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 = []
```

```
        # 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 [00:02<00:00, 63156896.68it/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
```

```python
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 = 0.001  # set the learning rate to 0.001
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 [00:59<4:55:23, 59.28s/it]

Training Loss : 2.3302755294799806, Testing Loss : 2.2376379322052,
Training Accuracy : 0.12612, Testing Accuracy : 0.1733

  1%|          | 2/300 [01:51<4:33:18, 55.03s/it]

Training Loss : 2.1800979666137694, Testing Loss : 2.105339261627197,
Training Accuracy : 0.19764, Testing Accuracy : 0.2379

  1%|          | 3/300 [02:42<4:24:21, 53.41s/it]

Training Loss : 2.066545298461914, Testing Loss : 1.989836116218567,
Training Accuracy : 0.2472, Testing Accuracy : 0.2829

  1%|▏         | 4/300 [03:34<4:19:31, 52.61s/it]

Training Loss : 1.9536855908203126, Testing Loss : 1.8889239568710328,
Training Accuracy : 0.29152, Testing Accuracy : 0.3224

  2%|▏         | 5/300 [04:26<4:17:34, 52.39s/it]

Training Loss : 1.86410318359375, Testing Loss : 1.8164858673095703,
Training Accuracy : 0.32394, Testing Accuracy : 0.3534

  2%|▏         | 6/300 [05:18<4:17:12, 52.49s/it]

Training Loss : 1.8066582479858397, Testing Loss : 1.77198698387146,
Training Accuracy : 0.35034, Testing Accuracy : 0.3673

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

Training Loss : 1.7557713940429687, Testing Loss : 1.726117094039917,
Training Accuracy : 0.3681, Testing Accuracy : 0.381

  3%|▎         | 8/300 [07:03<4:15:00, 52.40s/it]

Training Loss : 1.706555347290039, Testing Loss : 1.6913350030899048,
Training Accuracy : 0.38646, Testing Accuracy : 0.4002
```

```
  3%|▎         | 9/300 [07:56<4:15:07, 52.60s/it]

Training Loss : 1.6625385479736328, Testing Loss : 1.6443766328811646,
Training Accuracy : 0.40182, Testing Accuracy : 0.4164

  3%|▎         | 10/300 [08:48<4:13:10, 52.38s/it]

Training Loss : 1.6269939767456054, Testing Loss : 1.6197947128295898,
Training Accuracy : 0.41784, Testing Accuracy : 0.4217

  4%|▎         | 11/300 [09:41<4:12:57, 52.52s/it]

Training Loss : 1.5883992578125, Testing Loss : 1.584962646484375,
Training Accuracy : 0.43122, Testing Accuracy : 0.4377

  4%|▍         | 12/300 [10:33<4:12:09, 52.53s/it]

Training Loss : 1.556598942565918, Testing Loss : 1.5567666582107544,
Training Accuracy : 0.44386, Testing Accuracy : 0.4452

  4%|▍         | 13/300 [11:26<4:11:18, 52.54s/it]

Training Loss : 1.5279970127868652, Testing Loss : 1.5441452472686767,
Training Accuracy : 0.45124, Testing Accuracy : 0.452

  5%|▍         | 14/300 [12:19<4:10:33, 52.57s/it]

Training Loss : 1.5019983236694336, Testing Loss : 1.521228881263733,
Training Accuracy : 0.4633, Testing Accuracy : 0.4556

  5%|▌         | 15/300 [13:11<4:09:54, 52.61s/it]

Training Loss : 1.4764140660095215, Testing Loss : 1.4955274351119996,
Training Accuracy : 0.47412, Testing Accuracy : 0.4708

  5%|▌         | 16/300 [14:04<4:09:16, 52.66s/it]

Training Loss : 1.4539192327880859, Testing Loss : 1.4563615045547484,
Training Accuracy : 0.48494, Testing Accuracy : 0.4795

  6%|▌         | 17/300 [14:57<4:08:32, 52.70s/it]

Training Loss : 1.4299799559020996, Testing Loss : 1.4509963914871216,
Training Accuracy : 0.49002, Testing Accuracy : 0.4855

  6%|▌         | 18/300 [15:51<4:09:34, 53.10s/it]

Training Loss : 1.4122258882141114, Testing Loss : 1.4250725547790528,
Training Accuracy : 0.49776, Testing Accuracy : 0.4932

  6%|▋         | 19/300 [16:44<4:09:20, 53.24s/it]

Training Loss : 1.3954387979125977, Testing Loss : 1.4033933549880981,
Training Accuracy : 0.50176, Testing Accuracy : 0.501
```

```
  7%|▋         | 20/300 [17:37<4:07:21, 53.01s/it]

Training Loss : 1.368726671295166, Testing Loss : 1.3907081443786622,
Training Accuracy : 0.51354, Testing Accuracy : 0.5053

  7%|▋         | 21/300 [18:30<4:06:56, 53.11s/it]

Training Loss : 1.3497931159973144, Testing Loss : 1.38423984375,
Training Accuracy : 0.51872, Testing Accuracy : 0.5087

  7%|▋         | 22/300 [19:23<4:05:58, 53.09s/it]

Training Loss : 1.3379231217956542, Testing Loss : 1.3628114265441895,
Training Accuracy : 0.52218, Testing Accuracy : 0.5145

  8%|▊         | 23/300 [20:17<4:05:24, 53.16s/it]

Training Loss : 1.3202289453125, Testing Loss : 1.3608606285095215,
Training Accuracy : 0.52996, Testing Accuracy : 0.5161

  8%|▊         | 24/300 [21:10<4:04:29, 53.15s/it]

Training Loss : 1.3033856117248535, Testing Loss : 1.330485121536255,
Training Accuracy : 0.53584, Testing Accuracy : 0.5232

  8%|▊         | 25/300 [22:02<4:02:36, 52.93s/it]

Training Loss : 1.2896064360046386, Testing Loss : 1.3089887073516846,
Training Accuracy : 0.54108, Testing Accuracy : 0.5325

  9%|▊         | 26/300 [22:55<4:01:16, 52.83s/it]

Training Loss : 1.275663239135742, Testing Loss : 1.2978259906768799,
Training Accuracy : 0.54786, Testing Accuracy : 0.536

  9%|▉         | 27/300 [23:47<3:59:37, 52.67s/it]

Training Loss : 1.2588947496032714, Testing Loss : 1.279926103591919,
Training Accuracy : 0.55238, Testing Accuracy : 0.5447

  9%|▉         | 28/300 [24:40<3:58:37, 52.64s/it]

Training Loss : 1.2495627093505859, Testing Loss : 1.267288840675354,
Training Accuracy : 0.55598, Testing Accuracy : 0.5504

 10%|▉         | 29/300 [25:32<3:57:23, 52.56s/it]

Training Loss : 1.2333933677673339, Testing Loss : 1.2596893228530883,
Training Accuracy : 0.56226, Testing Accuracy : 0.5526

 10%|█         | 30/300 [26:24<3:55:23, 52.31s/it]

Training Loss : 1.2199437823486328, Testing Loss : 1.240540146446228,
Training Accuracy : 0.5672, Testing Accuracy : 0.5594
```

```
 10%|█         | 31/300 [27:16<3:54:23, 52.28s/it]
Training Loss : 1.2083785791015624, Testing Loss : 1.2281181840896607,
Training Accuracy : 0.572, Testing Accuracy : 0.5644

 11%|█         | 32/300 [28:08<3:53:02, 52.17s/it]
Training Loss : 1.1984157386779786, Testing Loss : 1.2348511032104492,
Training Accuracy : 0.57586, Testing Accuracy : 0.5607

 11%|█         | 33/300 [28:59<3:51:25, 52.01s/it]
Training Loss : 1.1820818676757812, Testing Loss : 1.2175111099243163,
Training Accuracy : 0.5801, Testing Accuracy : 0.5683

 11%|█         | 34/300 [29:52<3:51:03, 52.12s/it]
Training Loss : 1.1752272467041016, Testing Loss : 1.2043127811431884,
Training Accuracy : 0.5836, Testing Accuracy : 0.5749

 12%|█         | 35/300 [30:44<3:50:20, 52.15s/it]
Training Loss : 1.1637281964111328, Testing Loss : 1.2055995367050172,
Training Accuracy : 0.58816, Testing Accuracy : 0.5751

 12%|█         | 36/300 [31:37<3:50:29, 52.38s/it]
Training Loss : 1.1480155680847168, Testing Loss : 1.185491773033142,
Training Accuracy : 0.59212, Testing Accuracy : 0.5817

 12%|█         | 37/300 [32:29<3:48:34, 52.14s/it]
Training Loss : 1.1392427157592773, Testing Loss : 1.1724191440582274,
Training Accuracy : 0.595, Testing Accuracy : 0.5863

 13%|█         | 38/300 [33:21<3:48:04, 52.23s/it]
Training Loss : 1.1296360804748535, Testing Loss : 1.1624054832458497,
Training Accuracy : 0.60214, Testing Accuracy : 0.5896

 13%|█         | 39/300 [34:13<3:46:57, 52.17s/it]
Training Loss : 1.116548763885498, Testing Loss : 1.1543814849853515,
Training Accuracy : 0.60368, Testing Accuracy : 0.5931

 13%|█         | 40/300 [35:05<3:45:55, 52.14s/it]
Training Loss : 1.1128476052856446, Testing Loss : 1.1670999095916748,
Training Accuracy : 0.60558, Testing Accuracy : 0.5871

