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ANALYSIS ON HYPERPARAMETER TUNING IN DCGAN'S

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Abstract: In modern days, Deep Convolutional GAN (DCGAN's) were widely used to generate new data such as images and audio files. This has been growing very fastly and it is especially used for lot of companies that they are looking for ways that they can generate the new data based on predetermined data that they have collected. The output of DCGAN's are mainly depends upon the hyper parameters which are used in this models. For beginners, they don't what values (or) range should be taken to get the desired output.

In this project , we are making an analysis on hyper parameter tuning and provides the limitation for the hyperparameters of DCGAN's. And this project is very useful to the beginners whose are going to build a models using DCGAN's. In this we train our DCGAN model on two datasets . They are Anime dataset and human faces dataset.

1. Introduction

Many companies spent lot of money and time on creating new cartoon pictures and interior designs. Due to this lot of money and time will be wasted in the way that :

First they have to pay money to the designer to start the work.After the completion of design it will be inspected by director for approval. If the design gets rejected, it should be redesigned from starting. So this is a time taken process and money will also be wasted. To overcome this problem DCGAN's were used to design the new images .This model can also be used in generating new music tunes.

Deep Convolutional Generative Adversarial Network (DCGAN) are made of two distinct models, a generator and a discriminator. The working of the generator is to generate 'fake' images which are look like the training images. The working of the discriminator is to look at an image and outputs whether the image is a real training image or a fake image from the generator.

Hyperparameter tuning refers to the problem of finding an optimal set of parameter values for a learning algorithm. usually the process of choosing these values is a time-consuming task. For simple algorithms like linear regression also, finding the best set for the hyper parameters can be tough. Hyper parameter tuning works by running multiple trails in a single training job. Each trial is a complete execution of your training application with values for your chosen hyper parameters, set within limits you specify. The AI platform training service keeps track of the results of each trial and makes adjustments for subsequent trails. When the job is finished, you can get a summary of all the trails along with most effective configuration of values according to the criteria you specify. Hyper parameter tuning requires explicit communication between the AI platform training service and your training application. Your training application defines all the information that your model needs. You must define the hyper parameters (variables) that you want to adjust, and a target value for each parameter.

2. Literature Review

Deep Convolutional Generative Adversarial Network model were widely used in today's world. DCGAN's were mainly used for generating new images from the predetermined dataset. This has the ability to Learning features of huge unlabelled data and preserving those features to create new set of data. This has a great scope in fashion , art and machine learning.

DCGAN's mainly consists of two networks (i.e) Generator and Discriminator. The working of generator is to generate 'fake' images that look like the training images. The working of the discriminator is to look at an image and output whether the generated image is a real training image or a fake image from the generator. During training, the generator is trying to outsmart the discriminator by generating better and better fakes, while the discriminator is working to become a better detective and correctly classify the real and fake images.

The quality of image and to get the desired output is entirely depends upon hyper parameters. The hyper parameters of DCGAN's are No. of channels, No. of Epochs, Data Root, Batch size, Image size, Learning Rate, Beta1, No. of GPU's and so on. These hyper parameters plays a vital role to get the desired output. Hyperparameter tuning refers to the problem of finding an optimal set of parameter values for a learning algorithm. usually the process of choosing these values is a time-consuming task. For the beginners who wanted to working with this model have no any idea about what range should be taken to get the desired output. They take wrong input range and they didn't get the desired output. For example, if they take learning rate value as 0.1, then they get the noise image as output as shown in below:

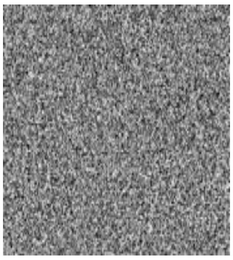


Fig: Noise image

In this paper, we are providing the what range (or) values should be taken for the given hyperparameters in DCGAN's in order to get the desired output. So, the beginners or students can easily bulid their model by using this paper.

