# Lab 5_1 Auto Encoder

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

```
class Autoencoder(nn.Module):
    def __init__(self):
        super(Autoencoder, self).__init__()

        # Encoder Layers
        self.fc1 = nn.Linear(784, 256)
        self.relu1 = nn.ReLU()
        self.fc2 = nn.Linear(256, 64)
        self.relu2 = nn.ReLU()
        self.fc3 = nn.Linear(64, 16)

        # Decoder Layers
        self.fc4 = nn.Linear(16, 16)
        self.relu3 = nn.ReLU()
        self.fc5 = nn.Linear(16, 256)
        self.relu4 = nn.ReLU()
        self.fc6 = nn.Linear(16, 784)
        self.sigmoid = nn.Sigmoid()

    def forward(self, x):
        # Encoder Forward Pass
        x = self.fc1(x)
        x = self.relu1(x)
        x = self.fc2(x)
        x = self.relu2(x)
        x = self.fc3(x)

        # Decoder Forward Pass
        x = self.fc4(x)
        # x = self.relu3(x)
        # x = self.fc5(x)
        x = self.relu4(x)
        x = self.fc6(x)
        x = self.sigmoid(x)

        return x
```

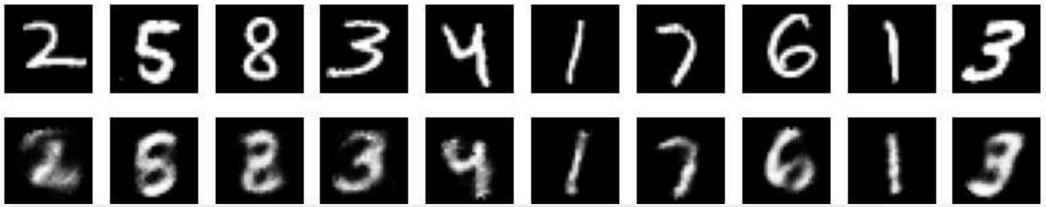
```
transform = transforms.ToTensor()
train_data = datasets.MNIST(root="./data", train=True, transform=transform, download=True)
train_loader = DataLoader(train_data, batch_size=64, shuffle=True)
```

```
device = torch.device("cuda" if torch.cuda.is_available() else "cpu")
autoencoder = Autoencoder().to(device)
criterion = nn.MSELoss()
optimizer = optim.Adam(autoencoder.parameters(), lr=0.001)
```

```
# Training Loop
num_epochs = 2
for epoch in range(num_epochs):
    for images, _ in train_loader:
        images = images.view(images.size(0), -1).to(device)
        outputs = autoencoder(images)
        loss = criterion(outputs, images)

        optimizer.zero_grad()
        loss.backward()
        optimizer.step()

    print(f"Epoch [{epoch+1}/{num_epochs}], Loss: {loss.item():.4f}")

print("Training complete.")
```

```
Epoch [1/2], Loss: 0.0414
Epoch [2/2], Loss: 0.0290
Training complete.
```

```
images, _ = next(iter(train_loader))
images = images.view(images.size(0), -1).to(device)
with torch.no_grad():
    reconstructed = autoencoder(images)

images = images.cpu().view(-1, 28, 28)
reconstructed = reconstructed.cpu().view(-1, 28, 28)

fig, axes = plt.subplots(2, 10, figsize=(10, 2))
for i in range(10):
    axes[0, i].imshow(images[i], cmap='gray')
    axes[0, i].axis('off')
    axes[1, i].imshow(reconstructed[i], cmap='gray')
    axes[1, i].axis('off')
plt.show()
```



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