16/09/2025 Lab7: Build a CNN model To Classify Cat & Dog Image

Aim: To Build and train CNN model That classify images into 2 categories: cat & dog.

Objective:

1) To understand the architecture of Convolutional Neural Network
2) To preprocess image datasets for training and testing
3) To Implement a CNN model using PyTorch
4) To evaluate the performance of model using accuracy & loss.

Pseudocode

```
BEGIN
  1) Import necessary libraries (Torch, Torchvision,
        Torch.nn)
  2) Load the dataset
  3) Create a class CNN with
       - Convolutional layer + ReLU + MaxPooling
       - Fully connected layers
       - Output layer with 2 neurons
  4) Train the data
     Initialize model, loss function
     For each epoch :
         For each batch in training data :
             Forward Pass
             Compute Loss
             Backpropagate loss
             Update weights
         Print training loss
  5) Testing
     - Evaluate model on Test data
     Calculate accuracy
END
```

Observation

1) Dataset

- Dataset contains image of cats and dogs
- Images resized to 128×128 & normalized before training

2) At beginning of training, CNN had randomly initialized weights, which resulted in high training loss and low accuracy

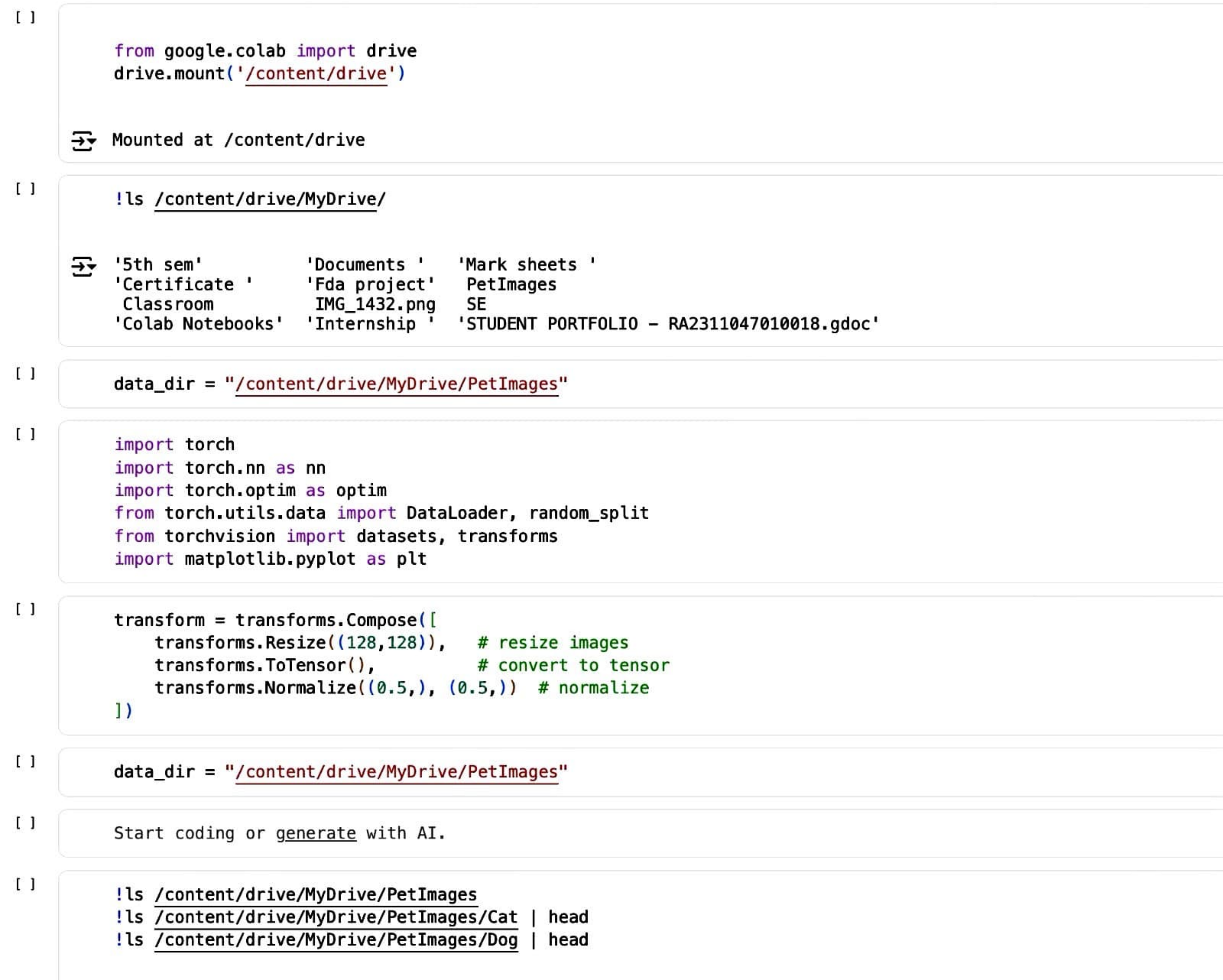
3) As Multiple epochs, CNN layer begain to extract meaning ful features such as edges, Textures, shape.

