

```
import torch
import torch.nn as nn
import torch.optim as optim
from torchvision import datasets, transforms
from torchvision.utils import make_grid
import matplotlib.pyplot as plt
import numpy as np
```

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

device(type='cuda')
```

```
transform = transforms.Compose([
    transforms.ToTensor(),
    transforms.Normalize((0.5,0.5,0.5),(0.5,0.5,0.5))
])

dataset = datasets.CIFAR10(root="/kaggle/working",
                           train=True,
                           download=True,
                           transform=transform)

loader = torch.utils.data.DataLoader(dataset,
                                      batch_size=128,
                                      shuffle=True,
                                      num_workers=2)
```

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```
def rgb_to_gray(x):
    r,g,b = x[:,0:1], x[:,1:2], x[:,2:3]
    gray = 0.299*r + 0.587*g + 0.114*b
    return gray.repeat(1,3,1,1)  # keep 3 channels
```

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

        self.encoder = nn.Sequential(
            nn.Conv2d(3,64,4,2,1), # 32→16
            nn.ReLU(),
            nn.Conv2d(64,128,4,2,1), # 16→8
            nn.BatchNorm2d(128),
            nn.ReLU(),
            nn.Conv2d(128,256,4,2,1), # 8→4
            nn.BatchNorm2d(256),
            nn.ReLU()
        )

        self.decoder = nn.Sequential(
            nn.ConvTranspose2d(256,128,4,2,1), # 4→8
            nn.BatchNorm2d(128),
            nn.ReLU(),
            nn.ConvTranspose2d(128,64,4,2,1), # 8→16
            nn.BatchNorm2d(64),
            nn.ReLU(),
            nn.ConvTranspose2d(64,3,4,2,1), # 16→32
            nn.Tanh()
        )

    def forward(self,x):
        x = self.encoder(x)
        x = self.decoder(x)
        return x

model = EncoderDecoder().to(device)
model
```

```
EncoderDecoder(  
    (encoder): Sequential(  
        (0): Conv2d(3, 64, kernel_size=(4, 4), stride=(2, 2), padding=(1, 1))  
        (1): ReLU()  
        (2): Conv2d(64, 128, kernel_size=(4, 4), stride=(2, 2), padding=(1, 1))  
        (3): BatchNorm2d(128, eps=1e-05, momentum=0.1, affine=True, track_running_stats=True)  
        (4): ReLU()  
        (5): Conv2d(128, 256, kernel_size=(4, 4), stride=(2, 2), padding=(1, 1))  
        (6): BatchNorm2d(256, eps=1e-05, momentum=0.1, affine=True, track_running_stats=True)  
        (7): ReLU()  
    )  
    (decoder): Sequential(  
        (0): ConvTranspose2d(256, 128, kernel_size=(4, 4), stride=(2, 2), padding=(1, 1))  
        (1): BatchNorm2d(128, eps=1e-05, momentum=0.1, affine=True, track_running_stats=True)  
        (2): ReLU()  
        (3): ConvTranspose2d(128, 64, kernel_size=(4, 4), stride=(2, 2), padding=(1, 1))  
        (4): BatchNorm2d(64, eps=1e-05, momentum=0.1, affine=True, track_running_stats=True)  
        (5): ReLU()  
        (6): ConvTranspose2d(64, 3, kernel_size=(4, 4), stride=(2, 2), padding=(1, 1))  
        (7): Tanh()  
    )  
)
```

```
criterion_L1 = nn.L1Loss()  
criterion_MSE = nn.MSELoss()  
  
optimizer = optim.Adam(model.parameters(), lr=0.0002)
```

```
epochs = 8  
  
for epoch in range(epochs):  
    total_loss = 0  
  
    for img, _ in loader:  
        img = img.to(device)  
        target = rgb_to_gray(img).to(device)  
  
        optimizer.zero_grad()
```

```
output = model(img)

loss_L1 = criterion_L1(output, target)
loss_MSE = criterion_MSE(output, target)

loss = loss_L1 + loss_MSE
loss.backward()
optimizer.step()

total_loss += loss.item()

print(f"Epoch {epoch+1}/{epochs} Loss: {total_loss/len(loader):.4f}")
```

```
Epoch 1/8 Loss: 0.1737
Epoch 2/8 Loss: 0.0834
Epoch 3/8 Loss: 0.0697
Epoch 4/8 Loss: 0.0607
Epoch 5/8 Loss: 0.0567
Epoch 6/8 Loss: 0.0535
Epoch 7/8 Loss: 0.0501
Epoch 8/8 Loss: 0.0471
```

