Basics of GAN

Generative

need to generate some probability distributions which become close to the original data that we want to approximate.

Adversarial

Means conflict or opposition, there will be two networks called discriminator and generator, these two networks will fight with each other in order to learn the probability distribution function.
GANs are deep neural net architectures composed of two neural networks. competing one against the other.

Definition

GAN are neural networks that are trained in an adversarial manner to generate data mimicking some distribution.
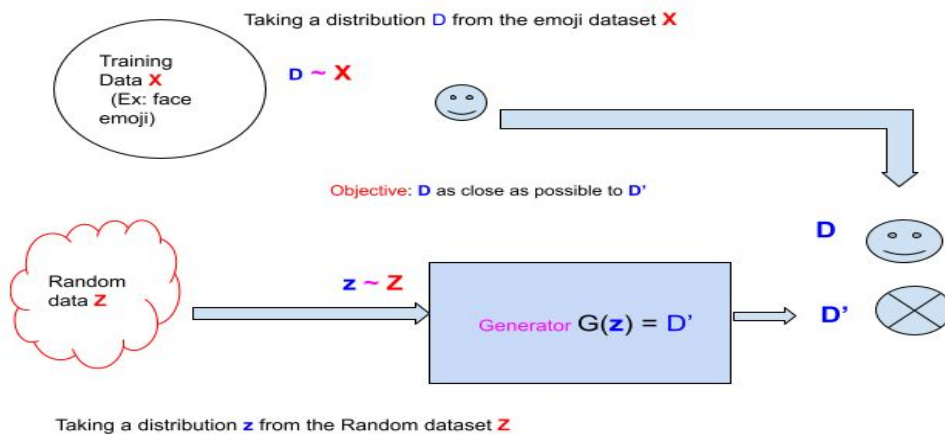There are two classes of model,

1. **Discriminative model**
   It is the one that discriminates between two classes of data like whether fake(0) or real(1).
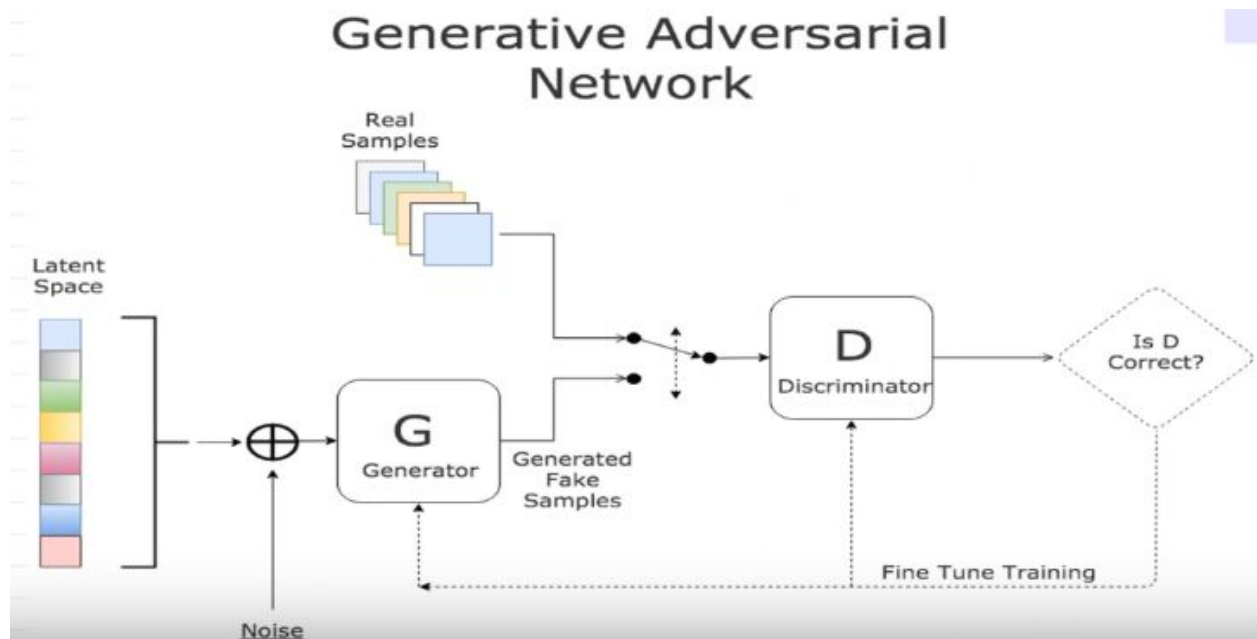
2. **Generative model**
   - A generative model G to be trained on training data X sampled from some true distribution.
   - D is the one which is given some standard random distribution.
   - Z produces a distribution D' which is close to D according to some closeness matrix.

