**Math behind GAN’s**

G stands for generator

D is Discriminator

Two methods in ML

1.Discriminative method=conditional prob of target variable given input variable

Logistic+linear regression

2.Generative method,joint probability of input and target

Generative model can be used to make new instances of data

We are learning or producing fake data points using a generator

These two models work in an adversarial model

P data

P z distribution of noise

We provide noise to the generator to produce reconstructed data and the reconstructed data and original data are checked for equality and probability of the reconstructed data being real is checked.

Y=1 and Y=0 is the level

D is trying to find dissimilarity

G fools D

2 player minimax game

Value function:Similar to Binary cross entropy function:

Min max(V(G,D)=E x~p data [ln (D(x))]+E z ~ pz [ln (1-D(G(z)))]

Expectation to represent entire data

Optimisation

Using of stochastic process

Training Loop:

-fix the learning rate of G

Inner loop for D:

-take m data samples and m fake data samples

-update theta D by grad descent.

Fix the learning of D

-take m fake data samples

-update theta D by grad descent

And here is the formula:

**Generator is trying to minimize the value function**

For every k updates of discriminator, generator is updated once:

Prove of P-g will convert to pdata at global minimum.

For fixed G,

V(G,D) = integral of px\*ln(D(x))+integral of pg x \*ln(1-D(x))

Represent value function

y=a ln x + b ln (1-x)

**Jhnason Shanon divergence**

To measure the difference between two distributions

JS Divergence

At convergence of the p data to pg then D(x)=½ of distinguishing real and fake data.

**Training of GAN’s**

G is generative model and auto