A Style Based Generator Architecture for Generative Adversarial Networks

Vyshak Puthusseri

Oct 09th, 2019

MCA CET

Introduction

- GAN : Generative Adversarial Network
- Style Transfer
- Style Based Generator Architecture for GAN

Deep Learning - HOW?

LTU Linear Threshold Unit
Building blocks of neural networks Proposed by Warren McCulloch and Walter Pitts
Only a concept, No learning strategy

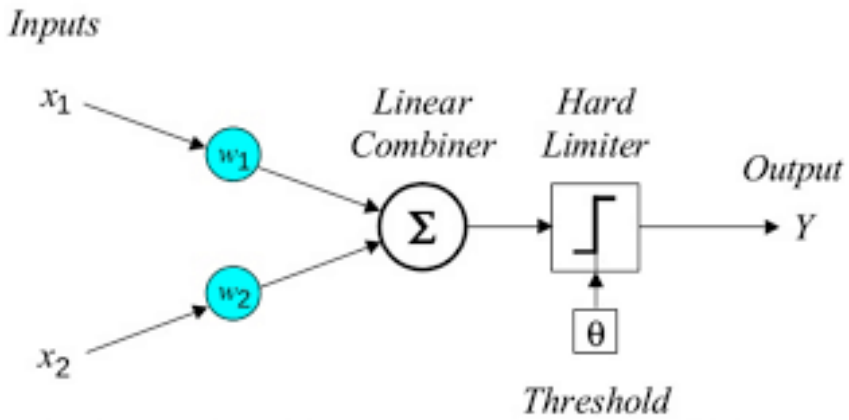
Deep Learning - HOW?

Perceptron

- LTU + Learning rule .

Perceptron

- LTU + Learning rule .
- Works only for binary classification



Deep Learning - HOW?

Multilayer Perceptron

- Multiple perceptrons are stacked side by side and on top

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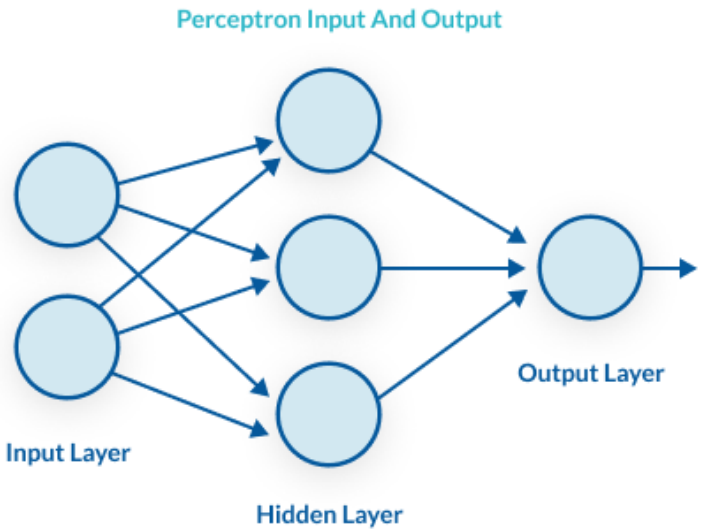
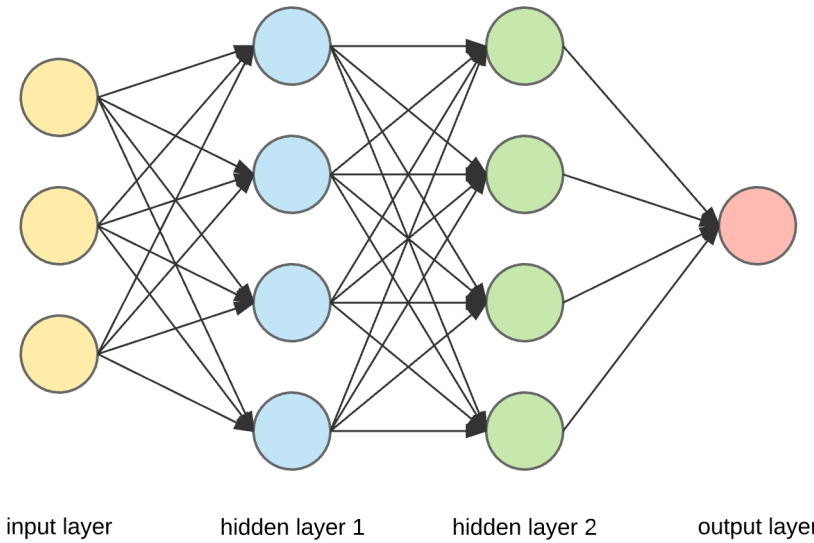
- Activation function : Sigmoid



Deep Learning - HOW?