4) Polling layers helped reduce dimensionality while retaining most important feature

5) After several epochs, model's loss decreases while accurecy improves.

Result

Implemented - Build CNN model to classify Cat & Dog image.



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

```
Mounted at /content/drive
```

```
!ls /content/drive/MyDrive/
```

```
'5th sem'          'Documents '   'Mark sheets '
'Certificate '     'Fda project'   PetImages
 Classroom          IMG_1432.png   SE
'Colab Notebooks'  'Internship '  'STUDENT PORTFOLIO - RA2311047010018.gdoc'
```

```
data_dir = "/content/drive/MyDrive/PetImages"
```

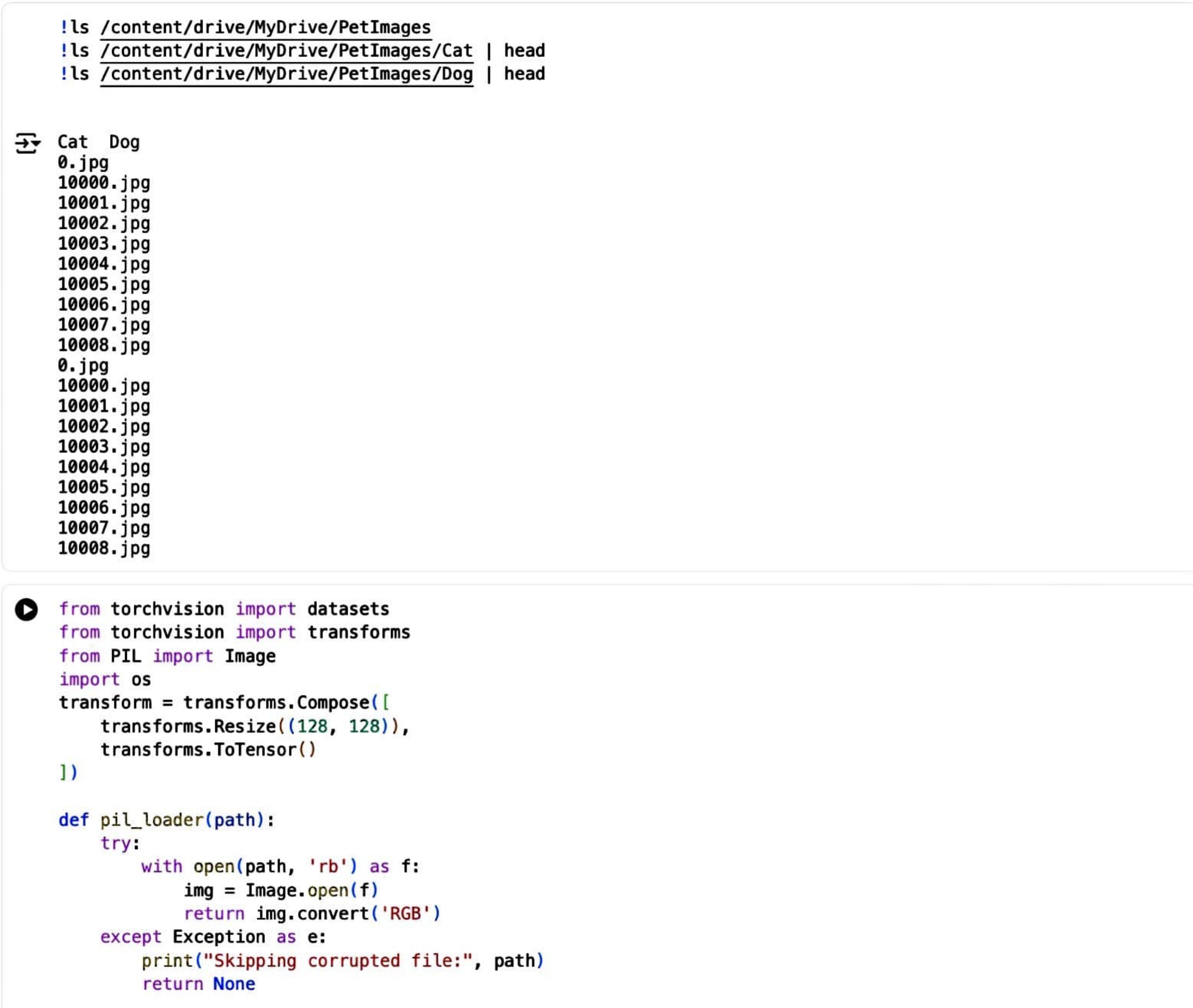
```
import torch
import torch.nn as nn
import torch.optim as optim
from torch.utils.data import DataLoader, random_split
from torchvision import datasets, transforms
import matplotlib.pyplot as plt
```

```
transform = transforms.Compose([
    transforms.Resize((128,128)),   # resize images
    transforms.ToTensor(),          # convert to tensor
    transforms.Normalize((0.5,), (0.5,))  # normalize
])
```

```
data_dir = "/content/drive/MyDrive/PetImages"
```

```
Start coding or generate with AI.
```

```
!ls /content/drive/MyDrive/PetImages
!ls /content/drive/MyDrive/PetImages/Cat | head
!ls /content/drive/MyDrive/PetImages/Dog | head
```

