Generating fake faces

with Generative Adverserial Network (GAN)

Introduction

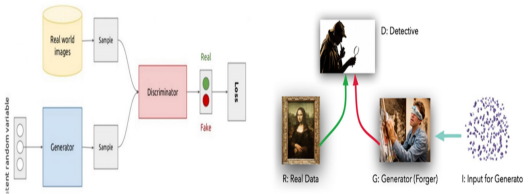
GANs represent a class of Unsupervised Machine Learning algorithms which can be characterized as two neural networks competing against each other.
GANs were introduced in 2014 by a Google research scientiest Ian J. Goodfellow
This new generation of Neural Nets are being used to :
produce samples of photorealistic images for the purpose of industrial design, shoes, bags, etc.
Reconstruct 3D models of objects from images
They were reported to be used by Facebook, and many other applications

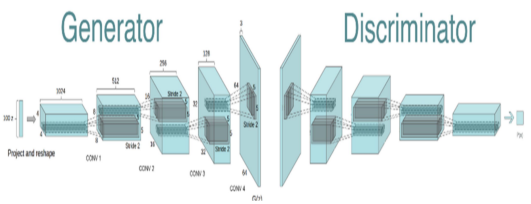
Analogy

One way to think about GANs is by thinking of one network as an art forger, and the other as an art expert. Art forger, in GAN literature known as Generator, is trying to forge pictures that resemble the originals. Art expert, in GAN literature known as Discriminator, recieves both the forged, and the original paintings and tries to discriminate which one is fake and which one is real.

Methodology

We can consider Generator network as function G which performs the mapping from latent space, to the space of the data (e.g images) .
Formal expression - $G:G(z)\rightarrow R\hat{}(|x|)$, where $z\in R\hat{}(|z|)$ is a sample from latent space, $x\in R\hat{}|x|$ is an image and |.| denotes the number of dimensions
Similarly, Discriminator networks can be characterized as function that maps from image data to probability of that image coming from real data distribution, or generator data distribution
Formal expression - $D:D(x)\rightarrow(0,1)$, where $x\in R\hat{}|x|$ is an image, either from real data distribution, or generator data distribution

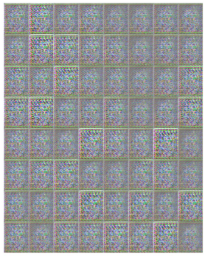




Results

I have made two experiments :
(A)Training DCGAN while using SELU activation function – reason behind this experiment is that, in the “High-Resolution Deep Convolution Generative Adverserial Network” paper, it has been proven that SELU greatly improves convergence speed on DCGAN structure
(B)Training DCGAN while using ReLU activation function – this experiment is based on the initial implementation of DCGAN, done by Alec Radford & Luke Metz in their “Unsupervised Representation Learning with Deep Convolutional Generative Adversarial Networks” paper

A



B

Possible Improvements

Dataset
Increased data quality –there is a need for images that have better quality, and same semantic interpretation.
Increased data quantity – more images ! One possible solution to this was data augmentation, but even with it, dataset is still small to train DCGAN.
Training
As mentioned before, we still do not have a good algorithm to find Nash equilibrium of the game. Improving the training stability of Generative Adverserial Networks is still an active area of research.
Architecture
Follow instructions proposed in “High-Resolution Deep Convolutional Generative Adverserial Networks” paper, and experiment with SELU activation function.