```
def denorm(x):
    return (x + 1) / 2
```

```
model.eval()

imgs, _ = next(iter(loader))
imgs = imgs[:8].to(device)

with torch.no_grad():
    outputs = model(imgs)

targets = rgb_to_gray(imgs)

imgs = denorm(imgs).cpu()
outputs = denorm(outputs).cpu()
targets = denorm(targets).cpu()
```

```
fig,ax = plt.subplots(3,8,figsize=(16,6))

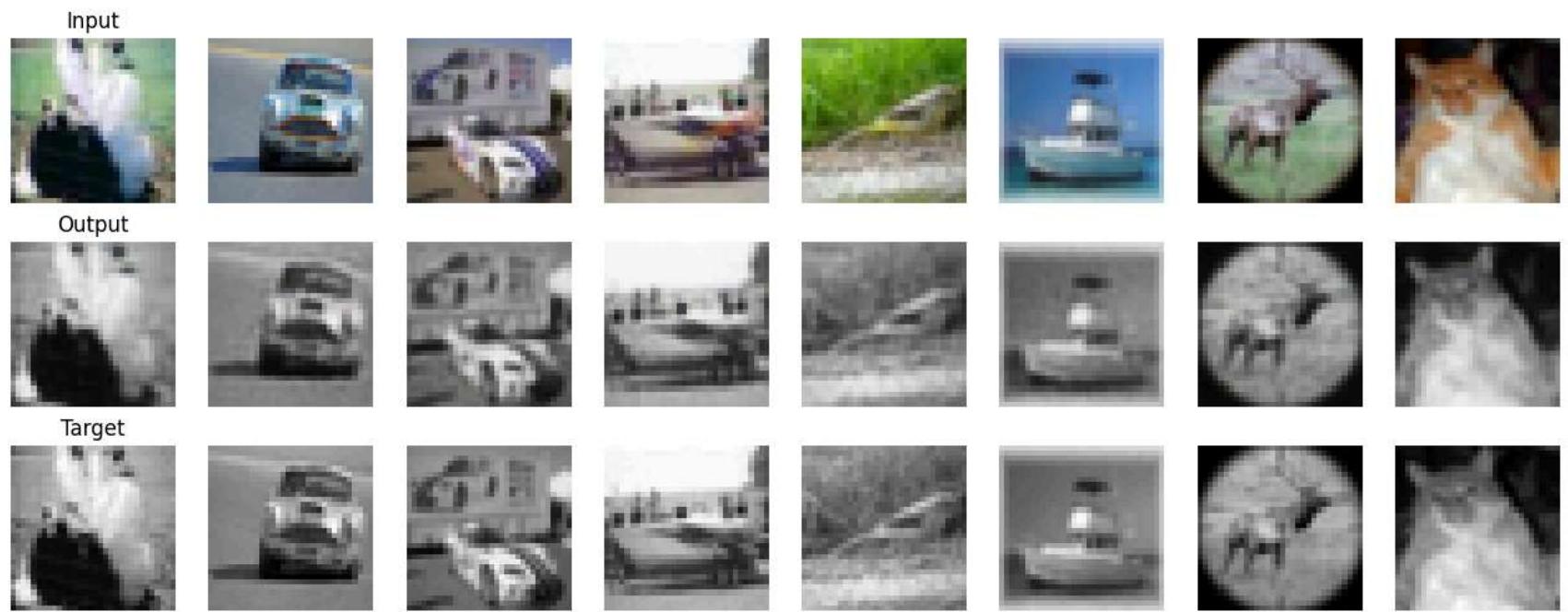
for i in range(8):
    ax[0,i].imshow(np.transpose(imgs[i],(1,2,0)))
    ax[0,i].axis("off")

    ax[1,i].imshow(np.transpose(outputs[i],(1,2,0)))
    ax[1,i].axis("off")

    ax[2,i].imshow(np.transpose(targets[i],(1,2,0)))
    ax[2,i].axis("off")

ax[0,0].set_title("Input")
ax[1,0].set_title("Output")
ax[2,0].set_title("Target")

plt.show()
```



```
model.eval()
total_L1,total_MSE,count = 0,0,0

with torch.no_grad():
    for img,_ in loader:
        img = img.to(device)
        target = rgb_to_gray(img)

        output = model(img)
```

```
total_L1 += criterion_L1(output,target).item()
total_MSE += criterion_MSE(output,target).item()
count += 1

print("Average L1 Loss:", total_L1/count)
print("Average MSE Loss:", total_MSE/count)
```