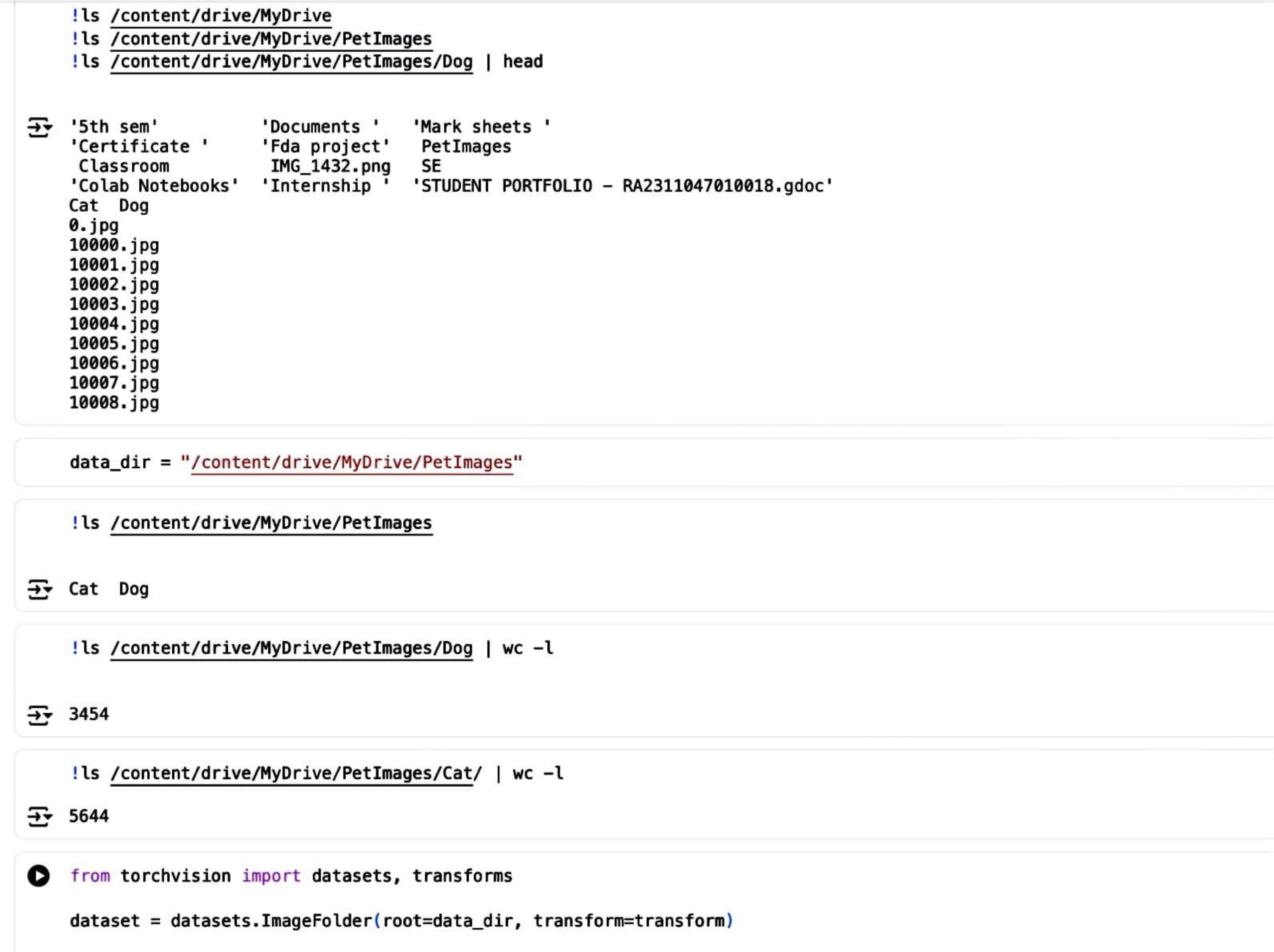


```
!ls /content/drive/MyDrive/PetImages
!ls /content/drive/MyDrive/PetImages/Cat | head
!ls /content/drive/MyDrive/PetImages/Dog | head
```

```
Cat  Dog
0.jpg
10000.jpg
10001.jpg
10002.jpg
10003.jpg
10004.jpg
10005.jpg
10006.jpg
10007.jpg
10008.jpg
0.jpg
10000.jpg
10001.jpg
10002.jpg
10003.jpg
10004.jpg
10005.jpg
10006.jpg
10007.jpg
10008.jpg
```

```python
from torchvision import datasets
from torchvision import transforms
from PIL import Image
import os
transform = transforms.Compose([
    transforms.Resize((128, 128)),
    transforms.ToTensor()
])

def pil_loader(path):
    try:
        with open(path, 'rb') as f:
            img = Image.open(f)
            return img.convert('RGB')
    except Exception as e:
        print("Skipping corrupted file:", path)
        return None
```



```
!ls /content/drive/MyDrive
!ls /content/drive/MyDrive/PetImages
!ls /content/drive/MyDrive/PetImages/Dog | head
```

```
'5th sem'           'Documents '   'Mark sheets '
'Certificate '      'Fda project'   PetImages
 Classroom           IMG_1432.png   SE
'Colab Notebooks'   'Internship '   'STUDENT PORTFOLIO - RA2311047010018.gdoc'
Cat  Dog
0.jpg
10000.jpg
10001.jpg
10002.jpg
10003.jpg
10004.jpg
10005.jpg
10006.jpg
10007.jpg
10008.jpg
```

```
data_dir = "/content/drive/MyDrive/PetImages"
```

```
!ls /content/drive/MyDrive/PetImages
```

```
Cat  Dog
```

```
!ls /content/drive/MyDrive/PetImages/Dog | wc -l
```

