Testing Loss : 0.900041445350647, Training Accuracy : 0.99998, Testing Accuracy : 0.909

  85%|████████▌ | 254/300 [3:36:39<39:06, 51.01s/it]

Training Loss : 6.433800255985262e-05, Testing Loss : 0.9025978561401368, Training Accuracy : 1.0, Testing Accuracy : 0.91

  85%|████████▌ | 255/300 [3:37:30<38:10, 50.90s/it]

Training Loss : 0.0001880900415128599, Testing Loss : 0.8977223369598388, Training Accuracy : 0.99994, Testing Accuracy : 0.9091

  85%|████████▌ | 256/300 [3:38:20<37:19, 50.89s/it]

Training Loss : 0.0003528121132853994, Testing Loss : 0.8843817012786865, Training Accuracy : 0.99994, Testing Accuracy : 0.9086

  86%|████████▌ | 257/300 [3:39:11<36:29, 50.92s/it]

Training Loss : 8.38282883031843e-05, Testing Loss : 0.8836763265609742, Training Accuracy : 1.0, Testing Accuracy : 0.9093

  86%|████████▌ | 258/300 [3:40:02<35:35, 50.84s/it]

Training Loss : 8.564110123630599e-05, Testing Loss : 0.8847475196838379, Training Accuracy : 0.99996, Testing Accuracy : 0.9092

  86%|████████▋ | 259/300 [3:40:53<34:43, 50.81s/it]

Training Loss : 0.00015333330261881203, Testing Loss : 0.8974042242050171, Training Accuracy : 0.99996, Testing Accuracy : 0.908

  87%|████████▋ | 260/300 [3:41:43<33:49, 50.74s/it]

Training Loss : 0.0001611334771888687, Testing Loss : 0.8933354608535766, Training Accuracy : 0.99992, Testing Accuracy : 0.9081

  87%|████████▋ | 261/300 [3:42:34<32:56, 50.68s/it]

Training Loss : 0.00015963064575724275, Testing Loss : 0.8880355043411254, Training Accuracy : 0.99994, Testing Accuracy : 0.9083

  87%|████████▋ | 262/300 [3:43:25<32:07, 50.72s/it]

Training Loss : 8.828595508399303e-05, Testing Loss : 0.8960384475708008, Training Accuracy : 0.99998, Testing Accuracy : 0.9077

88%|████████▊ | 263/300 [3:44:15<31:16, 50.71s/it]

Training Loss : 7.426386086227467e-05, Testing Loss : 0.9049221477508544, Training Accuracy : 1.0, Testing Accuracy : 0.9081

88%|████████▊ | 264/300 [3:45:06<30:26, 50.73s/it]

Training Loss : 4.167718523266558e-05, Testing Loss : 0.9002041599273681, Training Accuracy : 1.0, Testing Accuracy : 0.9076

88%|████████▊ | 265/300 [3:45:57<29:34, 50.71s/it]

Training Loss : 0.0001488295212648518, Testing Loss : 0.9009486927032471, Training Accuracy : 0.99992, Testing Accuracy : 0.9094

89%|████████▊ | 266/300 [3:46:48<28:44, 50.73s/it]

Training Loss : 0.00016064454841876796, Testing Loss : 0.8936187274932861, Training Accuracy : 0.99996, Testing Accuracy : 0.9078

89%|████████▉ | 267/300 [3:47:38<27:54, 50.75s/it]

Training Loss : 0.00026320853857683685, Testing Loss : 0.8961486850738526, Training Accuracy : 0.99994, Testing Accuracy : 0.9076

89%|████████▉ | 268/300 [3:48:29<27:03, 50.73s/it]

Training Loss : 0.00015724864671870818, Testing Loss : 0.8952534183502198, Training Accuracy : 0.99992, Testing Accuracy : 0.9069

90%|████████▉ | 269/300 [3:49:20<26:10, 50.67s/it]

Training Loss : 0.00020258985132941233, Testing Loss : 0.9011320625305176, Training Accuracy : 0.9999, Testing Accuracy : 0.9077

90%|█████████ | 270/300 [3:50:11<25:21, 50.73s/it]