 14%|█         | 41/300 [35:58<3:45:24, 52.22s/it]
Training Loss : 1.0991864750671387, Testing Loss : 1.142699208164215,
Training Accuracy : 0.61024, Testing Accuracy : 0.5961
```

```
 14%|█         | 42/300 [36:49<3:44:12, 52.14s/it]
Training Loss : 1.0898991386413575, Testing Loss : 1.1324939359664916,
Training Accuracy : 0.61758, Testing Accuracy : 0.5998

 14%|█         | 43/300 [37:42<3:43:44, 52.24s/it]
Training Loss : 1.0846185192871094, Testing Loss : 1.1234448356628417,
Training Accuracy : 0.61768, Testing Accuracy : 0.6015

 15%|█         | 44/300 [38:33<3:41:38, 51.95s/it]
Training Loss : 1.0743179658508302, Testing Loss : 1.117394988632202,
Training Accuracy : 0.62124, Testing Accuracy : 0.6058

 15%|█         | 45/300 [39:25<3:40:43, 51.93s/it]
Training Loss : 1.0658008206176757, Testing Loss : 1.1023930515289306,
Training Accuracy : 0.6255, Testing Accuracy : 0.6127

 15%|█         | 46/300 [40:17<3:39:45, 51.91s/it]
Training Loss : 1.0530667778015137, Testing Loss : 1.0926283399581909,
Training Accuracy : 0.62642, Testing Accuracy : 0.6177

 16%|█         | 47/300 [41:09<3:39:09, 51.97s/it]
Training Loss : 1.0514477851867676, Testing Loss : 1.0894517850875856,
Training Accuracy : 0.62958, Testing Accuracy : 0.6174

 16%|█         | 48/300 [42:01<3:38:06, 51.93s/it]
Training Loss : 1.0438542851257324, Testing Loss : 1.079536503791809,
Training Accuracy : 0.62924, Testing Accuracy : 0.6193

 16%|█         | 49/300 [42:54<3:38:21, 52.20s/it]
Training Loss : 1.0343946444702148, Testing Loss : 1.084318590927124,
Training Accuracy : 0.63466, Testing Accuracy : 0.6163

 17%|█         | 50/300 [43:45<3:36:23, 51.93s/it]
Training Loss : 1.0215884552001953, Testing Loss : 1.077563952255249,
Training Accuracy : 0.6391, Testing Accuracy : 0.6195

 17%|█         | 51/300 [44:37<3:35:21, 51.89s/it]
Training Loss : 1.016352422027588, Testing Loss : 1.061165160179138,
Training Accuracy : 0.64042, Testing Accuracy : 0.626

 17%|█         | 52/300 [45:29<3:34:18, 51.85s/it]
Training Loss : 1.0107727639770507, Testing Loss : 1.0573348220825196,
Training Accuracy : 0.64372, Testing Accuracy : 0.6297
```

```
 18%|██        | 53/300 [46:21<3:33:30, 51.87s/it]

Training Loss : 1.0019399932861328, Testing Loss : 1.0609624131202697,
Training Accuracy : 0.64758, Testing Accuracy : 0.629

 18%|██        | 54/300 [47:12<3:32:45, 51.89s/it]

Training Loss : 0.9962878680419922, Testing Loss : 1.0407556003570557,
Training Accuracy : 0.64934, Testing Accuracy : 0.6355

 18%|██        | 55/300 [48:04<3:31:01, 51.68s/it]

Training Loss : 0.9867826179504394, Testing Loss : 1.0484647336006165,
Training Accuracy : 0.65264, Testing Accuracy : 0.6334

 19%|██        | 56/300 [48:56<3:30:28, 51.76s/it]

Training Loss : 0.9831711340332031, Testing Loss : 1.0343383977890015,
Training Accuracy : 0.65362, Testing Accuracy : 0.6389

 19%|██        | 57/300 [49:47<3:29:36, 51.76s/it]

Training Loss : 0.9753326629638672, Testing Loss : 1.0249795289993286,
Training Accuracy : 0.65846, Testing Accuracy : 0.6421

 19%|██        | 58/300 [50:39<3:28:39, 51.73s/it]

Training Loss : 0.9638893608093262, Testing Loss : 1.0281381101608276,
Training Accuracy : 0.65924, Testing Accuracy : 0.6418

 20%|██        | 59/300 [51:31<3:27:43, 51.72s/it]

Training Loss : 0.9591435650634765, Testing Loss : 1.019882053756714,
Training Accuracy : 0.66052, Testing Accuracy : 0.6471

 20%|██        | 60/300 [52:22<3:25:47, 51.45s/it]

Training Loss : 0.9531505204772949, Testing Loss : 1.0101266613006592,
Training Accuracy : 0.66388, Testing Accuracy : 0.6499

 20%|██        | 61/300 [53:13<3:25:18, 51.54s/it]

Training Loss : 0.949258900604248, Testing Loss : 1.0045483199119567,
Training Accuracy : 0.66744, Testing Accuracy : 0.6532

 21%|██        | 62/300 [54:05<3:24:34, 51.57s/it]

Training Loss : 0.9385984059143067, Testing Loss : 0.9949243926048279,
Training Accuracy : 0.66944, Testing Accuracy : 0.6534

 21%|██        | 63/300 [54:57<3:23:46, 51.59s/it]

Training Loss : 0.9340343475341797, Testing Loss : 0.9952969148635864,
Training Accuracy : 0.67308, Testing Accuracy : 0.6588
```

```
 21%|██        | 64/300 [55:48<3:23:11, 51.66s/it]
Training Loss : 0.9249619648742676, Testing Loss : 0.9897576169967651,
Training Accuracy : 0.67458, Testing Accuracy : 0.6566
 22%|██        | 65/300 [56:39<3:21:34, 51.47s/it]
Training Loss : 0.9192296015930176, Testing Loss : 0.9886157735824584,
Training Accuracy : 0.67856, Testing Accuracy : 0.6596
 22%|██        | 66/300 [57:31<3:20:40, 51.46s/it]
Training Loss : 0.9206287948608398, Testing Loss : 0.9829085377693176,
Training Accuracy : 0.67488, Testing Accuracy : 0.6617
 22%|██        | 67/300 [58:22<3:19:48, 51.45s/it]
Training Loss : 0.9131725761413574, Testing Loss : 0.9765499263763427,
Training Accuracy : 0.67986, Testing Accuracy : 0.6664
 23%|██        | 68/300 [59:13<3:18:37, 51.37s/it]
Training Loss : 0.9036998314666748, Testing Loss : 0.9671326758384705,
Training Accuracy : 0.68316, Testing Accuracy : 0.6682
 23%|██        | 69/300 [1:00:05<3:17:31, 51.30s/it]
Training Loss : 0.900858835144043, Testing Loss : 0.9631631039619446,
Training Accuracy : 0.68312, Testing Accuracy : 0.6687
 23%|██        | 70/300 [1:00:56<3:16:56, 51.38s/it]
Training Loss : 0.8931233306884766, Testing Loss : 0.9578061486244202,
Training Accuracy : 0.68676, Testing Accuracy : 0.6738
 24%|██        | 71/300 [1:01:48<3:16:13, 51.41s/it]
Training Loss : 0.8919682344055175, Testing Loss : 0.9526526383399964,
Training Accuracy : 0.68716, Testing Accuracy : 0.6744
 24%|██        | 72/300 [1:02:40<3:15:57, 51.57s/it]
Training Loss : 0.8815233830261231, Testing Loss : 0.9503821634292603,
Training Accuracy : 0.68894, Testing Accuracy : 0.6725
 24%|██        | 73/300 [1:03:32<3:15:30, 51.68s/it]
Training Loss : 0.8804036399841308, Testing Loss : 0.9479284317970276,
Training Accuracy : 0.69184, Testing Accuracy : 0.6757
 25%|██        | 74/300 [1:04:23<3:14:19, 51.59s/it]
Training Loss : 0.8766143972778321, Testing Loss : 0.9533550196647644,
Training Accuracy : 0.69058, Testing Accuracy : 0.672
```

```
 25%|██▌       | 75/300 [1:05:15<3:14:05, 51.76s/it]

Training Loss : 0.8685102596282959, Testing Loss : 0.9382090277671814,
Training Accuracy : 0.69316, Testing Accuracy : 0.6775

 25%|██▌       | 76/300 [1:06:07<3:13:36, 51.86s/it]

Training Loss : 0.8608340579223632, Testing Loss : 0.9369188543319702,
Training Accuracy : 0.69888, Testing Accuracy : 0.6802

 26%|██▌       | 77/300 [1:06:59<3:12:53, 51.90s/it]

Training Loss : 0.8567653742980957, Testing Loss : 0.930767796421051,
Training Accuracy : 0.6985, Testing Accuracy : 0.6789

 26%|██▌       | 78/300 [1:07:50<3:11:21, 51.72s/it]

Training Loss : 0.8491772866821289, Testing Loss : 0.918894373703003,
Training Accuracy : 0.7002, Testing Accuracy : 0.6814

 26%|██▋       | 79/300 [1:08:42<3:10:37, 51.75s/it]

Training Loss : 0.8456308872985839, Testing Loss : 0.9260886274337768,
Training Accuracy : 0.7032, Testing Accuracy : 0.6796

 27%|██▋       | 80/300 [1:09:34<3:09:43, 51.74s/it]