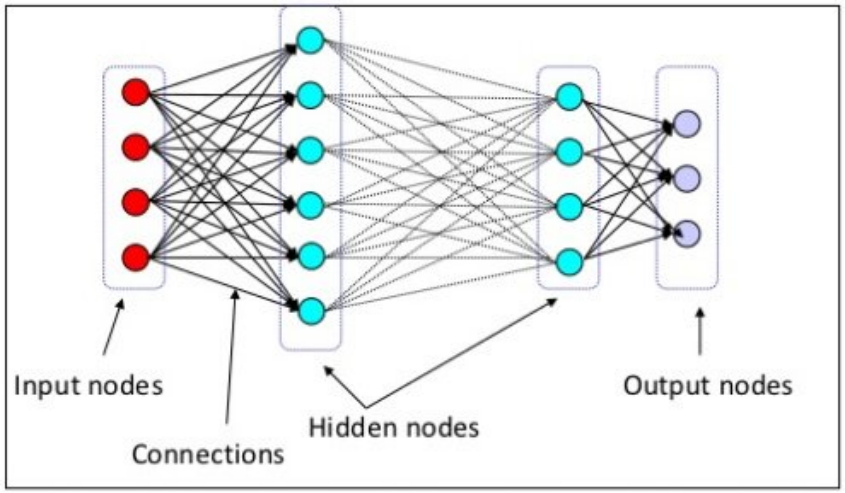
Deep Neural Network

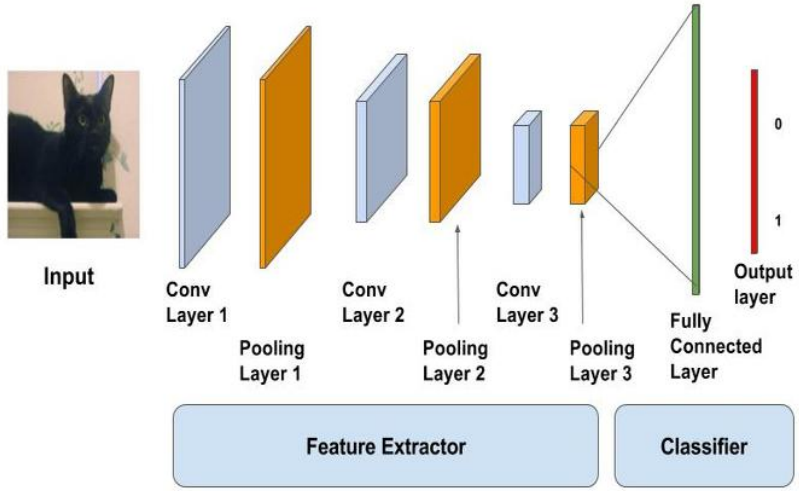
If there is only one hidden layer



Learning Weights of a deep neurral networks is called as deep learning

Why





Learning Weights of a deep neurral networks is called as deep learning

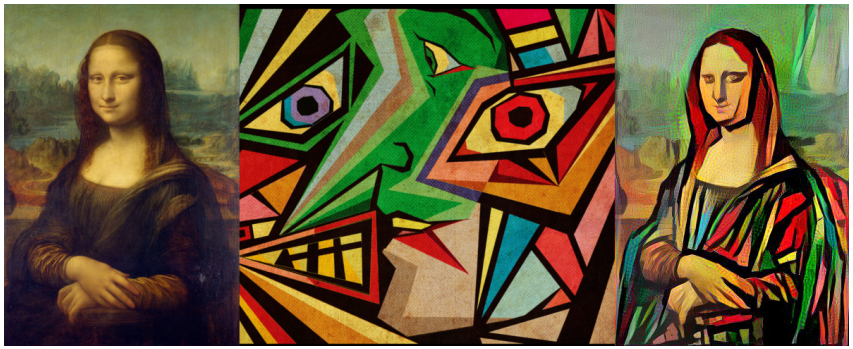
Neural Style Transfer

Style transfer relies on separating the content and style of an image. Given one content image and one style image, we aim to create a new, target image which should contain our desired content and style components:

- objects and their arrangement are similar to that of the content image (feature reconstruction)
- style, colors, and textures are similar to that of the style image (texture synthesis)

Neural Style Transfer

$$\text{content.image} + \text{style.image} = \text{new.imagewithstyle.transfered} \quad (1)$$



https://github.com/puthusseri/styleTransfer.git

Generative Adversarial Network

GANs are generative models: they create new data instances that resemble your training data.
eg: images that look like photographs of human faces, even though the faces don't belong to any real person.