Training Loss : 0.0001555970762873767, Testing Loss : 0.8970725683212281, Training Accuracy : 0.99994, Testing Accuracy : 0.9062

90%|█████████ | 271/300 [3:51:01<24:33, 50.80s/it]

Training Loss : 8.992030086203158e-05, Testing Loss : 0.9001034774780273, Training Accuracy : 0.99996, Testing Accuracy : 0.9076

 91%|█████████ | 272/300 [3:51:52<23:41, 50.78s/it]

Training Loss : 8.086783804639709e-05, Testing Loss : 0.8991886541366577, Training Accuracy : 0.99998, Testing Accuracy : 0.9058

 91%|█████████ | 273/300 [3:52:43<22:50, 50.76s/it]

Training Loss : 8.895734931990774e-05, Testing Loss : 0.8972369703292846, Training Accuracy : 0.99998, Testing Accuracy : 0.9069

 91%|█████████▏| 274/300 [3:53:33<21:57, 50.67s/it]

Training Loss : 0.0001062703420744765, Testing Loss : 0.8977965608596802, Training Accuracy : 0.99996, Testing Accuracy : 0.9066

 92%|█████████▏| 275/300 [3:54:24<21:09, 50.78s/it]

Training Loss : 7.35212997106646e-05, Testing Loss : 0.903005383682251, Training Accuracy : 1.0, Testing Accuracy : 0.9081

 92%|█████████▏| 276/300 [3:55:15<20:18, 50.78s/it]

Training Loss : 0.00010086078776652357, Testing Loss : 0.8910212690353394, Training Accuracy : 0.99998, Testing Accuracy : 0.9091

 92%|█████████▏| 277/300 [3:56:06<19:27, 50.78s/it]

Training Loss : 6.345088668364042e-05, Testing Loss : 0.8948294485092163, Training Accuracy : 1.0, Testing Accuracy : 0.9083

 93%|█████████▎| 278/300 [3:56:57<18:36, 50.76s/it]

Training Loss : 3.79780849277995e-05, Testing Loss : 0.8953192672729492, Training Accuracy : 1.0, Testing Accuracy : 0.9086

 93%|█████████▎| 279/300 [3:57:48<17:46, 50.79s/it]

Training Loss : 6.0222824082648e-05, Testing Loss : 0.8913285987854004, Training Accuracy : 1.0, Testing Accuracy : 0.9085

 93%|█████████▎| 280/300 [3:58:39<16:57, 50.87s/it]

Training Loss : 0.0001339137397097784, Testing Loss : 0.898799319267273, Training Accuracy : 0.99996, Testing Accuracy : 0.9073

94%|█████████▍| 281/300 [3:59:29<16:04, 50.74s/it]

Training Loss : 5.675085882240637e-05, Testing Loss : 0.8998699432373047, Training Accuracy : 0.99998, Testing Accuracy : 0.9091

94%|█████████▍| 282/300 [4:00:20<15:14, 50.78s/it]

Training Loss : 0.00017403147531562353, Testing Loss : 0.8963168973922729, Training Accuracy : 0.99996, Testing Accuracy : 0.9083

94%|█████████▍| 283/300 [4:01:11<14:25, 50.92s/it]

Training Loss : 7.690858631136508e-05, Testing Loss : 0.8903482683181763, Training Accuracy : 0.99998, Testing Accuracy : 0.9084

95%|█████████▍| 284/300 [4:02:03<13:38, 51.15s/it]

Training Loss : 5.6995820398824435e-05, Testing Loss : 0.8989663415908814, Training Accuracy : 0.99998, Testing Accuracy : 0.908

95%|█████████▌| 285/300 [4:02:54<12:48, 51.27s/it]

Training Loss : 0.00015025897333011018, Testing Loss : 0.8906532461166382, Training Accuracy : 0.99992, Testing Accuracy : 0.9082

95%|█████████▌| 286/300 [4:03:46<11:59, 51.40s/it]

Training Loss : 9.792858137820076e-05, Testing Loss : 0.8862478288650513, Training Accuracy : 0.99996, Testing Accuracy : 0.9091

96%|█████████▌| 287/300 [4:04:38<11:10, 51.59s/it]

