# CAP 6610, Machine Learning, Fall 2020

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**Generative Adversarial Network Architecture**:
Generator:
1) Input Layer – Inputs images of size (28,28,1)
2) Conv2D – Filters: 32, Kernel size-3, activation: RELU
3) Max Pooling 2D Layer – pool size: 2
4) Conv2D – Filters: 64, Kernel size-3, activation: RELU
5) Max Pooling 2D Layer – pool size: 2
6) Flatten Layer
7) Output layer – Nodes: 28*28
Discriminator:
1) Input Layer – Inputs images of size (28,28,1)
2) Conv2D – Filters: 128, Kernel size-3, activation: RELU
3) Max Pooling 2D Layer – pool size: 2
4) Conv2D – Filters: 64, Kernel size-3, activation: RELU
5) Max Pooling 2D Layer – pool size: 2
6) Flatten Layer
7) Output layer – Nodes: 1, activation: SOFTMAX
GAN Model is combination of Generator and Discriminator

**Variational Auto Encoder Architecture:**
 Encoder:
1) Input Layer – Inputs images of size (28,28,1)
2) Dense Layer – Nodes: 28*28, activation: RELU
3) Dense Layer – Nodes: 128, activation: RELU
4) Output layer – Nodes: 28, activation: SIGMOID
Decoder:
1) Input Layer – Inputs images of size (28,1)
2) Dense Layer – Nodes: 128, activation: RELU
3) Dense Layer – Nodes: 256, activation: RELU
4) Output layer – Nodes: 784, activation: SIGMOID
VAE is Combination of Encoder and Decoder.

**Accuracy:**
GAN has 0 % accuracy i.e. total failure while VAE has around 15% accuracy. GAN outputs complete white image while VAE shows some kind of blurry digit pattern in center of the image.

**Reason for Failure:**
1) GAN fails due to less epochs and smaller dataset used for training. Also, I might tweak the hyper parameters and change the architecture.
2) VAE fails due to simpler model architecture, I will use may be different type of architecture.
Both the models were trained on a smaller subset of dataset i.e. only for a single digit class with less epochs and no fine tuning of hyperparameters.