```
from torch.utils.data import DataLoader,Dataset
import torch
import torchvision.transforms as transforms
from torchvision import datasets
import torchvision.models as models
import torchvision
import matplotlib.pyplot as plt
import numpy as np
from tqdm import tqdm
```

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

```
cuda
```

```
train_data = datasets.CIFAR10(root='./data',train=True,download=True,transform=t
test_data = datasets.CIFAR10(root='./data',train=False,download=True,transform=t
train_loader = DataLoader(train_data,batch_size=64,shuffle=True)
test_loader = DataLoader(test_data,batch_size=64,shuffle=True)
```

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Files already downloaded and verified
Files already downloaded and verified
```

```
class VarAutoencoder(torch.nn.Module):
    def __init__(self):
        super(VarAutoencoder,self).__init__()
        self.relu = torch.nn.ReLU()
        self.sigmoid = torch.nn.Sigmoid()
        self.flatten = torch.nn.Flatten()
        self.fc1 = torch.nn.Linear(3072,128)
        self.fc2 = torch.nn.Linear(128,3072)
        self.mu = torch.nn.Linear(128,128)
        self.log_var = torch.nn.Linear(128,128)
        self.conv1 = torch.nn.Conv2d(3,16,5,padding=2)
        self.conv2 = torch.nn.Conv2d(16,3,5,padding=2)
        self.tconv1 = torch.nn.ConvTranspose2d(3,16,3,stride=1,padding=1)
        self.tconv2 = torch.nn.ConvTranspose2d(16,3,3,stride=1,padding=1)
        self.flatten = torch.nn.Flatten()
        self.unflatten = torch.nn.Unflatten(1,(3,32,32))

    def forward(self,x):
        x,mu,log_var = self.encode(x)
        x = self.reparameterize(mu,log_var)
        x = self.decode(x)
        return x,mu,log_var
    def encode(self,x):
        x = self.conv1(x)
        x = self.relu(x)
        x = self.conv2(x)
        x = self.relu(x)
        x = self.flatten(x)
```

```
            x = self.fc1(x)
            x = self.relu(x)
            mu = self.mu(x)
            log_var = self.log_var(x)
            return x,mu,log_var
        def decode(self,x):
            x = self.fc2(x)
            x = self.relu(x)
            x = self.unflatten(x)
            x = self.tconv1(x)
            x = self.relu(x)
            x = self.tconv2(x)
            x = self.sigmoid(x)
            return x
        def reparameterize(self,mu,logvar):
            std = torch.exp(0.5*logvar)
            eps = torch.randn_like(std)
            return mu + eps*std


    model = VarAutoencoder().to(device)
    epochs = 5
    optimizer = torch.optim.Adam(model.parameters(),lr=0.001)
    criterion = torch.nn.BCELoss(reduction='sum')


    for epoch in range(epochs):
        train_loss = 0.0
        for data in tqdm(train_loader):
            img,label = data
            img = img.to(device)
            output,mu,log_var = model(img)
            bce_loss = criterion(output,img)
            kld_loss = -0.5 * torch.sum(1 + log_var - mu.pow(2) - log_var.exp())
            loss = bce_loss + kld_loss
            train_loss += loss.item()
            loss.backward()
            optimizer.step()
            optimizer.zero_grad()
        print('\n'+f'epoch: {epoch}, loss: {train_loss}')
```

```
100%|██████████| 782/782 [00:11<00:00, 69.37it/s]

epoch: 0, loss: 97983583.375
100%|██████████| 782/782 [00:09<00:00, 78.52it/s]

epoch: 1, loss: 95307267.0234375
100%|██████████| 782/782 [00:09<00:00, 78.22it/s]

epoch: 2, loss: 93992385.39453125
100%|██████████| 782/782 [00:10<00:00, 77.65it/s]