Training Loss : 0.8427738986206055, Testing Loss : 0.9132624418258667,
Training Accuracy : 0.70408, Testing Accuracy : 0.6865

 27%|██▋       | 81/300 [1:10:26<3:09:31, 51.92s/it]

Training Loss : 0.8389222798156738, Testing Loss : 0.9143453728675842,
Training Accuracy : 0.70702, Testing Accuracy : 0.6834

 27%|██▋       | 82/300 [1:11:19<3:09:45, 52.23s/it]

Training Loss : 0.8317069567108154, Testing Loss : 0.9202948621749878,
Training Accuracy : 0.70822, Testing Accuracy : 0.6851

 28%|██▊       | 83/300 [1:12:11<3:08:07, 52.02s/it]

Training Loss : 0.826403046875, Testing Loss : 0.9085869963645935,
Training Accuracy : 0.71136, Testing Accuracy : 0.6861

 28%|██▊       | 84/300 [1:13:03<3:06:58, 51.94s/it]

Training Loss : 0.8242202591705322, Testing Loss : 0.8978699456214905,
Training Accuracy : 0.71022, Testing Accuracy : 0.6882

 28%|██▊       | 85/300 [1:13:54<3:05:07, 51.66s/it]

Training Loss : 0.8208591860961914, Testing Loss : 0.9094253799438476,
Training Accuracy : 0.7129, Testing Accuracy : 0.6864
```

```
 29%|███       | 86/300 [1:14:45<3:04:08, 51.63s/it]

Training Loss : 0.8162606964111329, Testing Loss : 0.8919789839744567,
Training Accuracy : 0.71632, Testing Accuracy : 0.6921

 29%|███       | 87/300 [1:15:36<3:02:12, 51.32s/it]

Training Loss : 0.8109617622375488, Testing Loss : 0.888532534122467,
Training Accuracy : 0.71614, Testing Accuracy : 0.6968

 29%|███       | 88/300 [1:16:27<3:00:58, 51.22s/it]

Training Loss : 0.8057002756500244, Testing Loss : 0.8866221133232117,
Training Accuracy : 0.71804, Testing Accuracy : 0.6955

 30%|███       | 89/300 [1:17:18<2:59:45, 51.11s/it]

Training Loss : 0.8042900648498535, Testing Loss : 0.8899623345375061,
Training Accuracy : 0.72, Testing Accuracy : 0.6959

 30%|███       | 90/300 [1:18:09<2:59:28, 51.28s/it]

Training Loss : 0.7971516540527344, Testing Loss : 0.887058837890625,
Training Accuracy : 0.722, Testing Accuracy : 0.6962

 30%|███       | 91/300 [1:19:00<2:57:45, 51.03s/it]

Training Loss : 0.7928802001953125, Testing Loss : 0.8775093267440796,
Training Accuracy : 0.72154, Testing Accuracy : 0.7004

 31%|███       | 92/300 [1:19:51<2:56:41, 50.97s/it]

Training Loss : 0.7881345213317871, Testing Loss : 0.876437825679779,
Training Accuracy : 0.72498, Testing Accuracy : 0.6974

 31%|███       | 93/300 [1:20:42<2:56:26, 51.14s/it]

Training Loss : 0.7874258981323242, Testing Loss : 0.8726165979385376,
Training Accuracy : 0.72582, Testing Accuracy : 0.7036

 31%|███       | 94/300 [1:21:34<2:56:20, 51.36s/it]

Training Loss : 0.7828336709594726, Testing Loss : 0.8716294746398926,
Training Accuracy : 0.72638, Testing Accuracy : 0.7029

 32%|███       | 95/300 [1:22:24<2:54:26, 51.06s/it]

Training Loss : 0.7794900206756592, Testing Loss : 0.8682725026130677,
Training Accuracy : 0.72758, Testing Accuracy : 0.7035

 32%|███       | 96/300 [1:23:15<2:53:16, 50.96s/it]

Training Loss : 0.7802376372528076, Testing Loss : 0.8630575058937072,
Training Accuracy : 0.72992, Testing Accuracy : 0.7059
```

```
 32%|███       | 97/300 [1:24:06<2:52:38, 51.02s/it]

Training Loss : 0.7696206253814697, Testing Loss : 0.8601488072395325,
Training Accuracy : 0.73112, Testing Accuracy : 0.7068

 33%|███       | 98/300 [1:24:57<2:51:24, 50.91s/it]

Training Loss : 0.7689883731079101, Testing Loss : 0.8646409945487976,
Training Accuracy : 0.7297, Testing Accuracy : 0.7025

 33%|███       | 99/300 [1:25:48<2:50:34, 50.92s/it]

Training Loss : 0.7620670502471923, Testing Loss : 0.8584285460472106,
Training Accuracy : 0.73268, Testing Accuracy : 0.7056

 33%|███       | 100/300 [1:26:39<2:49:46, 50.93s/it]

Training Loss : 0.7586766351318359, Testing Loss : 0.859719076538086,
Training Accuracy : 0.73476, Testing Accuracy : 0.7054

 34%|███       | 101/300 [1:27:30<2:49:11, 51.01s/it]

Training Loss : 0.754823023223877, Testing Loss : 0.8509044174194336,
Training Accuracy : 0.73548, Testing Accuracy : 0.7119

 34%|███       | 102/300 [1:28:21<2:48:07, 50.95s/it]

Training Loss : 0.7524405961608887, Testing Loss : 0.8511079051971435,
Training Accuracy : 0.73536, Testing Accuracy : 0.7071

 34%|███       | 103/300 [1:29:12<2:47:40, 51.07s/it]

Training Loss : 0.7487065507507324, Testing Loss : 0.8469164655685425,
Training Accuracy : 0.7375, Testing Accuracy : 0.7118

 35%|███       | 104/300 [1:30:03<2:46:47, 51.06s/it]

Training Loss : 0.7466765863800049, Testing Loss : 0.8460192555427551,
Training Accuracy : 0.74098, Testing Accuracy : 0.712

 35%|███       | 105/300 [1:30:56<2:47:31, 51.55s/it]

Training Loss : 0.7417825612640381, Testing Loss : 0.8431708649635314,
Training Accuracy : 0.73966, Testing Accuracy : 0.7129

 35%|███       | 106/300 [1:31:47<2:46:32, 51.51s/it]

Training Loss : 0.7356565464782715, Testing Loss : 0.8400452352523804,
Training Accuracy : 0.7437, Testing Accuracy : 0.7115

 36%|███       | 107/300 [1:32:39<2:45:52, 51.57s/it]

Training Loss : 0.7354266311645508, Testing Loss : 0.8397464994430542,
Training Accuracy : 0.74296, Testing Accuracy : 0.712
```

```
 36%|███▌      | 108/300 [1:33:32<2:45:59, 51.87s/it]
Training Loss : 0.732104012298584, Testing Loss : 0.837688184261322,
Training Accuracy : 0.74484, Testing Accuracy : 0.7151
 36%|███▋      | 109/300 [1:34:24<2:45:29, 51.98s/it]
Training Loss : 0.7312503077697754, Testing Loss : 0.8357272541046142,
Training Accuracy : 0.74444, Testing Accuracy : 0.7144
 37%|███▋      | 110/300 [1:35:15<2:43:38, 51.68s/it]
Training Loss : 0.7272765816497803, Testing Loss : 0.8426239525794983,
Training Accuracy : 0.7467, Testing Accuracy : 0.7104
 37%|███▋      | 111/300 [1:36:06<2:42:51, 51.70s/it]
Training Loss : 0.7225382384490967, Testing Loss : 0.8277552762031555,
Training Accuracy : 0.74742, Testing Accuracy : 0.7175
 37%|███▋      | 112/300 [1:36:58<2:41:59, 51.70s/it]
Training Loss : 0.7232051644134522, Testing Loss : 0.8285332593441009,
Training Accuracy : 0.74698, Testing Accuracy : 0.7172
 38%|███▊      | 113/300 [1:37:49<2:40:18, 51.44s/it]
Training Loss : 0.717964534072876, Testing Loss : 0.8240204976081849,
Training Accuracy : 0.749, Testing Accuracy : 0.7177
 38%|███▊      | 114/300 [1:38:41<2:39:42, 51.52s/it]
Training Loss : 0.71279696434021, Testing Loss : 0.8287187553405762,
Training Accuracy : 0.7518, Testing Accuracy : 0.7164
 38%|███▊      | 115/300 [1:39:32<2:38:58, 51.56s/it]
Training Loss : 0.7133254125976562, Testing Loss : 0.822620842885971,
Training Accuracy : 0.75208, Testing Accuracy : 0.7183
 39%|███▊      | 116/300 [1:40:24<2:38:33, 51.70s/it]
Training Loss : 0.7062709171295166, Testing Loss : 0.8228168731212616,
Training Accuracy : 0.75376, Testing Accuracy : 0.7169
 39%|███▉      | 117/300 [1:41:16<2:37:23, 51.60s/it]
Training Loss : 0.7081866450500488, Testing Loss : 0.8257977927207947,
Training Accuracy : 0.75344, Testing Accuracy : 0.719
 39%|███▉      | 118/300 [1:42:07<2:36:19, 51.54s/it]
Training Loss : 0.7019697862243652, Testing Loss : 0.8152582844734192,
Training Accuracy : 0.7574, Testing Accuracy : 0.7213
```

```
 40%|████      | 119/300 [1:42:59<2:35:43, 51.62s/it]
Training Loss : 0.7011977547454834, Testing Loss : 0.8110094345092773,
Training Accuracy : 0.75346, Testing Accuracy : 0.7241

