1. Make a brief introduction about variational autoencoder (VAE). List one advantage comparing with vanilla autoencoder and one problem of VAE.

Ans:
U-Net. Reference: https://kknews.cc/zh-tw/tech/6aqgyzl.html

Pro: 結構簡單、穩定。由於feature map的維度沒有改變，因此完整地保留的資料特徵。而拼接更允許模型選擇淺層特徵或深層特徵，因此對語意分割任務具有優勢。

Con: multi-scale skip conncetion使用了不必要的資訊，也浪費了計算資源。這也是Enhancing U-Net模型被提出的動機——Khanh, Trinh Le Ba, et al. "Enhancing U-Net with spatial-channel attention gate for abnormal tissue segmentation in medical imaging." Applied Sciences 10.17 (2020): 5729.

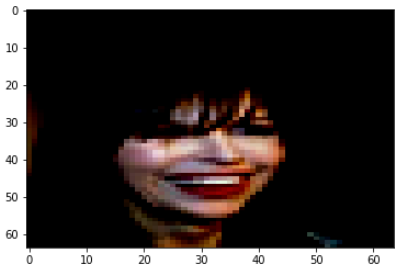
2. Train a fully connected autoencoder and adjust at least two different element of the latent representation. Show your model architecture, plot out the original image, the reconstructed images for each adjustment and describe the differences.

Ans: 模型架構

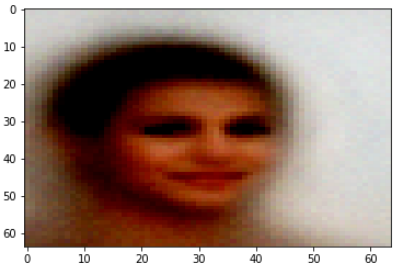
```
class fcn_autoencoder(nn.Module):
    def __init__(self):
        super(fcn_autoencoder, self).__init__()
        self.encoder = nn.Sequential(
            nn.Linear(64 * 64 * 3, 128),
            nn.ReLU(),
            nn.Linear(128, 64),
            nn.ReLU(),
            nn.Linear(64, 12),
            nn.ReLU(),
            nn.Linear(12, 3)
        )
        self.decoder = nn.Sequential(
            nn.Linear(3, 12),
            nn.ReLU(),
            nn.Linear(12, 64),
            nn.ReLU(),
            nn.Linear(64, 128),
            nn.ReLU(),
            nn.Linear(128, 64 * 64 * 3),
            nn.Tanh()
        )

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

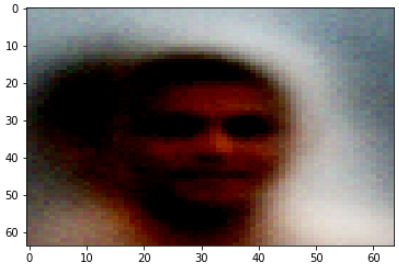
原始圖片



原始輸出



把encoder最後一層*2，變成12->12



把encoder最後一層/3，變成12->1