# Generative AI Assignment

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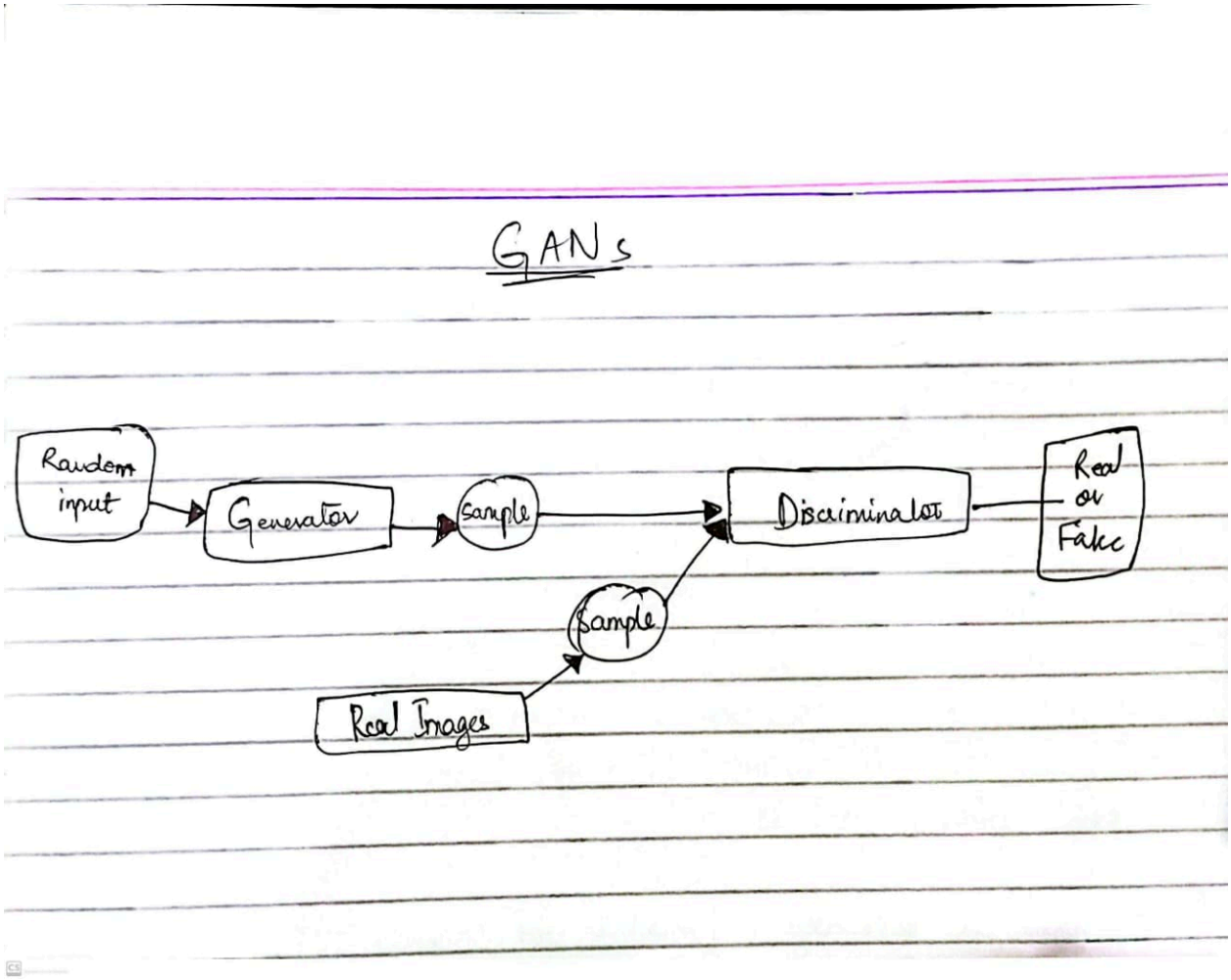