 40%|████      | 120/300 [1:43:51<2:35:28, 51.82s/it]
Training Loss : 0.6973335580444336, Testing Loss : 0.807154498577118,
Training Accuracy : 0.7571, Testing Accuracy : 0.7248

 40%|████      | 121/300 [1:44:42<2:33:56, 51.60s/it]
Training Loss : 0.6967884708404541, Testing Loss : 0.809644556427002,
Training Accuracy : 0.75616, Testing Accuracy : 0.7243

 41%|████      | 122/300 [1:45:34<2:33:18, 51.68s/it]
Training Loss : 0.6925562807464599, Testing Loss : 0.8097870592594146,
Training Accuracy : 0.7605, Testing Accuracy : 0.7216

 41%|████      | 123/300 [1:46:26<2:32:09, 51.58s/it]
Training Loss : 0.6876038710784912, Testing Loss : 0.8095151605606079,
Training Accuracy : 0.75812, Testing Accuracy : 0.7251

 41%|████      | 124/300 [1:47:17<2:30:48, 51.41s/it]
Training Loss : 0.6837809352111817, Testing Loss : 0.8132763421058655,
Training Accuracy : 0.7622, Testing Accuracy : 0.7248

 42%|████      | 125/300 [1:48:08<2:30:15, 51.52s/it]
Training Loss : 0.684292452468872, Testing Loss : 0.8083933998584747,
Training Accuracy : 0.76124, Testing Accuracy : 0.723

 42%|████      | 126/300 [1:49:00<2:29:28, 51.54s/it]
Training Loss : 0.6812598225402832, Testing Loss : 0.8028189610004425,
Training Accuracy : 0.76242, Testing Accuracy : 0.7252

 42%|████      | 127/300 [1:49:52<2:28:50, 51.62s/it]
Training Loss : 0.6777583180999756, Testing Loss : 0.8037578841209412,
Training Accuracy : 0.76428, Testing Accuracy : 0.7263

 43%|████      | 128/300 [1:50:43<2:27:26, 51.43s/it]
Training Loss : 0.6794801540374756, Testing Loss : 0.8052429594993591,
Training Accuracy : 0.76386, Testing Accuracy : 0.7251

 43%|████      | 129/300 [1:51:34<2:26:44, 51.49s/it]
Training Loss : 0.6774738301086426, Testing Loss : 0.7986997215747833,
Training Accuracy : 0.76186, Testing Accuracy : 0.7273
```

```
 43%|████▎     | 130/300 [1:52:26<2:26:15, 51.62s/it]

Training Loss : 0.6700889385223389, Testing Loss : 0.7969005400657654,
Training Accuracy : 0.76542, Testing Accuracy : 0.731

 44%|████▎     | 131/300 [1:53:19<2:25:59, 51.83s/it]

Training Loss : 0.6721801474761963, Testing Loss : 0.7972584075450897,
Training Accuracy : 0.76374, Testing Accuracy : 0.7303

 44%|████▍     | 132/300 [1:54:10<2:24:31, 51.62s/it]

Training Loss : 0.6633339641571044, Testing Loss : 0.7980364191055298,
Training Accuracy : 0.76964, Testing Accuracy : 0.7245

 44%|████▍     | 133/300 [1:55:02<2:23:51, 51.68s/it]

Training Loss : 0.6665700027465821, Testing Loss : 0.792530521440506,
Training Accuracy : 0.76782, Testing Accuracy : 0.7325

 45%|████▍     | 134/300 [1:55:53<2:23:00, 51.69s/it]

Training Loss : 0.6671720369720459, Testing Loss : 0.794489186000824,
Training Accuracy : 0.76726, Testing Accuracy : 0.727

 45%|████▌     | 135/300 [1:56:44<2:21:29, 51.45s/it]

Training Loss : 0.6606291150665283, Testing Loss : 0.7921144254207612,
Training Accuracy : 0.7703, Testing Accuracy : 0.7265

 45%|████▌     | 136/300 [1:57:36<2:20:49, 51.52s/it]

Training Loss : 0.6587756245422364, Testing Loss : 0.789256167602539,
Training Accuracy : 0.77244, Testing Accuracy : 0.7278

 46%|████▌     | 137/300 [1:58:27<2:19:43, 51.43s/it]

Training Loss : 0.6577178137969971, Testing Loss : 0.7849105538368225,
Training Accuracy : 0.77106, Testing Accuracy : 0.7304

 46%|████▌     | 138/300 [1:59:19<2:19:20, 51.61s/it]

Training Loss : 0.6559770851135254, Testing Loss : 0.7879712157726287,
Training Accuracy : 0.7723, Testing Accuracy : 0.7282

 46%|████▋     | 139/300 [2:00:10<2:17:56, 51.41s/it]

Training Loss : 0.6548545720672607, Testing Loss : 0.7841992888927459,
Training Accuracy : 0.77082, Testing Accuracy : 0.731

 47%|████▋     | 140/300 [2:01:01<2:17:08, 51.43s/it]

Training Loss : 0.6492717205810546, Testing Loss : 0.7813444545269013,
Training Accuracy : 0.77418, Testing Accuracy : 0.731
```

```
 47%|████▋     | 141/300 [2:01:53<2:16:06, 51.36s/it]

Training Loss : 0.6473432587432861, Testing Loss : 0.7819427581310272,
Training Accuracy : 0.77432, Testing Accuracy : 0.7324

 47%|████▋     | 142/300 [2:02:44<2:15:04, 51.29s/it]

Training Loss : 0.645362035446167, Testing Loss : 0.7855876896381379,
Training Accuracy : 0.7751, Testing Accuracy : 0.7289

 48%|████▊     | 143/300 [2:03:35<2:14:26, 51.38s/it]

Training Loss : 0.645050090713501, Testing Loss : 0.7786757165908813,
Training Accuracy : 0.7763, Testing Accuracy : 0.7335

 48%|████▊     | 144/300 [2:04:27<2:13:47, 51.46s/it]

Training Loss : 0.6448700315856933, Testing Loss : 0.7779757187366486,
Training Accuracy : 0.77416, Testing Accuracy : 0.7353

 48%|████▊     | 145/300 [2:05:19<2:13:30, 51.68s/it]

Training Loss : 0.6436138897705078, Testing Loss : 0.7794378238201142,
Training Accuracy : 0.7767, Testing Accuracy : 0.7323

 49%|████▉     | 146/300 [2:06:10<2:11:57, 51.41s/it]

Training Loss : 0.642012241821289, Testing Loss : 0.7854746610164642,
Training Accuracy : 0.77522, Testing Accuracy : 0.7276

 49%|████▉     | 147/300 [2:07:02<2:11:13, 51.46s/it]

Training Loss : 0.6379210945892334, Testing Loss : 0.7757691784858703,
Training Accuracy : 0.77652, Testing Accuracy : 0.735

 49%|████▉     | 148/300 [2:07:53<2:10:24, 51.48s/it]

Training Loss : 0.6334159011840821, Testing Loss : 0.7743856380462647,
Training Accuracy : 0.7801, Testing Accuracy : 0.7353

 50%|█████     | 149/300 [2:08:44<2:09:10, 51.33s/it]

Training Loss : 0.627819453201294, Testing Loss : 0.7740666614055633,
Training Accuracy : 0.78158, Testing Accuracy : 0.7327

 50%|█████     | 150/300 [2:09:36<2:08:30, 51.41s/it]

Training Loss : 0.6308455143737793, Testing Loss : 0.7733498318195343,
Training Accuracy : 0.78052, Testing Accuracy : 0.7351

 50%|█████     | 151/300 [2:10:27<2:07:41, 51.42s/it]

Training Loss : 0.635202131576538, Testing Loss : 0.7703308360099792,
Training Accuracy : 0.7785, Testing Accuracy : 0.7349
```

```
 51%|█████     | 152/300 [2:11:18<2:06:26, 51.26s/it]
Training Loss : 0.6287451190185547, Testing Loss : 0.771305806350708,
Training Accuracy : 0.77978, Testing Accuracy : 0.7345

 51%|█████     | 153/300 [2:12:10<2:06:02, 51.44s/it]
Training Loss : 0.6269095348358155, Testing Loss : 0.772982190322876,
Training Accuracy : 0.78168, Testing Accuracy : 0.7371

 51%|█████     | 154/300 [2:13:01<2:05:03, 51.40s/it]
Training Loss : 0.6288258871459961, Testing Loss : 0.7700191073894501,
Training Accuracy : 0.77998, Testing Accuracy : 0.7341

 52%|█████     | 155/300 [2:13:53<2:04:51, 51.66s/it]
Training Loss : 0.6201641492462158, Testing Loss : 0.7648253800392151,
Training Accuracy : 0.78492, Testing Accuracy : 0.7355

 52%|█████     | 156/300 [2:14:44<2:03:30, 51.46s/it]
Training Loss : 0.6227487791442871, Testing Loss : 0.7656177315235138,
Training Accuracy : 0.78334, Testing Accuracy : 0.7363

 52%|█████     | 157/300 [2:15:36<2:02:42, 51.48s/it]
Training Loss : 0.6207016876983643, Testing Loss : 0.7673818842411041,
Training Accuracy : 0.78328, Testing Accuracy : 0.7353