```
Average L1 Loss: 0.034967856791318225
Average MSE Loss: 0.002348968748460569
```

```
import torch
import torchvision.transforms as T
import torchvision
import numpy as np
import matplotlib.pyplot as plt
from PIL import Image
```

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

model = torchvision.models.segmentation.deeplabv3_resnet101(pretrained=True)
model = model.to(device).eval()
```

```
img = Image.open("/content/774b8330-f15f-11f0-8c02-e5e7c184d682.jpg").convert("RGB")
plt.imshow(img)
plt.axis("off")
```

```
(np.float64(-0.5), np.float64(3839.5), np.float64(2159.5), np.float64(-0.5))
```



```
transform = T.Compose([
    T.Resize((512,512)),
    T.ToTensor(),
    T.Normalize(mean=[0.485,0.456,0.406],
               std=[0.229,0.224,0.225])
])

input_tensor = transform(img).unsqueeze(0).to(device)
```

```
with torch.no_grad():
    output = model(input_tensor)[“out”][0]

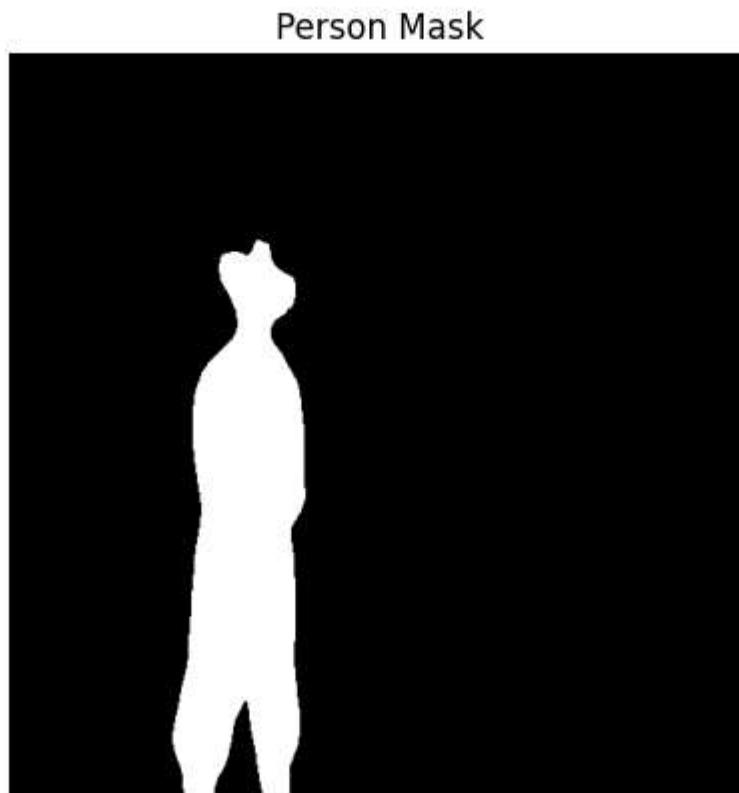
mask = output.argmax(0).cpu().numpy()

# Class 15 = person in COCO dataset
person_mask = (mask == 15).astype(np.uint8)

plt.imshow(person_mask, cmap="gray")
```

```
plt.title("Person Mask")
plt.axis("off")

(np.float64(-0.5), np.float64(511.5), np.float64(511.5), np.float64(-0.5))
```



```
person_mask = Image.fromarray(person_mask*255).resize(img.size)
person_mask = np.array(person_mask)/255
person_mask = np.expand_dims(person_mask, axis=2)
```

```
bg = Image.open("/content/Tropical_Beach_Background.jpg").convert("RGB")
bg = bg.resize(img.size)

plt.imshow(bg)
plt.axis("off")
```

```
(np.float64(-0.5), np.float64(3839.5), np.float64(2159.5), np.float64(-0.5))
```



```
img_np = np.array(img)/255  
bg_np = np.array(bg)/255  
  
result = img_np*person_mask + bg_np*(1-person_mask)  
  
plt.imshow(result)  
plt.title("Background Changed")  
plt.axis("off")
```

```
(np.float64(-0.5), np.float64(3839.5), np.float64(2159.5), np.float64(-0.5))
```

Background Changed