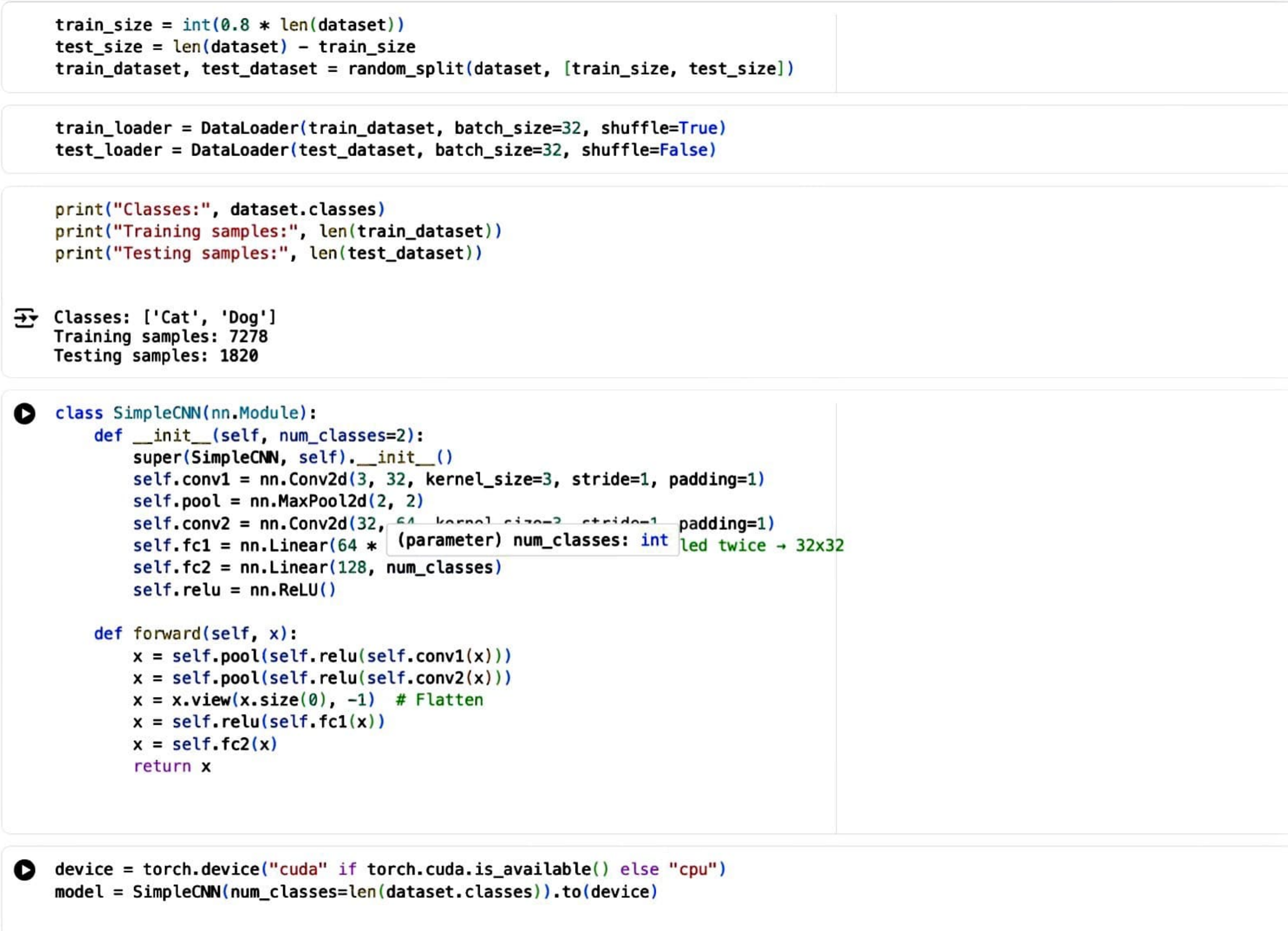
```
3454
```

```
!ls /content/drive/MyDrive/PetImages/Cat/ | wc -l
```

```
5644
```

```
from torchvision import datasets, transforms

dataset = datasets.ImageFolder(root=data_dir, transform=transform)
```



```
train_size = int(0.8 * len(dataset))
test_size = len(dataset) - train_size
train_dataset, test_dataset = random_split(dataset, [train_size, test_size])
```

```
train_loader = DataLoader(train_dataset, batch_size=32, shuffle=True)
test_loader = DataLoader(test_dataset, batch_size=32, shuffle=False)
```