 53%|█████     | 158/300 [2:16:29<2:02:38, 51.82s/it]
Training Loss : 0.6196722919464112, Testing Loss : 0.7620752824306488,
Training Accuracy : 0.78394, Testing Accuracy : 0.7378

 53%|█████     | 159/300 [2:17:21<2:01:53, 51.87s/it]
Training Loss : 0.614910485458374, Testing Loss : 0.762954493522644,
Training Accuracy : 0.78458, Testing Accuracy : 0.7377

 53%|█████     | 160/300 [2:18:12<2:01:01, 51.86s/it]
Training Loss : 0.6183418715667724, Testing Loss : 0.7632344197273254,
Training Accuracy : 0.78656, Testing Accuracy : 0.7388

 54%|█████     | 161/300 [2:19:04<2:00:01, 51.81s/it]
Training Loss : 0.6149234529876709, Testing Loss : 0.7583617666721344,
Training Accuracy : 0.7864, Testing Accuracy : 0.7392

 54%|█████     | 162/300 [2:19:56<1:59:20, 51.89s/it]
Training Loss : 0.6131347835540771, Testing Loss : 0.7618032670497894,
Training Accuracy : 0.78552, Testing Accuracy : 0.7385
```

```
 54%|█████▍    | 163/300 [2:20:49<1:58:55, 52.08s/it]

Training Loss : 0.6112786471557617, Testing Loss : 0.7595058870792389,
Training Accuracy : 0.78844, Testing Accuracy : 0.7401

 55%|█████▍    | 164/300 [2:21:41<1:58:22, 52.23s/it]

Training Loss : 0.6065699626922607, Testing Loss : 0.7623827006340027,
Training Accuracy : 0.78996, Testing Accuracy : 0.7388

 55%|█████▌    | 165/300 [2:22:33<1:57:26, 52.20s/it]

Training Loss : 0.6025980780029296, Testing Loss : 0.7571527176856995,
Training Accuracy : 0.78982, Testing Accuracy : 0.7386

 55%|█████▌    | 166/300 [2:23:26<1:56:47, 52.29s/it]

Training Loss : 0.6045398991394043, Testing Loss : 0.7579538080215454,
Training Accuracy : 0.78728, Testing Accuracy : 0.7397

 56%|█████▌    | 167/300 [2:24:18<1:55:45, 52.22s/it]

Training Loss : 0.6038384046936035, Testing Loss : 0.7545988851070404,
Training Accuracy : 0.7906, Testing Accuracy : 0.7422

 56%|█████▌    | 168/300 [2:25:10<1:54:54, 52.23s/it]

Training Loss : 0.604914200668335, Testing Loss : 0.7539011447429657,
Training Accuracy : 0.78986, Testing Accuracy : 0.7389

 56%|█████▋    | 169/300 [2:26:02<1:53:32, 52.00s/it]

Training Loss : 0.5996950121307373, Testing Loss : 0.7568904878616333,
Training Accuracy : 0.79152, Testing Accuracy : 0.7416

 57%|█████▋    | 170/300 [2:26:55<1:53:21, 52.32s/it]

Training Loss : 0.5975821217346191, Testing Loss : 0.7540211153030395,
Training Accuracy : 0.79232, Testing Accuracy : 0.7412

 57%|█████▋    | 171/300 [2:27:47<1:52:32, 52.34s/it]

Training Loss : 0.5966293388366699, Testing Loss : 0.7546346893310547,
Training Accuracy : 0.79208, Testing Accuracy : 0.7431

 57%|█████▋    | 172/300 [2:28:39<1:51:02, 52.05s/it]

Training Loss : 0.5957964948272705, Testing Loss : 0.7507884285449982,
Training Accuracy : 0.79172, Testing Accuracy : 0.7436

 58%|█████▊    | 173/300 [2:29:31<1:50:15, 52.09s/it]

Training Loss : 0.5964646598052978, Testing Loss : 0.7539882627487182,
Training Accuracy : 0.7939, Testing Accuracy : 0.7435
```

```
 58%|█████▊    | 174/300 [2:30:23<1:49:37, 52.20s/it]

Training Loss : 0.5953150811767578, Testing Loss : 0.7516456897258759,
Training Accuracy : 0.79226, Testing Accuracy : 0.7431

 58%|█████▊    | 175/300 [2:31:15<1:48:20, 52.01s/it]

Training Loss : 0.5926983929443359, Testing Loss : 0.7504803943634033,
Training Accuracy : 0.79412, Testing Accuracy : 0.7417

 59%|█████▊    | 176/300 [2:32:07<1:47:37, 52.08s/it]

Training Loss : 0.5920140654754639, Testing Loss : 0.7507030664920807,
Training Accuracy : 0.79294, Testing Accuracy : 0.7447

 59%|█████▉    | 177/300 [2:32:59<1:46:57, 52.17s/it]

Training Loss : 0.5924142713165284, Testing Loss : 0.7510139019966126,
Training Accuracy : 0.79442, Testing Accuracy : 0.7411

 59%|█████▉    | 178/300 [2:33:51<1:46:03, 52.16s/it]

Training Loss : 0.5906419395446777, Testing Loss : 0.7473683171272277,
Training Accuracy : 0.79342, Testing Accuracy : 0.7433

 60%|█████▉    | 179/300 [2:34:42<1:44:25, 51.78s/it]

Training Loss : 0.5855770269012451, Testing Loss : 0.751407872390747,
Training Accuracy : 0.7956, Testing Accuracy : 0.7446

 60%|██████    | 180/300 [2:35:34<1:43:34, 51.79s/it]

Training Loss : 0.5837292163848877, Testing Loss : 0.7500366930961608,
Training Accuracy : 0.796, Testing Accuracy : 0.7423

 60%|██████    | 181/300 [2:36:26<1:42:51, 51.87s/it]

Training Loss : 0.5865461408233642, Testing Loss : 0.7458638042926788,
Training Accuracy : 0.79618, Testing Accuracy : 0.7457

 61%|██████    | 182/300 [2:37:18<1:41:47, 51.76s/it]

Training Loss : 0.5850877934265136, Testing Loss : 0.7430187744617462,
Training Accuracy : 0.79762, Testing Accuracy : 0.7442

 61%|██████    | 183/300 [2:38:10<1:41:08, 51.87s/it]

Training Loss : 0.5839141330718994, Testing Loss : 0.7486705345153809,
Training Accuracy : 0.79628, Testing Accuracy : 0.7446

 61%|██████▏   | 184/300 [2:39:02<1:40:23, 51.93s/it]

Training Loss : 0.5783853332519531, Testing Loss : 0.7436869091510773,
Training Accuracy : 0.7986, Testing Accuracy : 0.7453
```

```
 62%|██████▏   | 185/300 [2:39:53<1:39:05, 51.70s/it]

Training Loss : 0.5769978988647461, Testing Loss : 0.7436987771987915,
Training Accuracy : 0.80028, Testing Accuracy : 0.7464

 62%|██████▏   | 186/300 [2:40:45<1:38:10, 51.67s/it]

Training Loss : 0.5766680799865722, Testing Loss : 0.7447810997009278,
Training Accuracy : 0.79968, Testing Accuracy : 0.7466

 62%|██████▏   | 187/300 [2:41:36<1:37:14, 51.64s/it]

Training Loss : 0.5741072554016113, Testing Loss : 0.7408370122432709,
Training Accuracy : 0.80212, Testing Accuracy : 0.7467

 63%|██████▎   | 188/300 [2:42:27<1:36:04, 51.47s/it]

Training Loss : 0.5752492360687256, Testing Loss : 0.7421512436866761,
Training Accuracy : 0.79868, Testing Accuracy : 0.7442

 63%|██████▎   | 189/300 [2:43:19<1:35:14, 51.49s/it]

Training Loss : 0.5776847373199463, Testing Loss : 0.7415394486427307,
Training Accuracy : 0.79902, Testing Accuracy : 0.7454

 63%|██████▎   | 190/300 [2:44:11<1:34:31, 51.56s/it]

Training Loss : 0.5733901979827881, Testing Loss : 0.7423482487678528,
Training Accuracy : 0.79894, Testing Accuracy : 0.7437

 64%|██████▎   | 191/300 [2:45:01<1:33:14, 51.32s/it]

Training Loss : 0.5739572156524658, Testing Loss : 0.7418063534736633,
Training Accuracy : 0.79874, Testing Accuracy : 0.7458

 64%|██████▍   | 192/300 [2:45:53<1:32:30, 51.39s/it]

Training Loss : 0.571212449874878, Testing Loss : 0.7381078717708588,
Training Accuracy : 0.80074, Testing Accuracy : 0.748

 64%|██████▍   | 193/300 [2:46:44<1:31:34, 51.35s/it]

Training Loss : 0.5708727695083619, Testing Loss : 0.7401099372386932,
Training Accuracy : 0.80262, Testing Accuracy : 0.7466

 65%|██████▍   | 194/300 [2:47:35<1:30:30, 51.23s/it]

Training Loss : 0.5740026821136475, Testing Loss : 0.7422475076198578,
Training Accuracy : 0.8004, Testing Accuracy : 0.7465

 65%|██████▌   | 195/300 [2:48:27<1:30:02, 51.45s/it]

Training Loss : 0.5688934748077392, Testing Loss : 0.7427793495178223,
Training Accuracy : 0.80278, Testing Accuracy : 0.7461
```

```
 65%|██████    | 196/300 [2:49:19<1:29:25, 51.59s/it]