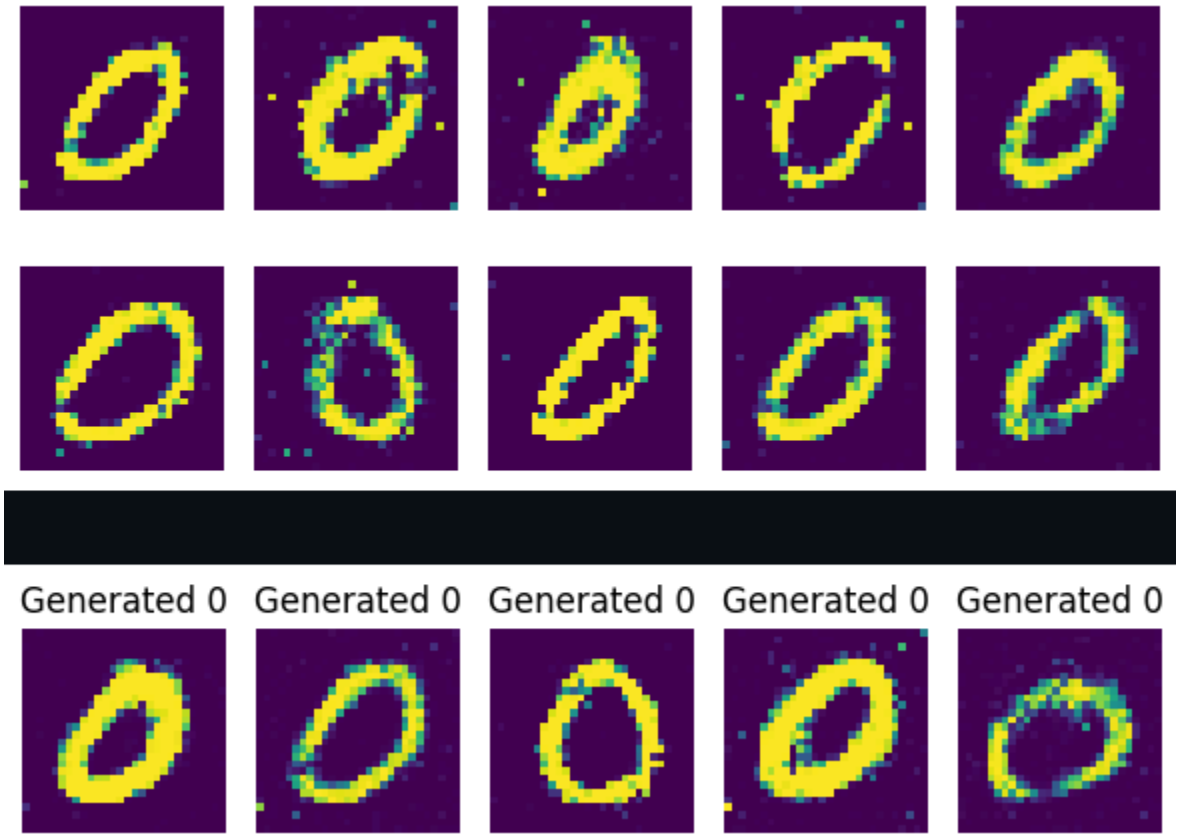

The discriminator also outputs the generator loss and the discriminator loss

Generator: Creates fake images from random noise.

Discriminator: Tries to tell apart real images from fake (generated ones)