GAN : Applications

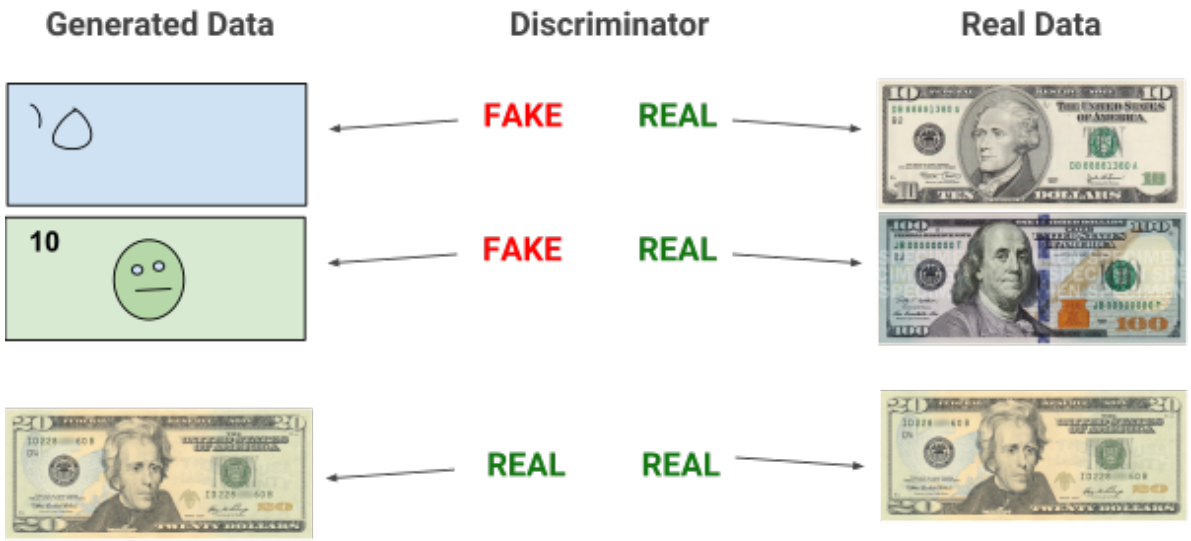
- Image to image translation (in unsupervised way)
- blue prints to real image
- photo to cartoon (Facebook AI research)
- photo of day to night (NVIDIA Research)
- Creating stimulated training set (eg : face recognition problem)
- for imitaion learning

GAN : Overview

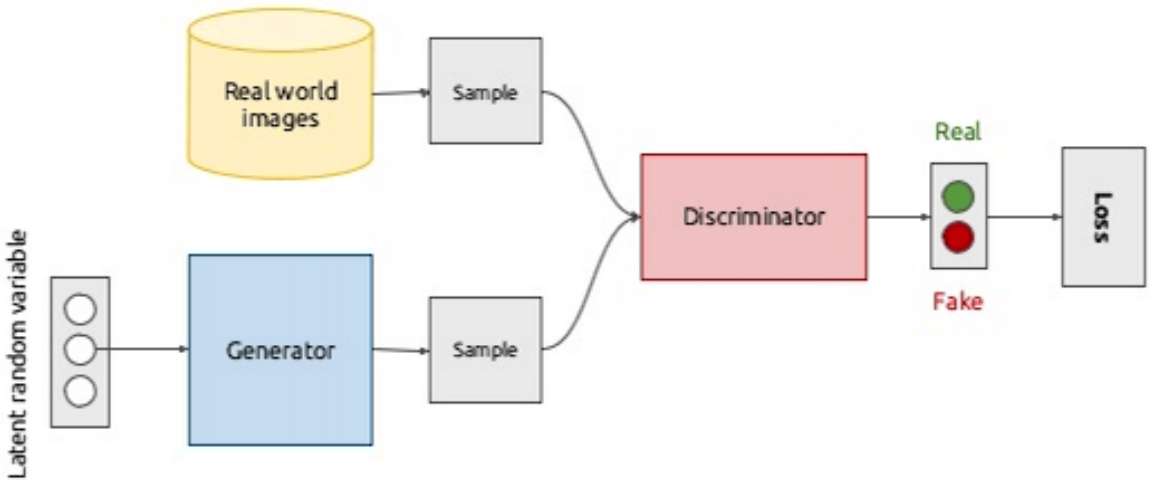
GANs has two parts:

- The generator : learns to generate plausible data. The generated instances become negative training examples for the discriminator.
- The discriminator: learns to distinguish the generator's fake data from real data. The discriminator penalizes the generator for producing implausible results.