Taking a distribution **D** from the emoji dataset **X**

Training Data **X** (Ex: face emoji) **D ~ X**

Objective: **D** as close as possible to **D'**

D

Random data **Z**   **z ~ Z**   Generator **G(z) = D'**   **D'**

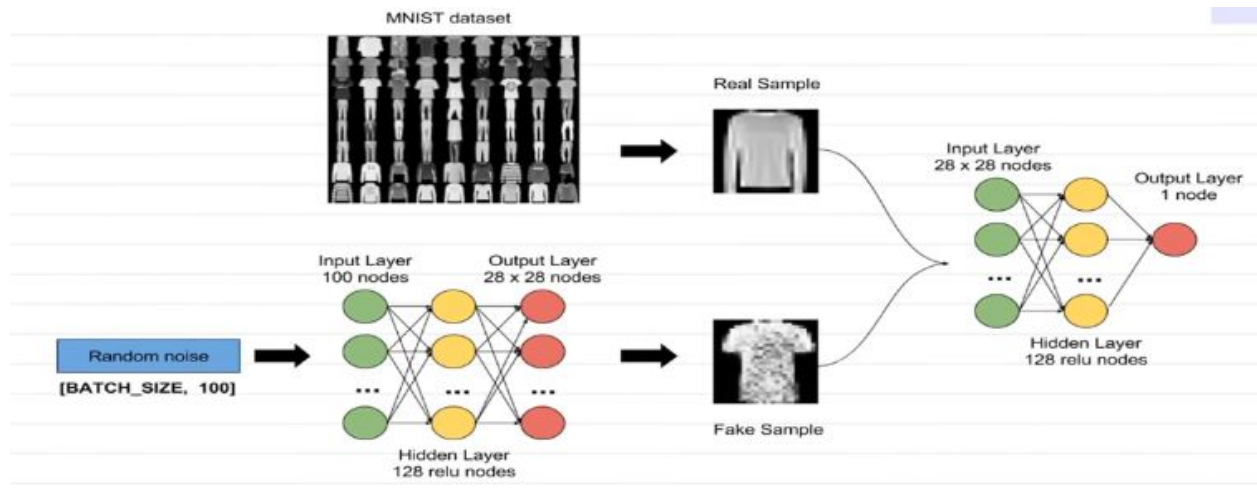Taking a distribution **z** from the Random dataset **Z**

GAN Model

The GAN model architecture involves two sub-models: a *generator model* for generating new examples and a *discriminator model* for classifying whether generated examples are real, from the domain, or fake, generated by the generator model.

Generative Adversarial Network

Real Samples

Latent Space

D Discriminator   Is D Correct?

G Generator   Generated Fake Samples

Fine Tune Training

Noise

GAN for MINST Fashion Dataset
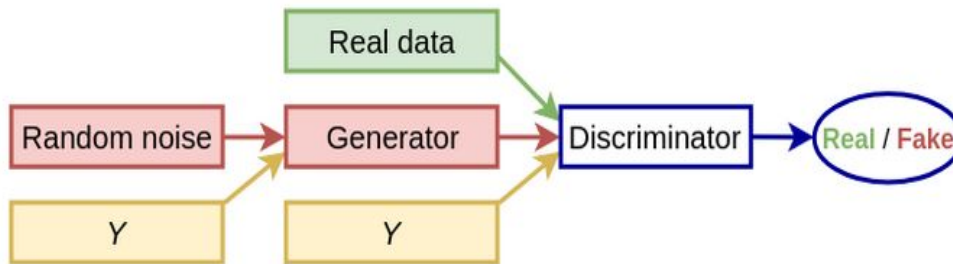
Conditional GANs

Definition

Conditional GAN is a generative adversarial network whose Generator and Discriminator are conditioned during training by using some additional information.[1] This auxiliary information could be, in theory, anything, such as a class label, a set of tags, or even a written description.

Why do we need this?

Generative models generate data(images) from random samples as we see before. There is no control over the output. For example In MNIST Fashion dataset GAN will generate randomly images like Trouser, Bag, Coat, shirts etc. You have **no control** (drawbacks of GAN) over the output data.

If you want to control the output, that is if you want to show only shoes or shorts not randomly then you need to use the conditional GAN.

- Now the Generative model will take the random distribution by condition lets say **Y.**
- So the function will be G(**Z/Y**) = **D' .**
- D is the one which is given some standard random distribution. Also give the distribution by condition **Y** ,

Conditional GAN