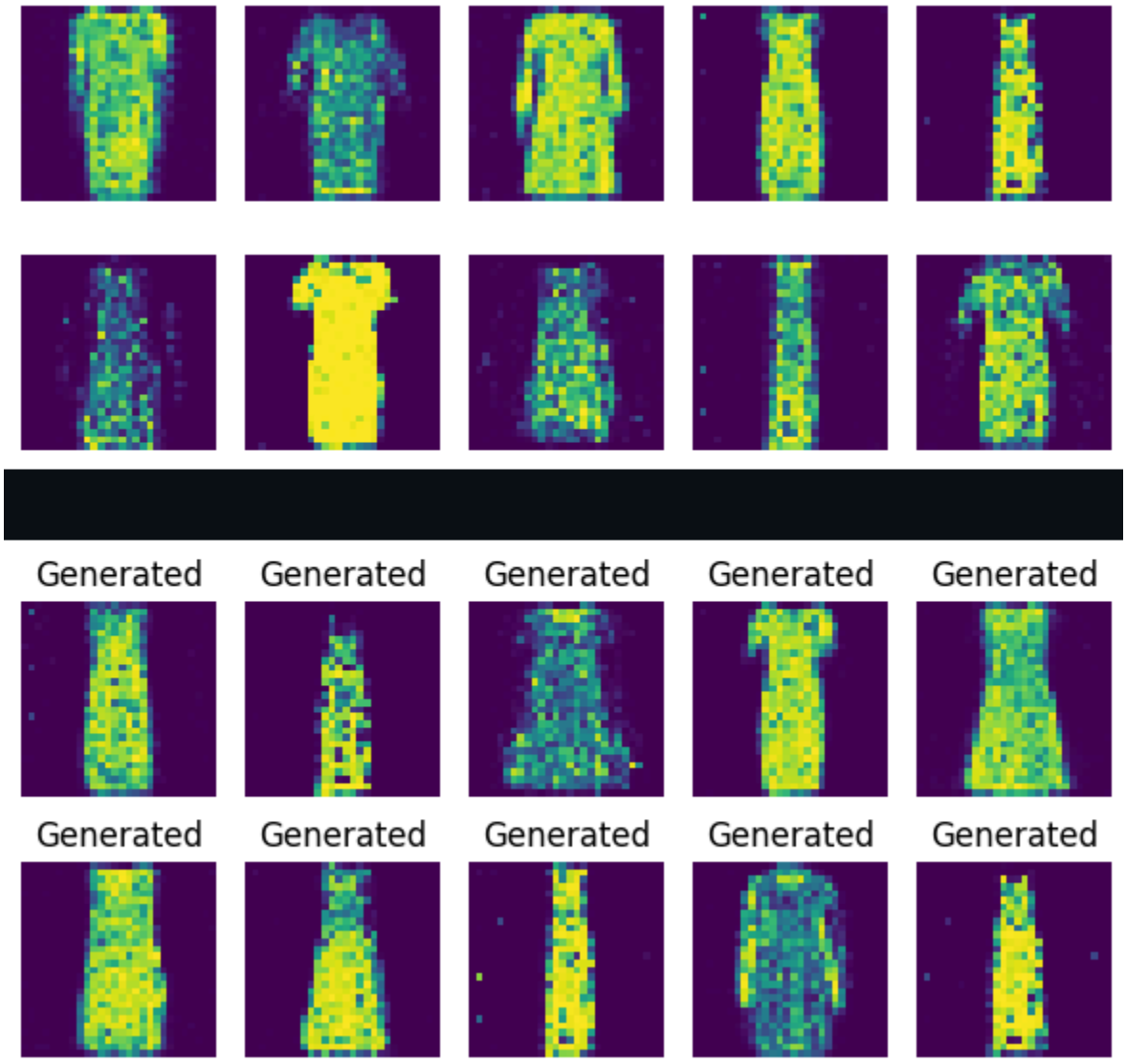
## GANs Digits Output

The 10 images given on top are original images while the bottom 5 are generated using the model

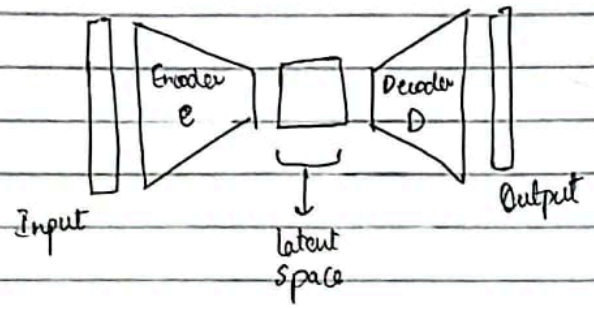


## GANs Fashion Output

The 10 images given on top are original images while the bottom 10 are generated using the model



# VAE

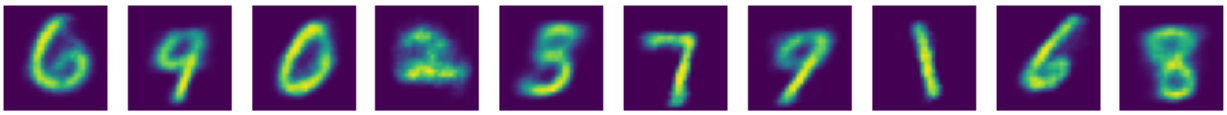



Latent Space is basically a compressed representation of the input data. This allows to group similar ~~features~~ images based on important features.