epoch: 3, loss: 93194891.95898438
100%|██████████| 782/782 [00:09<00:00, 83.63it/s]
epoch: 4, loss: 92813088.25585938
```

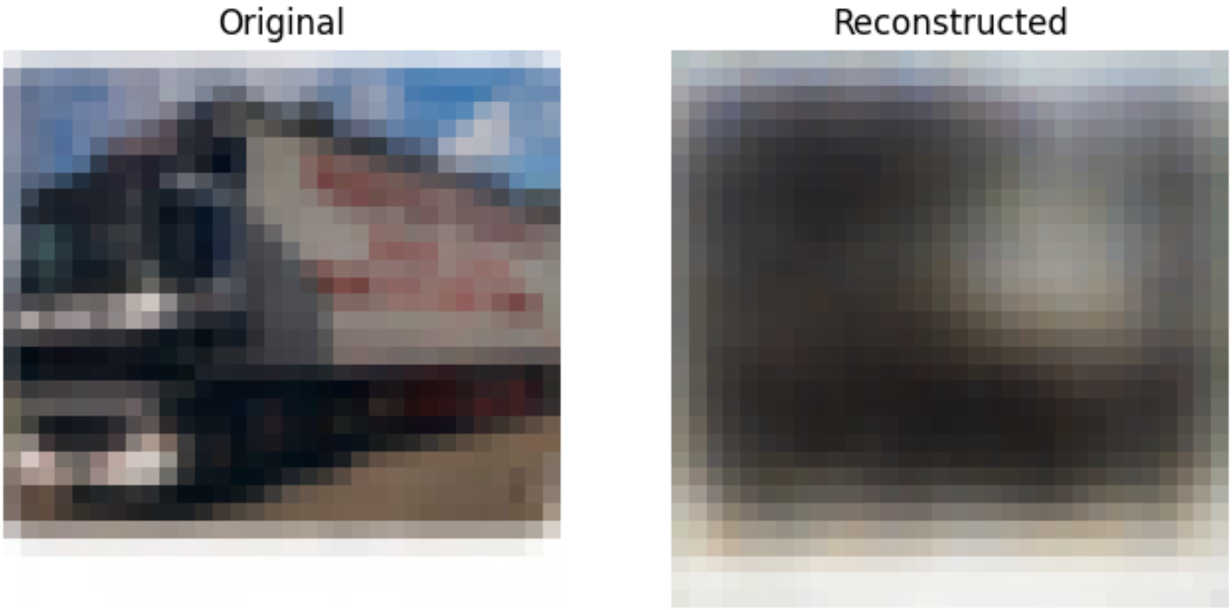
```
data_iter = iter(train_loader)
images,labels = next(data_iter)

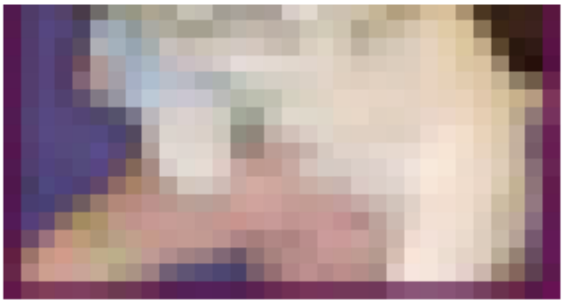
with torch.no_grad():
    output,mu,log_var = model(images.to(device))
    output = output.cpu()
    output = output.numpy()
    print(output.shape)
    output = np.reshape(output,(64,3,32,32))



for j in range(5):
    image = images[j]
    image = np.transpose(image,(1,2,0))
    output_im = output[j]
    output_im = np.transpose(output_im,(1,2,0))
    fig, axes = plt.subplots(1, 2, figsize=(8, 4))
    axes[0].imshow(image)
    axes[0].set_title('Original')
    axes[0].axis('off')
    axes[1].imshow(output_im)
    axes[1].set_title('Reconstructed')
    axes[1].axis('off')
    plt.show()
```

```
(64, 3, 32, 32)
```





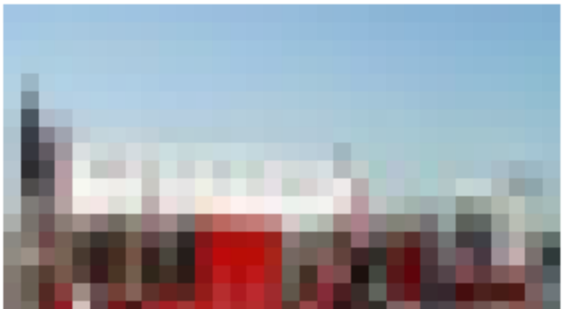
Original

Reconstructed

Original

Reconstructed

Original



Reconstructed

```
with torch.no_grad():
    z = torch.randn(16, 128).to(device)
    samples = model.decode(z).cpu().view(-1,3,32,32)

fig, axes = plt.subplots(4, 4, figsize=(8, 8))
for i, ax in enumerate(axes.flatten()):
    ax.imshow(samples[i].permute(1, 2, 0))
    ax.axis("off")
plt.show()
```