3. Existing System :

Many companies spent lot of money and time on creating new cartoon pictures , interior designs and audios. In order to reduce this cost and time , Deep Convolutional Generative Adversarial Network (DCGAN's) is an alternative solution which is used for generating new data from the predetermined data.

But there is an problem with this, the beginner who want to build this model have no idea about how much value (or) range is to be taken to make a model and get desired output.

4. Proposed System

In this proposed system , we are making an analysis on hyperparameter tuning. We provide what values to be taken for parameters to get the desired output.

This project provides the limitation for the hyper parameters of DCGAN's. And this paper is very useful to the beginner who are going to build a models using DCGAN's. In this we train our DCGAN model on two datasets. They are Anime dataset and human faces dataset.

Advantages :

- For beginners whose wanted built this model have got a idea about what parameter range should be taken to get the good quality image and desired output.
- By this model, new images will be generated fastly without any cost.
- Generates photographs of Human faces,Cartoon characters.
- This model can also be used for Image-to-Image Translation, Text-to-Image Translation, Photos to Emojis.
- By this model, one can also generate new audio files.
- Generates New Human Poses.
- This can also be used for Face Aging, Photograph Editing, Photo Blending.

4.1 DCGAN Architecture :

This architecture describes the work flow of DCGAN's. They are made of two distinct models, a generator and a discriminator . The working of the generator is to produce or generate 'fake' images that look same as the training images. The working of the discriminator is to look at an image and tells us whether the image is a real training image or a fake image from the generator. This explicitly uses convolutional and convolutional transpose layers in the discriminator and generator , respectively .

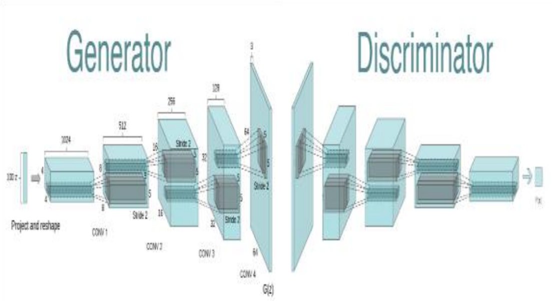


fig: DCGAN architecture

Flow Diagram of DCGAN:

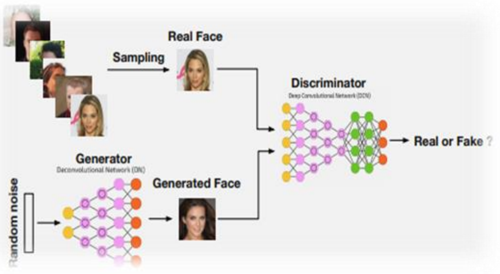


Fig:DCGAN flow chart

Generator :

The Generator Network takes random noise as input, then runs the noise through the differentiable function(neural network) to transform the noise and reshape it to have a recognizable structure similar to the images in the training dataset. The output of the Generator is determined by the choice of the input random noise. Running the Generator Network over several different random input noises results in different realistic output images.The end goal of the Generator is to learn a distribution similar to the distribution of the training dataset to sample out realistic images.

Discriminator :

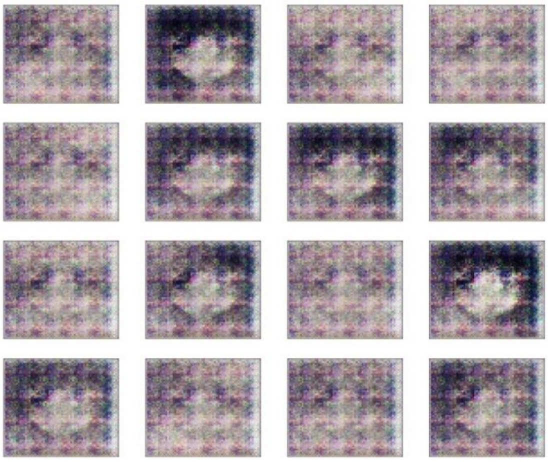
Discriminator Network is a basic classifier network that outputs the probability of an image to be real. So, during the training process, the Discriminator Network is shown real images from the training set half the time and fake images from Generator another half of the time. The Discriminator target is to assign a probability near 1, for real images and probability considered as a (two player) non-cooperative game, where each player wishes to minimize its cost function.