GAN : Training



GAN : Architecture



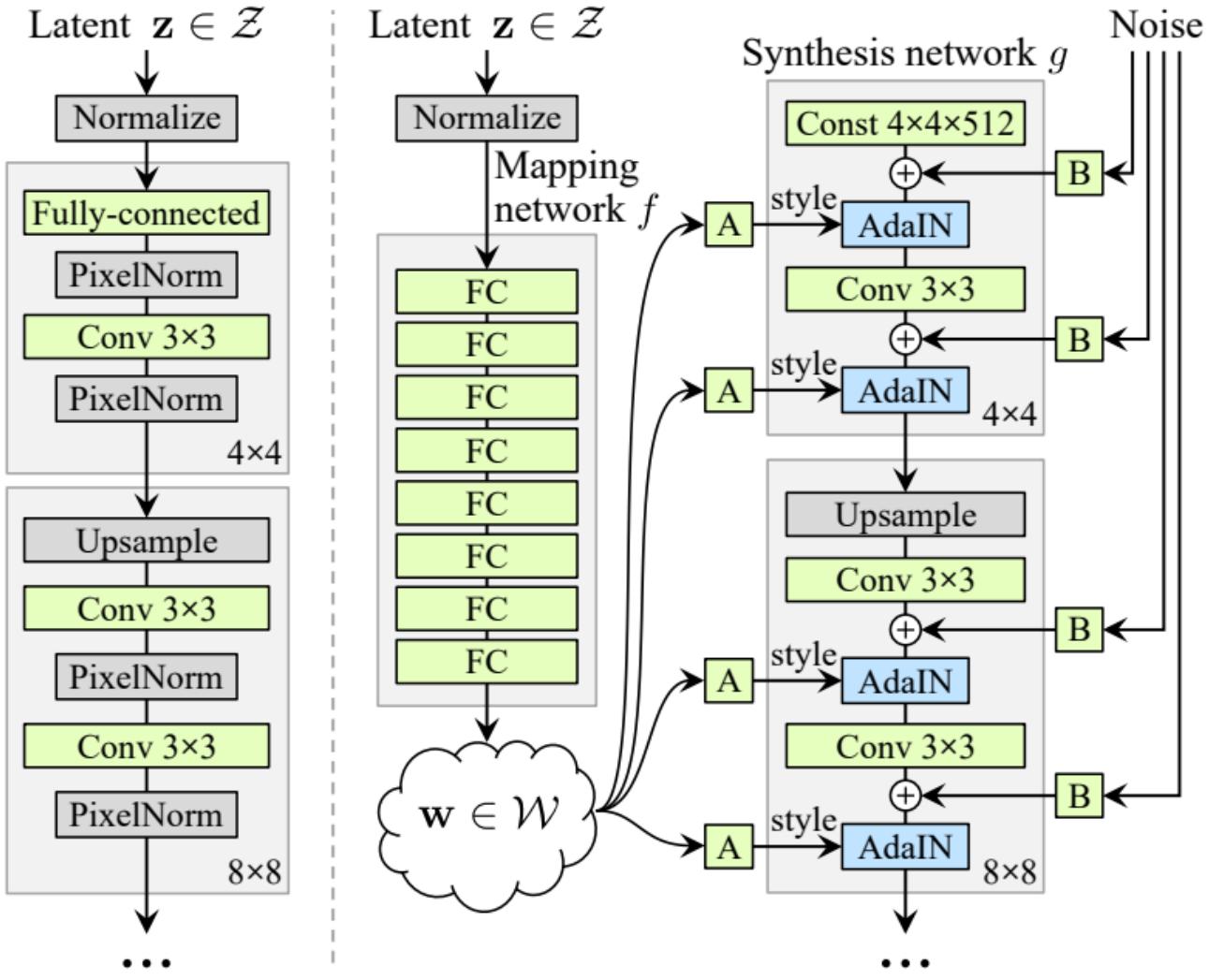
Style Based GAN

- Introduced by NVIDIA
- Improved the efficiency of GAN by improving the generator
- Introduced new automated metrics - perceptual path length and linear seperability
- Result was : new dataset Flickr Face HQ (FFHQ) of size 2.56 TB

Style Based Generator

- The weights are studied through the 8 layer affine transformation.
- Feature maps are normalized using AdaIN
- Generate stochastic details by introducing the explicit noise for each layer.
- Final resulting feature maps are passd to the discriminator.