Training Loss : 0.0001875969904307476, Testing Loss : 0.8913717193603515, Training Accuracy : 0.99994, Testing Accuracy : 0.9099

96%|█████████▌| 288/300 [4:05:30<10:18, 51.54s/it]

Training Loss : 6.713005687173791e-05, Testing Loss : 0.8928942699432373, Training Accuracy : 0.99996, Testing Accuracy : 0.9096

96%|█████████▋| 289/300 [4:06:22<09:28, 51.69s/it]

Training Loss : 7.681953863211674e-05, Testing Loss : 0.8867801252365113, Training Accuracy : 0.99998, Testing Accuracy : 0.9094

```
 97%|█████████▋| 290/300 [4:07:13<08:35, 51.58s/it]

Training Loss : 0.00010515581149370519, Testing Loss :
0.8936367736816406, Training Accuracy : 0.99998, Testing Accuracy :
0.9098

 97%|█████████▋| 291/300 [4:08:04<07:42, 51.37s/it]

Training Loss : 5.34507504199064e-05, Testing Loss :
0.9020443077087402, Training Accuracy : 1.0, Testing Accuracy : 0.9094

 97%|█████████▋| 292/300 [4:08:55<06:49, 51.23s/it]

Training Loss : 4.531724847141049e-05, Testing Loss :
0.893029552268982, Training Accuracy : 1.0, Testing Accuracy : 0.9091

 98%|█████████▊| 293/300 [4:09:46<05:57, 51.12s/it]

Training Loss : 7.499904556716956e-05, Testing Loss :
0.8911246658325195, Training Accuracy : 0.99998, Testing Accuracy :
0.9103

 98%|█████████▊| 294/300 [4:10:37<05:06, 51.07s/it]

Training Loss : 0.000151848534910132, Testing Loss :
0.8883499725341797, Training Accuracy : 0.99996, Testing Accuracy :
0.9094

 98%|█████████▊| 295/300 [4:11:28<04:15, 51.04s/it]

Training Loss : 9.402232863081736e-05, Testing Loss :
0.893212726020813, Training Accuracy : 0.99996, Testing Accuracy :
0.909

 99%|█████████▉| 296/300 [4:12:18<03:24, 51.00s/it]

Training Loss : 0.00011274880523808861, Testing Loss :
0.8893809450149536, Training Accuracy : 0.99996, Testing Accuracy :
0.9093

 99%|█████████▉| 297/300 [4:13:10<02:33, 51.07s/it]

Training Loss : 4.8712326661543556e-05, Testing Loss :
0.8950667188644409, Training Accuracy : 1.0, Testing Accuracy : 0.9097

 99%|█████████▉| 298/300 [4:14:01<01:42, 51.09s/it]

Training Loss : 4.7734787972403866e-05, Testing Loss :
0.8879029741287231, Training Accuracy : 0.99998, Testing Accuracy :
0.9097

100%|██████████| 299/300 [4:14:52<00:51, 51.17s/it]
```

```
Training Loss : 6.081132718552908e-05, Testing Loss :
0.8918021245956421, Training Accuracy : 1.0, Testing Accuracy : 0.9093

100%|██████████| 300/300 [4:15:43<00:00, 51.15s/it]

Training Loss : 5.994382976879024e-05, Testing Loss :
0.8847070940017701, Training Accuracy : 0.99998, Testing Accuracy :
0.9091
```