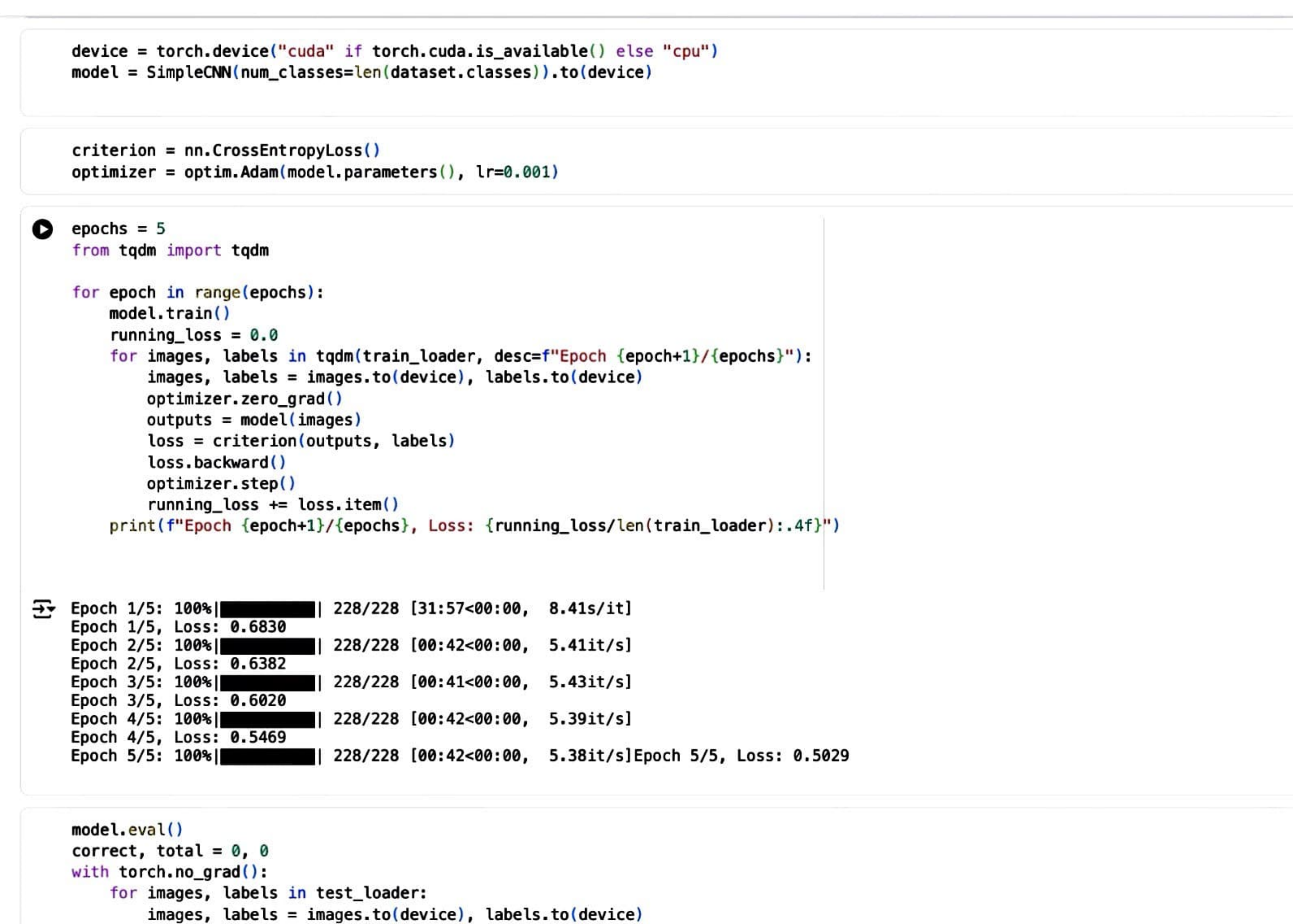
```
print("Classes:", dataset.classes)
print("Training samples:", len(train_dataset))
print("Testing samples:", len(test_dataset))
```

```
Classes: ['Cat', 'Dog']
Training samples: 7278
Testing samples: 1820
```

```
class SimpleCNN(nn.Module):
    def __init__(self, num_classes=2):
        super(SimpleCNN, self).__init__()
        self.conv1 = nn.Conv2d(3, 32, kernel_size=3, stride=1, padding=1)
        self.pool = nn.MaxPool2d(2, 2)
        self.conv2 = nn.Conv2d(32, 64, kernel_size=3, stride=1, padding=1)
        self.fc1 = nn.Linear(64 * (parameter) num_classes: int led twice → 32x32
        self.fc2 = nn.Linear(128, num_classes)
        self.relu = nn.ReLU()

    def forward(self, x):
        x = self.pool(self.relu(self.conv1(x)))
        x = self.pool(self.relu(self.conv2(x)))
        x = x.view(x.size(0), -1)  # Flatten
        x = self.relu(self.fc1(x))
        x = self.fc2(x)
        return x
```

```
device = torch.device("cuda" if torch.cuda.is_available() else "cpu")
model = SimpleCNN(num_classes=len(dataset.classes)).to(device)
```



```
device = torch.device("cuda" if torch.cuda.is_available() else "cpu")
model = SimpleCNN(num_classes=len(dataset.classes)).to(device)
```