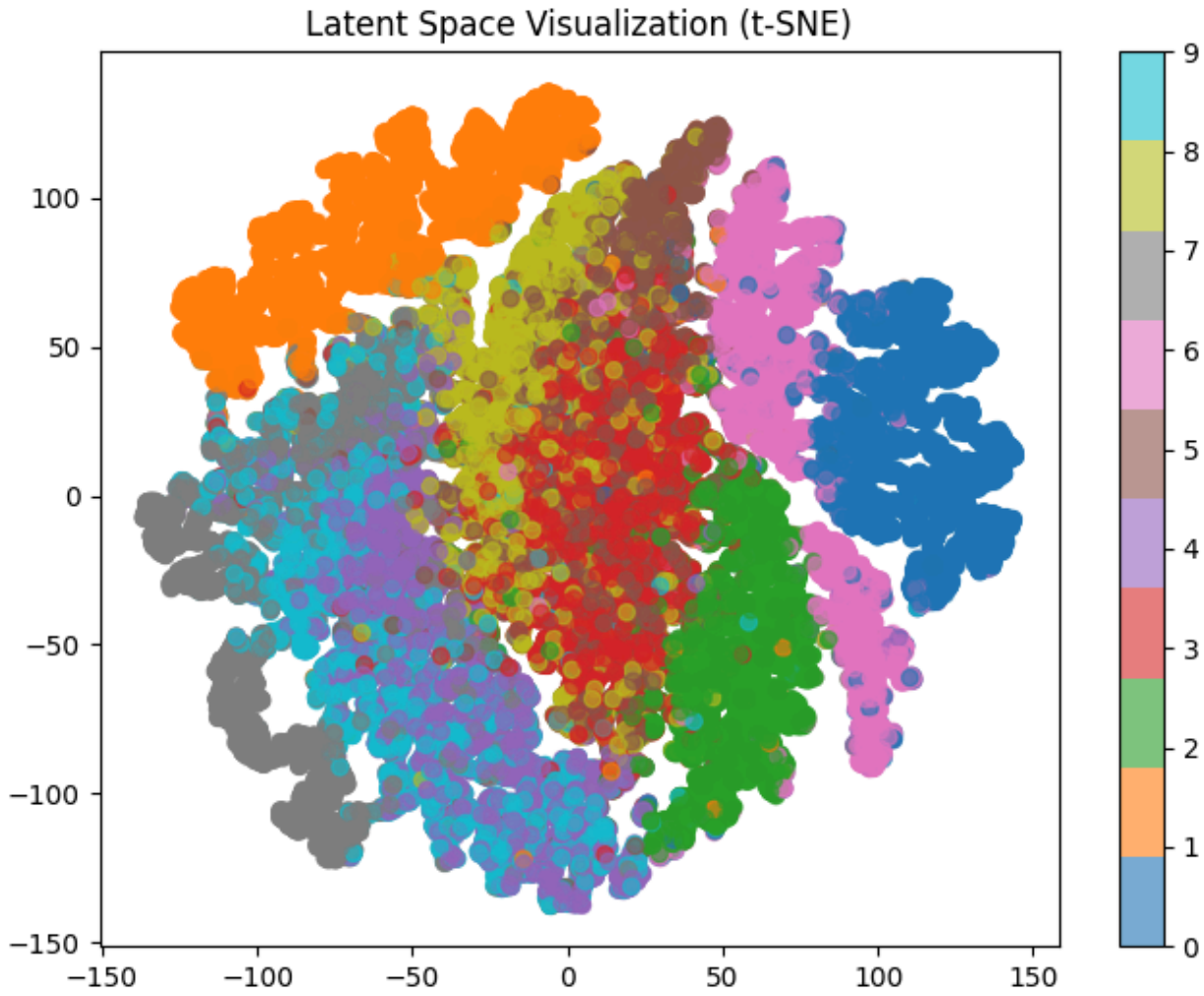
Encoder is basically responsible for compressing the input data into lower dimensional latent space. It does so while also learning the important features in the image and also outputs $\mu$ and $\sigma^2$.
(mean) (variance)

Decoder is responsible for generating images based on the latent space representation.

## VAEs Output



## Plot for latent space representation



# PART 4 - Analysis

For this assignment I compared GANs and VAEs using the MNIST dataset (fashion and digits) to see which works better in three areas:

1. Image quality – How good the images look
2. Training stability – How easy they are to train
3. Latent space – How well they organize information

**Image Quality** – How good the images look : GANs make sharper images, but sometimes repeat the same ones or create errors. VAEs on the other hand made more clearer and consistent images however for some reason, the images generated with VAEs seemed blurry sometimes.

**Training Stability** – How easy they are to train : Personally for me GANs were a lot more difficult to train and failed often. VAE were relatively easier to train.

**Latent Space** – How well they organize information : GANs don't really have a structured way of organizing data while VAEs learn a well-organized pattern, making them better for controlled image generation.

**How to Improve** :

- GANs: Use better training techniques to reduce errors.
- VAEs: Use better decoders to make images sharper.

# PART 5 - Save world with VAE

Performed analysis on the credit card dataset from kaggle to see and detect anomalies
I had limited time so ran 50 epochs only

```
Epoch [10/50], Average Loss: 19.3509
Epoch [20/50], Average Loss: 18.3026
Epoch [30/50], Average Loss: 18.0777
Epoch [40/50], Average Loss: 17.9263
Epoch [50/50], Average Loss: 17.7928
Number of anomalies detected: 14241
Percentage of anomalies: 5.00%
```