Training Loss : 0.5653926245880126, Testing Loss : 0.7402111252784729,
Training Accuracy : 0.8035, Testing Accuracy : 0.747

 66%|██████    | 197/300 [2:50:10<1:28:20, 51.46s/it]

Training Loss : 0.566748480758667, Testing Loss : 0.7369751336574555,
Training Accuracy : 0.80216, Testing Accuracy : 0.7471

 66%|██████    | 198/300 [2:51:02<1:27:33, 51.50s/it]

Training Loss : 0.5636849768066406, Testing Loss : 0.7405192532539367,
Training Accuracy : 0.80558, Testing Accuracy : 0.7469

 66%|██████    | 199/300 [2:51:53<1:26:40, 51.49s/it]

Training Loss : 0.5632931942749023, Testing Loss : 0.7367521004199982,
Training Accuracy : 0.8037, Testing Accuracy : 0.7479

 67%|██████    | 200/300 [2:52:44<1:25:31, 51.31s/it]

Training Loss : 0.5643835237884521, Testing Loss : 0.7396342049598694,
Training Accuracy : 0.80194, Testing Accuracy : 0.7463

 67%|██████    | 201/300 [2:53:36<1:24:47, 51.39s/it]

Training Loss : 0.5617421462249755, Testing Loss : 0.7386535752773284,
Training Accuracy : 0.80528, Testing Accuracy : 0.7455

 67%|██████    | 202/300 [2:54:27<1:24:03, 51.47s/it]

Training Loss : 0.5609784973907471, Testing Loss : 0.7356376839637756,
Training Accuracy : 0.80616, Testing Accuracy : 0.7484

 68%|██████    | 203/300 [2:55:18<1:22:54, 51.29s/it]

Training Loss : 0.555689328994751, Testing Loss : 0.7345695200920105,
Training Accuracy : 0.80688, Testing Accuracy : 0.748

 68%|██████    | 204/300 [2:56:10<1:22:21, 51.48s/it]

Training Loss : 0.5559873395538331, Testing Loss : 0.7370190481662751,
Training Accuracy : 0.8063, Testing Accuracy : 0.7468

 68%|██████    | 205/300 [2:57:02<1:21:36, 51.54s/it]

Training Loss : 0.558742223892212, Testing Loss : 0.7349719676971436,
Training Accuracy : 0.80632, Testing Accuracy : 0.7474

 69%|██████    | 206/300 [2:57:53<1:20:41, 51.50s/it]

Training Loss : 0.556509464416504, Testing Loss : 0.7335562657356263,
Training Accuracy : 0.80592, Testing Accuracy : 0.7484
```

```
 69%|███████   | 207/300 [2:58:46<1:20:12, 51.75s/it]
Training Loss : 0.5598419194030761, Testing Loss : 0.7328723646640778,
Training Accuracy : 0.80488, Testing Accuracy : 0.7493
 69%|███████   | 208/300 [2:59:37<1:19:17, 51.71s/it]
Training Loss : 0.5543358125305176, Testing Loss : 0.7382353961467742,
Training Accuracy : 0.80742, Testing Accuracy : 0.747
 70%|███████   | 209/300 [3:00:29<1:18:26, 51.72s/it]
Training Loss : 0.5567960133361817, Testing Loss : 0.7339872601509094,
Training Accuracy : 0.80654, Testing Accuracy : 0.7484
 70%|███████   | 210/300 [3:01:20<1:17:21, 51.58s/it]
Training Loss : 0.5575109889221191, Testing Loss : 0.7379111841678619,
Training Accuracy : 0.80552, Testing Accuracy : 0.7474
 70%|███████   | 211/300 [3:02:11<1:16:21, 51.48s/it]
Training Loss : 0.5535582650756836, Testing Loss : 0.7332428534030915,
Training Accuracy : 0.8076, Testing Accuracy : 0.7488
 71%|███████   | 212/300 [3:03:02<1:15:14, 51.30s/it]
Training Loss : 0.5529251174926758, Testing Loss : 0.7331848472118377,
Training Accuracy : 0.80656, Testing Accuracy : 0.7499
 71%|███████   | 213/300 [3:03:54<1:14:28, 51.36s/it]
Training Loss : 0.5521344578552246, Testing Loss : 0.7322416175365448,
Training Accuracy : 0.80744, Testing Accuracy : 0.7491
 71%|███████▏  | 214/300 [3:04:45<1:13:45, 51.46s/it]
Training Loss : 0.5501396900939941, Testing Loss : 0.7338197490692139,
Training Accuracy : 0.80942, Testing Accuracy : 0.7496
 72%|███████▏  | 215/300 [3:05:36<1:12:36, 51.26s/it]
Training Loss : 0.555408772277832, Testing Loss : 0.7315373587608337,
Training Accuracy : 0.80728, Testing Accuracy : 0.7503
 72%|███████▏  | 216/300 [3:06:28<1:12:02, 51.46s/it]
Training Loss : 0.5499723013305664, Testing Loss : 0.7289384161949157,
Training Accuracy : 0.8087, Testing Accuracy : 0.7498
 72%|███████▏  | 217/300 [3:07:20<1:11:20, 51.57s/it]
Training Loss : 0.5502906803894043, Testing Loss : 0.7323610906600952,
Training Accuracy : 0.8099, Testing Accuracy : 0.7487
```

73%|███████ | 218/300 [3:08:11<1:10:11, 51.36s/it]

Training Loss : 0.5519379167938232, Testing Loss : 0.730635938167572,
Training Accuracy : 0.80882, Testing Accuracy : 0.7504

73%|███████ | 219/300 [3:09:03<1:09:27, 51.45s/it]

Training Loss : 0.5495639393615722, Testing Loss : 0.7290821988582611,
Training Accuracy : 0.80958, Testing Accuracy : 0.7509

73%|███████ | 220/300 [3:09:54<1:08:42, 51.53s/it]

Training Loss : 0.5493247219085693, Testing Loss : 0.7306615197181702,
Training Accuracy : 0.80856, Testing Accuracy : 0.7519

74%|███████ | 221/300 [3:10:46<1:07:43, 51.43s/it]

Training Loss : 0.5508409716796875, Testing Loss : 0.7285486634731293,
Training Accuracy : 0.80874, Testing Accuracy : 0.7509

74%|███████ | 222/300 [3:11:37<1:07:00, 51.54s/it]

Training Loss : 0.5453010552978516, Testing Loss : 0.7293187219142914,
Training Accuracy : 0.80962, Testing Accuracy : 0.7504

74%|███████ | 223/300 [3:12:29<1:06:16, 51.64s/it]

Training Loss : 0.5439342929077149, Testing Loss : 0.7280285910129547,
Training Accuracy : 0.81088, Testing Accuracy : 0.7525

75%|███████ | 224/300 [3:13:20<1:05:12, 51.48s/it]

Training Loss : 0.5465311709594727, Testing Loss : 0.7285967005252838,
Training Accuracy : 0.8093, Testing Accuracy : 0.7501

75%|███████ | 225/300 [3:14:12<1:04:30, 51.60s/it]

Training Loss : 0.5437541773986816, Testing Loss : 0.7303741005897522,
Training Accuracy : 0.81288, Testing Accuracy : 0.7504

75%|███████ | 226/300 [3:15:05<1:04:02, 51.92s/it]

Training Loss : 0.5420999011230468, Testing Loss : 0.7310445878982544,
Training Accuracy : 0.81222, Testing Accuracy : 0.7489

76%|███████ | 227/300 [3:15:56<1:03:01, 51.80s/it]

Training Loss : 0.5452809269714356, Testing Loss : 0.7294026520252228,
Training Accuracy : 0.80816, Testing Accuracy : 0.7526

76%|███████ | 228/300 [3:16:48<1:02:16, 51.90s/it]

Training Loss : 0.5415382562255859, Testing Loss : 0.7290093338012695,
Training Accuracy : 0.81092, Testing Accuracy : 0.7529

```
 76%|███████▌  | 229/300 [3:17:41<1:01:36, 52.06s/it]

Training Loss : 0.5388096965026855, Testing Loss : 0.7266996584892272,
Training Accuracy : 0.81172, Testing Accuracy : 0.7507

 77%|███████▋  | 230/300 [3:18:32<1:00:29, 51.86s/it]

Training Loss : 0.5391953239440918, Testing Loss : 0.7283105129241944,
Training Accuracy : 0.8111, Testing Accuracy : 0.7525

 77%|███████▋  | 231/300 [3:19:24<59:43, 51.94s/it]

Training Loss : 0.5402540323638916, Testing Loss : 0.7262706237316131,
Training Accuracy : 0.81032, Testing Accuracy : 0.7516

 77%|███████▋  | 232/300 [3:20:16<58:51, 51.93s/it]

Training Loss : 0.5395408419036866, Testing Loss : 0.7309688320636749,
Training Accuracy : 0.8106, Testing Accuracy : 0.7504

 78%|███████▊  | 233/300 [3:21:07<57:43, 51.70s/it]

Training Loss : 0.5400442029571533, Testing Loss : 0.7255270185470581,
Training Accuracy : 0.8119, Testing Accuracy : 0.7504

 78%|███████▊  | 234/300 [3:22:00<56:59, 51.82s/it]

Training Loss : 0.5374506092834472, Testing Loss : 0.7261676687717438,
Training Accuracy : 0.81222, Testing Accuracy : 0.7523

 78%|███████▊  | 235/300 [3:22:52<56:20, 52.00s/it]