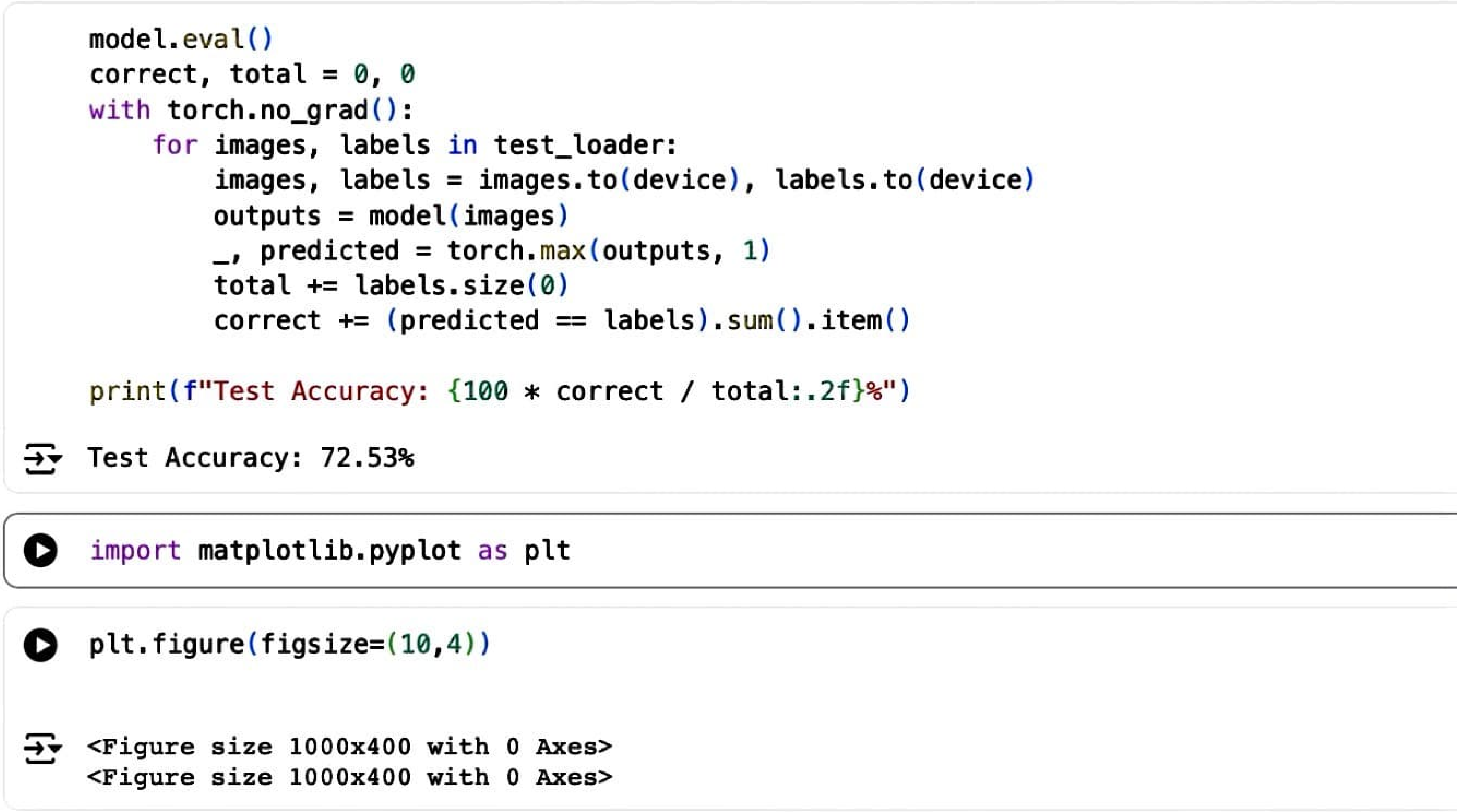
```
criterion = nn.CrossEntropyLoss()
optimizer = optim.Adam(model.parameters(), lr=0.001)
```

```
epochs = 5
from tqdm import tqdm

for epoch in range(epochs):
    model.train()
    running_loss = 0.0
    for images, labels in tqdm(train_loader, desc=f"Epoch {epoch+1}/{epochs}"):
        images, labels = images.to(device), labels.to(device)
        optimizer.zero_grad()
        outputs = model(images)
        loss = criterion(outputs, labels)
        loss.backward()
        optimizer.step()
        running_loss += loss.item()
    print(f"Epoch {epoch+1}/{epochs}, Loss: {running_loss/len(train_loader):.4f}")
```

```
Epoch 1/5: 100%|██████████| 228/228 [31:57<00:00,  8.41s/it]
Epoch 1/5, Loss: 0.6830
Epoch 2/5: 100%|██████████| 228/228 [00:42<00:00,  5.41it/s]
Epoch 2/5, Loss: 0.6382
Epoch 3/5: 100%|██████████| 228/228 [00:41<00:00,  5.43it/s]
Epoch 3/5, Loss: 0.6020
Epoch 4/5: 100%|██████████| 228/228 [00:42<00:00,  5.39it/s]
Epoch 4/5, Loss: 0.5469
Epoch 5/5: 100%|██████████| 228/228 [00:42<00:00,  5.38it/s]Epoch 5/5, Loss: 0.5029
```

```
model.eval()
correct, total = 0, 0
with torch.no_grad():
    for images, labels in test_loader:
        images, labels = images.to(device), labels.to(device)
```



```python
model.eval()
correct, total = 0, 0
with torch.no_grad():
    for images, labels in test_loader:
        images, labels = images.to(device), labels.to(device)
        outputs = model(images)
        _, predicted = torch.max(outputs, 1)
        total += labels.size(0)
        correct += (predicted == labels).sum().item()

print(f"Test Accuracy: {100 * correct / total:.2f}%")
```

```
Test Accuracy: 72.53%
```

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

```python
plt.figure(figsize=(10,4))
```

```
<Figure size 1000x400 with 0 Axes>
<Figure size 1000x400 with 0 Axes>
```