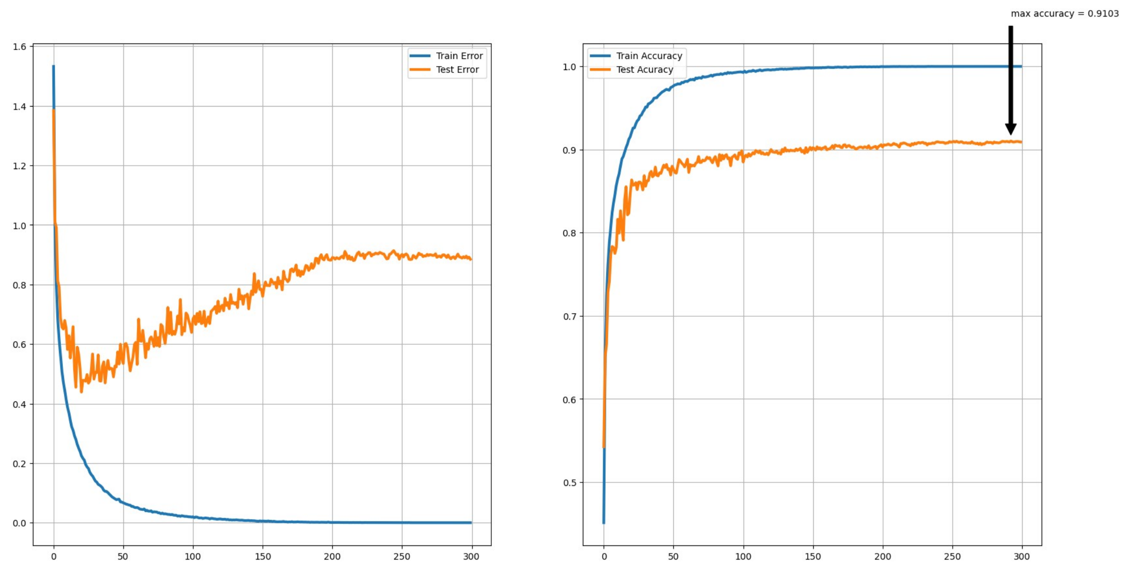
```
print("Maximum Testing Accuracy: %s"%(max(test_accuracy)))
xmax = np.argmax(test_accuracy)
ymax = max(test_accuracy)
```

```
Maximum Testing Accuracy: 0.9103
```

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/model1.pt')
```

Below we are just converting our pt model into onnx format to build the Resnet Architecture diagram

```
pip install onnx
```

```
Looking in indexes: https://pypi.org/simple, https://us-python.pkg.dev/colab-wheels/public/simple/
Collecting onnx
  Downloading onnx-1.13.1-cp39-cp39-manylinux_2_17_x86_64.manylinux2014_x86_64.whl (13.5 MB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 13.5/13.5 MB 89.7 MB/s eta 0:00:00
ent already satisfied: typing-extensions>=3.6.2.1 in /usr/local/lib/python3.9/dist-packages (from onnx) (4.5.0)
Requirement already satisfied: numpy>=1.16.6 in /usr/local/lib/python3.9/dist-packages (from onnx) (1.22.4)
Requirement already satisfied: protobuf<4,>=3.20.2 in /usr/local/lib/python3.9/dist-packages (from onnx) (3.20.3)
Installing collected packages: onnx
Successfully installed onnx-1.13.1
```

```
model = resnet_model()
model.load_state_dict(torch.load('/content/model1.pt'))
# set the model to inference mode
model.eval()

# Let's create a dummy input tensor
dummy_input = torch.randn(4, 3, 32, 32)
```

```python
# torch.onnx.export(model, dummy_input, "final_model.onnx")

# Export the model
torch.onnx.export(model,         # model being run
      dummy_input,       # model input (or a tuple for multiple
inputs)
      "final_model1_0pt1.onnx",       # where to save the model
      export_params=True,  # store the trained parameter weights
inside the model file
      opset_version=13,    # the ONNX version to export the model to
      do_constant_folding=True,  # whether to execute constant folding
for optimization
      input_names = ['modelInput'],   # the model's input names
      output_names = ['modelOutput'],# the model's output names
)

torch.save(model.state_dict(), 'final_model1_0pt1.pt')
```

```
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
============= Diagnostic Run torch.onnx.export version 2.0.0+cu118
=============
verbose: False, log level: Level.ERROR
======================= 0 NONE 0 NOTE 0 WARNING 0 ERROR
========================
```

```python
from google.colab import files
files.download('final_model1_0pt1.onnx')
```

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

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

```python
import urllib.request
from IPython.display import SVG, display

# URL of the SVG image we are downloading
url = "https://svgshare.com/i/s0w.svg"

# Download the SVG image
svg_data = urllib.request.urlopen(url).read()
```

```python
# Display the SVG image in Colab
display(SVG(svg_data))
```