Q 1.b –

Skip connection vs Earlier Model Performance Comparison using 'batch_size':100 –

Vanilla CNN (earlier model) –

After Epoch [25/25], Val Loss: 1.5925, Val Acc: 41.1%,

U-Net Skip connection –

Epoch [25/25], Val Loss: 1.3496, Val Acc: 49.3%

U-Net Skip connection Performing Much better.

Qualitatively the colorized outputs are slightly better too.(better colorization for the horses- **more saturation**/colorfulness; less black & white)

WHY SKIP CONNECTION CAN IMPROVE THE PERFORMANCE OF our CNN ?

1. In deep neural networks, while backpropagating the gradients become very small (or might even become 0)—since we are multiplying a number of gradients whose absolute values are often less than 1 – Hence the initial layers are not learning at all. But Skip connection solves this issue – helping us go deeper & thus help us learn more complex features.
2. In an **Encoder – Decoder** architecture (like what we are using) – if we add a skip connections in the, **fine-grained details can be recovered in the prediction**. This is because in the Decoder part , we are taking inputs from corresponding resolution (in Encoder) for upsampling.
3. We have experimentally seen that symmetrical long skip connections work incredibly effectively in dense prediction tasks (like medical image segmentation) - even though there is no theoretical justification.

Q 1.c)

WITH DIFFERENT BATCH SIZES- (for Unet)

DEFAULT – with batch size 100 :

Epoch [25/25], Val Loss: 1.3496, Val Acc: 49.3%

Epoch [25/25], Val Loss: 1.4123, Val Acc: 46.9%,- for batch size 200

Epoch [25/25], Val Loss: 1.3316, Val Acc: 49.3%, for 50

Epoch [25/25], Val Loss: 1.3266, Val Acc: 50.3% for 20

Epoch [25/25], Val Loss: 1.2850, Val Acc: 52.2% for BATCH SIZE 10

We can see that the Image output is much better (the horses are better colorized- more colourful- more saturation) for a lower batch size of 10 as compared to a batch size of 100 or 200