Training Loss : 0.5392829465103149, Testing Loss : 0.7260795965671539,
Training Accuracy : 0.81182, Testing Accuracy : 0.7523

 79%|███████▊  | 236/300 [3:23:44<55:18, 51.85s/it]

Training Loss : 0.5407634764099121, Testing Loss : 0.7277666614055633,
Training Accuracy : 0.8115, Testing Accuracy : 0.7508

 79%|███████▉  | 237/300 [3:24:36<54:34, 51.97s/it]

Training Loss : 0.5364729180145263, Testing Loss : 0.7276045772552491,
Training Accuracy : 0.81448, Testing Accuracy : 0.7499

 79%|███████▉  | 238/300 [3:25:28<53:44, 52.02s/it]

Training Loss : 0.5378822114562988, Testing Loss : 0.7269744907855987,
Training Accuracy : 0.81248, Testing Accuracy : 0.7523

 80%|███████▉  | 239/300 [3:26:19<52:34, 51.71s/it]

Training Loss : 0.5379065439605712, Testing Loss : 0.7264815457344055,
Training Accuracy : 0.81146, Testing Accuracy : 0.7521
```

```
 80%|████████  | 240/300 [3:27:11<51:47, 51.79s/it]
Training Loss : 0.5354925579833985, Testing Loss : 0.724833454322815,
Training Accuracy : 0.81252, Testing Accuracy : 0.7526
 80%|████████  | 241/300 [3:28:03<51:01, 51.88s/it]
Training Loss : 0.5365601551818847, Testing Loss : 0.7240631539344787,
Training Accuracy : 0.81334, Testing Accuracy : 0.753
 81%|████████  | 242/300 [3:28:54<49:58, 51.69s/it]
Training Loss : 0.5316081612396241, Testing Loss : 0.7245356646060943,
Training Accuracy : 0.81602, Testing Accuracy : 0.754
 81%|████████  | 243/300 [3:29:46<49:16, 51.86s/it]
Training Loss : 0.5367434603118897, Testing Loss : 0.7255007013320923,
Training Accuracy : 0.81496, Testing Accuracy : 0.7521
 81%|████████▏ | 244/300 [3:30:38<48:26, 51.90s/it]
Training Loss : 0.5398796863555908, Testing Loss : 0.723655391073227,
Training Accuracy : 0.81286, Testing Accuracy : 0.7546
 82%|████████▏ | 245/300 [3:31:29<47:18, 51.62s/it]
Training Loss : 0.5328421145629882, Testing Loss : 0.7244967077732086,
Training Accuracy : 0.81532, Testing Accuracy : 0.7527
 82%|████████▏ | 246/300 [3:32:21<46:35, 51.76s/it]
Training Loss : 0.5335491781616211, Testing Loss : 0.7237378364562989,
Training Accuracy : 0.81476, Testing Accuracy : 0.7534
 82%|████████▏ | 247/300 [3:33:13<45:44, 51.79s/it]
Training Loss : 0.5288028695678711, Testing Loss : 0.7245239873409272,
Training Accuracy : 0.81616, Testing Accuracy : 0.7535
 83%|████████▎ | 248/300 [3:34:05<44:44, 51.63s/it]
Training Loss : 0.5299453258514404, Testing Loss : 0.7234393569946289,
Training Accuracy : 0.81684, Testing Accuracy : 0.7541
 83%|████████▎ | 249/300 [3:34:57<43:59, 51.76s/it]
Training Loss : 0.536722269668579, Testing Loss : 0.7237580746173858,
Training Accuracy : 0.81352, Testing Accuracy : 0.7544
 83%|████████▎ | 250/300 [3:35:49<43:15, 51.91s/it]
Training Loss : 0.5334728505706787, Testing Loss : 0.7241987561225891,
Training Accuracy : 0.81554, Testing Accuracy : 0.7538
```

```
 84%|████████  | 251/300 [3:36:40<42:14, 51.72s/it]
Training Loss : 0.5315838188171387, Testing Loss : 0.723238652896881,
Training Accuracy : 0.81394, Testing Accuracy : 0.7548
 84%|████████  | 252/300 [3:37:32<41:23, 51.74s/it]
Training Loss : 0.5303538816833496, Testing Loss : 0.7218820837974549,
Training Accuracy : 0.81428, Testing Accuracy : 0.7562
 84%|████████  | 253/300 [3:38:24<40:33, 51.78s/it]
Training Loss : 0.530984977722168, Testing Loss : 0.722178482055664,
Training Accuracy : 0.81372, Testing Accuracy : 0.7532
 85%|████████  | 254/300 [3:39:15<39:35, 51.64s/it]
Training Loss : 0.5296695864105224, Testing Loss : 0.724532053899765,
Training Accuracy : 0.8156, Testing Accuracy : 0.754
 85%|████████  | 255/300 [3:40:07<38:43, 51.63s/it]
Training Loss : 0.5296282250213623, Testing Loss : 0.7219169945716858,
Training Accuracy : 0.81506, Testing Accuracy : 0.754
 85%|████████  | 256/300 [3:40:58<37:52, 51.65s/it]
Training Loss : 0.5288636022186279, Testing Loss : 0.722880678844452,
Training Accuracy : 0.81686, Testing Accuracy : 0.7526
 86%|████████  | 257/300 [3:41:50<36:54, 51.50s/it]
Training Loss : 0.5302314849090576, Testing Loss : 0.7221141076087951,
Training Accuracy : 0.81582, Testing Accuracy : 0.7536
 86%|████████  | 258/300 [3:42:41<36:02, 51.48s/it]
Training Loss : 0.5269983541107178, Testing Loss : 0.7251783792495727,
Training Accuracy : 0.8159, Testing Accuracy : 0.7532
 86%|████████  | 259/300 [3:43:34<35:27, 51.88s/it]
Training Loss : 0.5234844978332519, Testing Loss : 0.7243002165317536,
Training Accuracy : 0.8185, Testing Accuracy : 0.7527
 87%|████████  | 260/300 [3:44:27<34:46, 52.15s/it]
Training Loss : 0.5295895686340332, Testing Loss : 0.7230228434562683,
Training Accuracy : 0.81588, Testing Accuracy : 0.7511
 87%|████████  | 261/300 [3:45:20<34:08, 52.53s/it]
Training Loss : 0.5242036417388916, Testing Loss : 0.7219674731731415,
Training Accuracy : 0.81752, Testing Accuracy : 0.753
```

87%|█████████ | 262/300 [3:46:12<33:11, 52.41s/it]

Training Loss : 0.5295034020233155, Testing Loss : 0.7227299841403961,
Training Accuracy : 0.81544, Testing Accuracy : 0.7543

88%|█████████ | 263/300 [3:47:05<32:24, 52.55s/it]

Training Loss : 0.5271530016326904, Testing Loss : 0.7224538014888764,
Training Accuracy : 0.81472, Testing Accuracy : 0.7523

88%|█████████ | 264/300 [3:47:57<31:23, 52.31s/it]

Training Loss : 0.525967679901123, Testing Loss : 0.7269585051059723,
Training Accuracy : 0.81788, Testing Accuracy : 0.7531

88%|█████████ | 265/300 [3:48:49<30:27, 52.22s/it]

Training Loss : 0.526448166885376, Testing Loss : 0.7226627879142761,
Training Accuracy : 0.81658, Testing Accuracy : 0.7522

89%|█████████ | 266/300 [3:49:41<29:36, 52.24s/it]

Training Loss : 0.527202204208374, Testing Loss : 0.7226114688873291,
Training Accuracy : 0.81742, Testing Accuracy : 0.7534

89%|█████████ | 267/300 [3:50:32<28:32, 51.90s/it]

Training Loss : 0.5256145510864257, Testing Loss : 0.7203925126552582,
Training Accuracy : 0.81774, Testing Accuracy : 0.7535

89%|█████████ | 268/300 [3:51:24<27:36, 51.76s/it]

Training Loss : 0.5238948811340332, Testing Loss : 0.7205493521690368,
Training Accuracy : 0.81724, Testing Accuracy : 0.7541

90%|█████████ | 269/300 [3:52:17<26:57, 52.18s/it]

Training Loss : 0.5249511246490478, Testing Loss : 0.7228584589004516,
Training Accuracy : 0.81632, Testing Accuracy : 0.7534

90%|█████████ | 270/300 [3:53:08<26:00, 52.00s/it]

Training Loss : 0.5197812713623047, Testing Loss : 0.7204909152507782,
Training Accuracy : 0.82112, Testing Accuracy : 0.7539

90%|█████████ | 271/300 [3:54:00<25:06, 51.96s/it]

Training Loss : 0.5243725959014892, Testing Loss : 0.7207136933326721,
Training Accuracy : 0.81768, Testing Accuracy : 0.7557

91%|█████████ | 272/300 [3:54:53<24:24, 52.32s/it]

Training Loss : 0.5229091888427735, Testing Loss : 0.7201496270179748,
Training Accuracy : 0.81958, Testing Accuracy : 0.7531

```
 91%|█████████ | 273/300 [3:55:45<23:27, 52.13s/it]

Training Loss : 0.5199211405944825, Testing Loss : 0.7208912141323089,
Training Accuracy : 0.82028, Testing Accuracy : 0.7525

 91%|█████████▏| 274/300 [3:56:37<22:35, 52.14s/it]

Training Loss : 0.5233039277648925, Testing Loss : 0.7210268091201782,
Training Accuracy : 0.81902, Testing Accuracy : 0.7535