Style Based Generator : Architecture



(a) Traditional (b) Style-based generator

Image Quality

- Comparing with CELENA-HQ with FFHQ based on Frechet inception distances (FID) , a great improvement happens
- Used truncation trick
- Used 26.3M parameters for training
- Generated image is of 1024 * 1024 resolution

Style Based Generator : Properties

- Style mixing - mixing regularization

Style Based Generator : Properties

- Stochastic variation

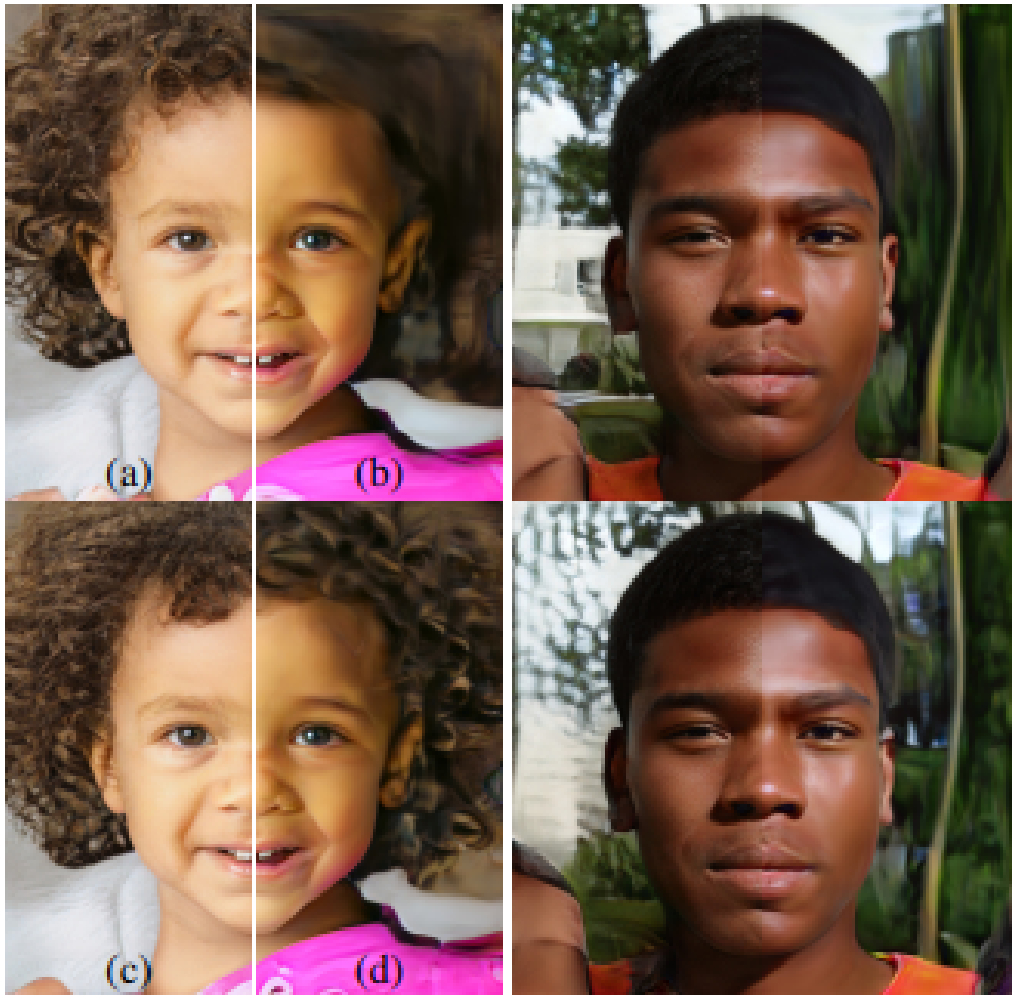


Figure 5. Effect of noise inputs at different layers of our generator. (a) Noise is applied to all layers. (b) No noise. (c) Noise in

Conclusions

Thank you

Questions?