MACHINE LEARNING III

Deep GAN

Group Assignment II

Professor: Rubén Zazo Candil

Group: E

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Students:

1. Jaime Bardisa
2. Nuno Cardoso
3. Alvaro Céliz
4. Mariana Coca
5. Raquel Suñer
6. Eduardo Troncoso
7. Jules Vanthournout

1. Generating MNIST data

TODO 1. *Explain the high-level idea of Generative Adversarial Nets.*

Generative Adversarial Networks are an unsupervised learning task of Machine Learning. They are composed of two models which compete against each other to analyze, capture and copy the variances and patterns within the data in order to generate new examples which can be drawn from the original dataset. These two models are the Generator and the Discriminator.

The Generator is a neural network which creates fake data to be trained of the Discriminator. Its main goal is to make the discriminator classify its output as real. It uses backpropagation to adjust each weight in the right direction. On the other hand, the Discriminator is a neural network that identifies real from fake data created by the generator. Real data is used by the discriminator as positive samples during the training, and fake data is used as negative samples.

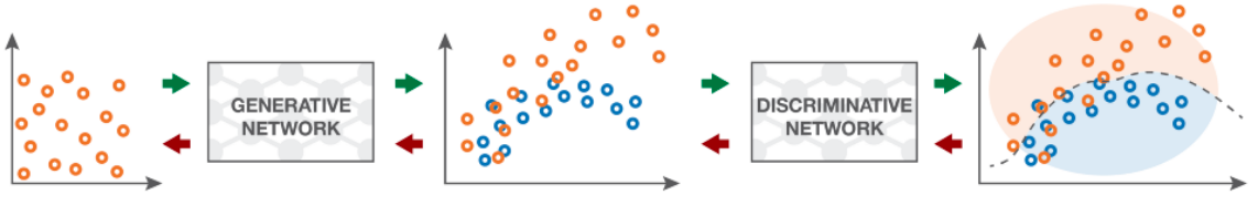
GANs are most commonly used in image, video and voice generation.

TODO 2. *Both the generator and discriminator are convolutional neural nets.*

Which are the inputs and expected outputs of both of them before and after training?

The main task of GANs is a discrimination task between "true" and generated samples of data. The discriminator takes samples from "true" and generated data, and classifies them as accurately as possible. On the other hand, the generator is trained to fool the discriminator as much as possible.

The generator takes as input a simple random variable, and once trained, returns a random variable that supports the targeted distribution. If both distributions are far from each other, the discriminator will easily classify and provide a high confidence level for most points. However, due to its high complexity, the discriminative function will be modelled with another neural network as it will have difficulty to make the class prediction for the two distributions to be equal in all points. For this reason, it will take as input a point and return as output the probability of this point to be "true".



The above diagram represents Generative Adversarial Networks. It displays how the generator takes random variables as inputs and generate new data points. The discriminator takes "true" and generated data to build a classifier. The aim of the generator is to fool the discriminator so this one can differentiate between "true" and generated data.

https://machinelearningmastery.com/what-are-generative-adversarial-networks-gans/

TODO 3. *The core functions are train and its subfunction train_step. Explain step by step what they are doing.*

2. Generate CIFAR10-images

TODO 1. *Complete the code for the Generator model.*
Done in the collab file following the specifications

TODO 2. *Complete the code for the Discriminator model.*

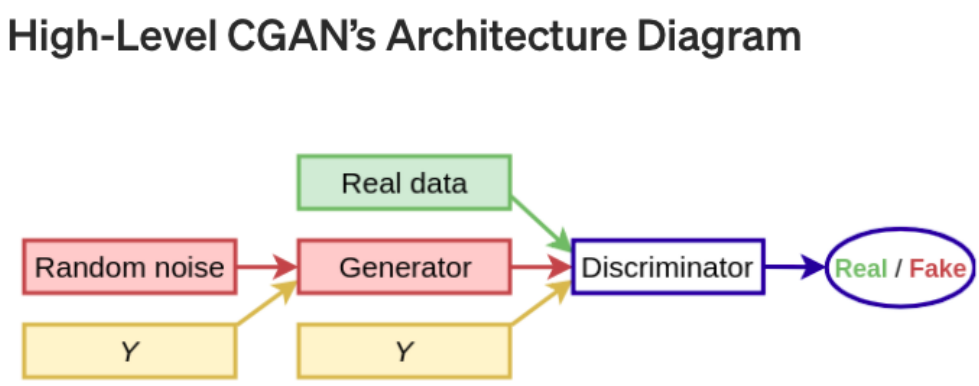
Done in the collab file following the specifications

3. Conditional GANs

TODO 1. *Explain what a Conditional Generative Adversarial network is.*

Conditional Generative Adversarial Networks (CGANs) are an extension of the GANs model; a deep learning technique where a conditional setting is applied. They are allowed to generate images with specific conditions or attributes and are also formed by a Generator and a Discriminator component. Both components are conditioned by specific information such as class labels or data from other modalities. As a result, the final model can learn multi-modal mapping; from input or output, by feeding it with different contextual data.

CGANs are mainly used in image-to-image translation, video generation and computer vision tasks amongst others.



The above diagram displays how random data runs through the Generator all the way to the Discriminator is order to identify "true" and generated data.

https://medium.datadriveninvestor.com/an-introduction-to-conditional-gans-cgans-727d1f5bb011

EXTRA. *Create your own Conditional Generative Adversarial Network to generate conditioned samples in the Fashion MNIST dataset.*