 92%|█████████▏| 275/300 [3:57:30<21:48, 52.35s/it]

Training Loss : 0.5201033264160156, Testing Loss : 0.7217312747478485,
Training Accuracy : 0.81818, Testing Accuracy : 0.7537

 92%|█████████▏| 276/300 [3:58:22<20:50, 52.12s/it]

Training Loss : 0.5207027841949463, Testing Loss : 0.7199962153911591,
Training Accuracy : 0.81842, Testing Accuracy : 0.7537

 92%|█████████▏| 277/300 [3:59:14<20:00, 52.19s/it]

Training Loss : 0.5212011118316651, Testing Loss : 0.7200637726783753,
Training Accuracy : 0.81766, Testing Accuracy : 0.7547

 93%|█████████▎| 278/300 [4:00:06<19:08, 52.21s/it]

Training Loss : 0.5189762901306152, Testing Loss : 0.722559945344925,
Training Accuracy : 0.82064, Testing Accuracy : 0.7546

 93%|█████████▎| 279/300 [4:00:58<18:10, 51.94s/it]

Training Loss : 0.5175838941192626, Testing Loss : 0.7209029875278473,
Training Accuracy : 0.81994, Testing Accuracy : 0.7542

 93%|█████████▎| 280/300 [4:01:50<17:21, 52.06s/it]

Training Loss : 0.5231870544433593, Testing Loss : 0.7232957612991333,
Training Accuracy : 0.8184, Testing Accuracy : 0.7557

 94%|█████████▎| 281/300 [4:02:42<16:27, 51.96s/it]

Training Loss : 0.5214292402648926, Testing Loss : 0.7212178409576416,
Training Accuracy : 0.81944, Testing Accuracy : 0.7554

 94%|█████████▍| 282/300 [4:03:33<15:30, 51.69s/it]

Training Loss : 0.5190781694793701, Testing Loss : 0.7217596880435944,
Training Accuracy : 0.81948, Testing Accuracy : 0.754

 94%|█████████▍| 283/300 [4:04:25<14:39, 51.76s/it]

Training Loss : 0.519767861328125, Testing Loss : 0.7202742505073547,
Training Accuracy : 0.8193, Testing Accuracy : 0.7548
```

```
 95%|█████████▍| 284/300 [4:05:17<13:48, 51.78s/it]

Training Loss : 0.5196378798675537, Testing Loss : 0.7202192903518677,
Training Accuracy : 0.82038, Testing Accuracy : 0.7543

 95%|█████████▌| 285/300 [4:06:08<12:54, 51.61s/it]

Training Loss : 0.5147596120071412, Testing Loss : 0.7199161007881164,
Training Accuracy : 0.82108, Testing Accuracy : 0.7551

 95%|█████████▌| 286/300 [4:06:59<12:02, 51.63s/it]

Training Loss : 0.5212698266601562, Testing Loss : 0.7178469490528107,
Training Accuracy : 0.81834, Testing Accuracy : 0.7563

 96%|█████████▌| 287/300 [4:07:51<11:10, 51.61s/it]

Training Loss : 0.5191083152770997, Testing Loss : 0.7178165232658387,
Training Accuracy : 0.82008, Testing Accuracy : 0.7561

 96%|█████████▌| 288/300 [4:08:42<10:17, 51.42s/it]

Training Loss : 0.5160406899261475, Testing Loss : 0.7191216518402099,
Training Accuracy : 0.82094, Testing Accuracy : 0.7532

 96%|█████████▋| 289/300 [4:09:33<09:25, 51.44s/it]

Training Loss : 0.5165945455169678, Testing Loss : 0.7186889680862427,
Training Accuracy : 0.82088, Testing Accuracy : 0.7562

 97%|█████████▋| 290/300 [4:10:25<08:35, 51.54s/it]

Training Loss : 0.5188279246520996, Testing Loss : 0.7214446084022522,
Training Accuracy : 0.81864, Testing Accuracy : 0.7557

 97%|█████████▋| 291/300 [4:11:16<07:42, 51.40s/it]

Training Loss : 0.5133235363006592, Testing Loss : 0.7200361176013946,
Training Accuracy : 0.81986, Testing Accuracy : 0.7572

 97%|█████████▋| 292/300 [4:12:08<06:50, 51.36s/it]

Training Loss : 0.5163669821166992, Testing Loss : 0.719260885477066,
Training Accuracy : 0.8212, Testing Accuracy : 0.754

 98%|█████████▊| 293/300 [4:12:59<06:00, 51.43s/it]

Training Loss : 0.5153334563446045, Testing Loss : 0.7188194784641266,
Training Accuracy : 0.82098, Testing Accuracy : 0.7563

 98%|█████████▊| 294/300 [4:13:50<05:07, 51.25s/it]

Training Loss : 0.5173708248138428, Testing Loss : 0.7195120042800903,
Training Accuracy : 0.8194, Testing Accuracy : 0.7542
```

```
 98%|█████████▊| 295/300 [4:14:42<04:16, 51.36s/it]

Training Loss : 0.51390779296875, Testing Loss : 0.7181234461307525,
Training Accuracy : 0.82318, Testing Accuracy : 0.7546

 99%|█████████▊| 296/300 [4:15:33<03:25, 51.46s/it]

Training Loss : 0.519036547241211, Testing Loss : 0.7184048498153687,
Training Accuracy : 0.81896, Testing Accuracy : 0.7549

 99%|█████████▉| 297/300 [4:16:24<02:33, 51.32s/it]

Training Loss : 0.5149884439849853, Testing Loss : 0.7173306464195252,
Training Accuracy : 0.82024, Testing Accuracy : 0.7562

 99%|█████████▉| 298/300 [4:17:16<01:42, 51.36s/it]

Training Loss : 0.5178519683074951, Testing Loss : 0.7184451131343842,
Training Accuracy : 0.8202, Testing Accuracy : 0.7554

100%|█████████▉| 299/300 [4:18:07<00:51, 51.33s/it]

Training Loss : 0.5143584937286377, Testing Loss : 0.7163005756855011,
Training Accuracy : 0.82052, Testing Accuracy : 0.7552

100%|██████████| 300/300 [4:18:58<00:00, 51.79s/it]

Training Loss : 0.5170489376068115, Testing Loss : 0.717925022315979,
Training Accuracy : 0.8192, Testing Accuracy : 0.7559
```

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

```
Maximum Testing Accuracy: 0.7572
```

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

```python
# 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
```

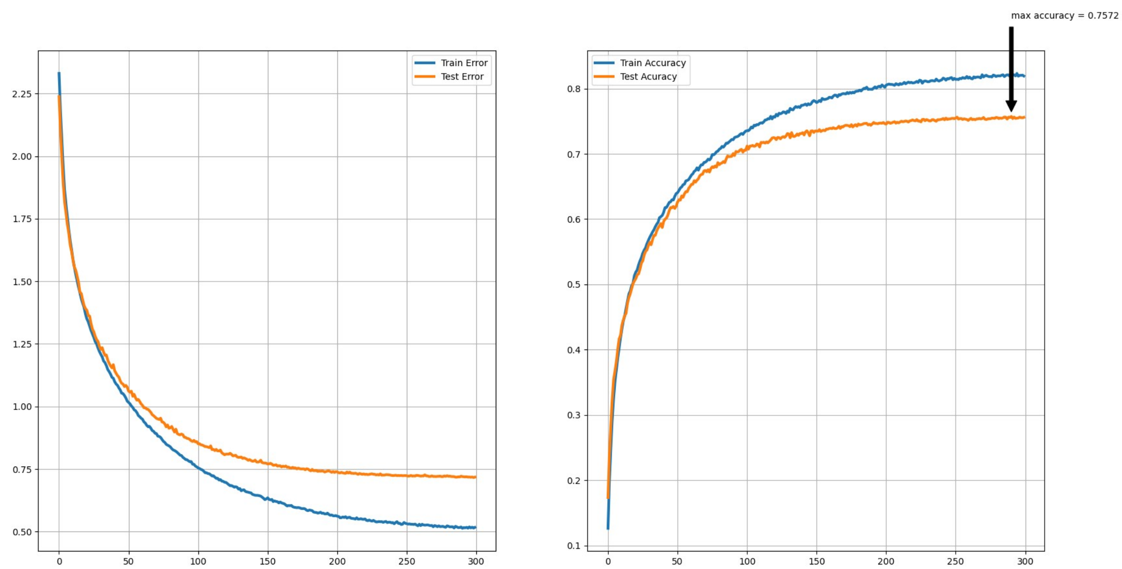
```
of epochs on the second subplot.
fig2.plot(range(n), train_accuracy, '-', linewidth='3', label='Train
Accuracy')
fig2.plot(range(n), test_accuracy, '-', linewidth='3', label='Test
Acuracy')

# 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')
```

We tried our model with 3 different optimizer, Adam, AdaGrad and AdaDelta, and below is the bar plot with their accuracy.

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 93.1 MB/s eta
0:00:00
ent 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)
Requirement already satisfied: typing-extensions>=3.6.2.1 in
/usr/local/lib/python3.9/dist-packages (from onnx) (4.5.0)
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)
# 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_0pt001.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()

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

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

# URL of the PNG image
url = "https://i.postimg.cc/hP7v0zPk/final-model1-1-onnx.png"

# Download the PNG image
png_data = urllib.request.urlopen(url).read()

# Display the PNG image in Colab
display(Image(png_data))
```