5. Output Images :

5.1 : ANIME DATASET OUTPUT :

After training the DCGAN model on Anime dataset , the following images were generated.

After Epochs-1, the newly generated images are :



After 20 Epochs, the newly generated images are :

After 30 Epochs, the newly generated images are :

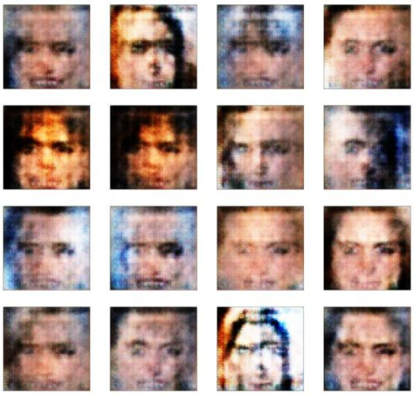
After 50 Epochs, the newly generated images are:

Number of epochs value should be taken in higher value to produce the images with good quality. In this , we are taking 50 epochs to the model to get the better result. Training for longer will probably lead to better results but will also take much longer.

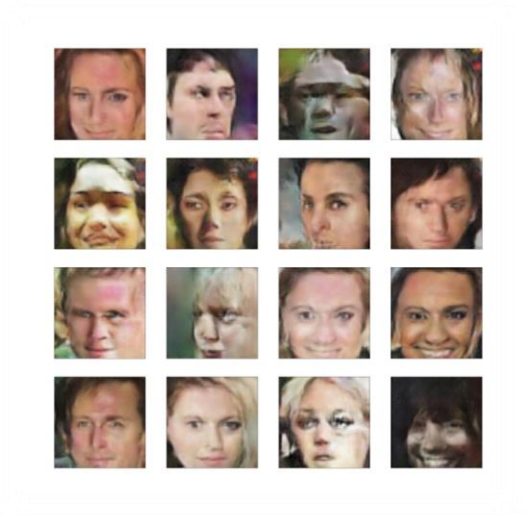
5.2: HUMAN FACES DATASET:

After training the DCGAN model on human faces dataset which can be download from internet, the following images were generated.

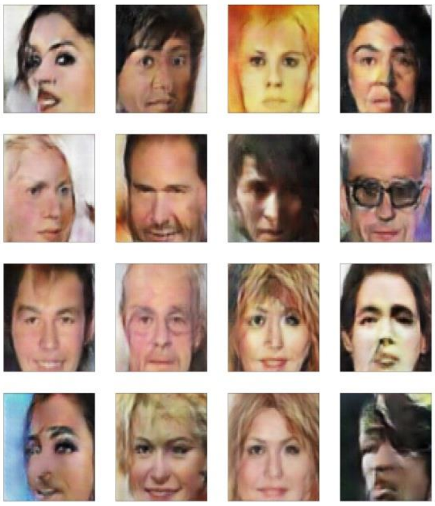
After Epochs-1, the newly generated images are :



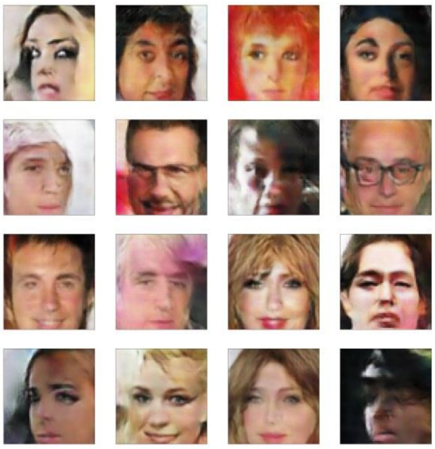
After Epochs-10, the newly generated images are:



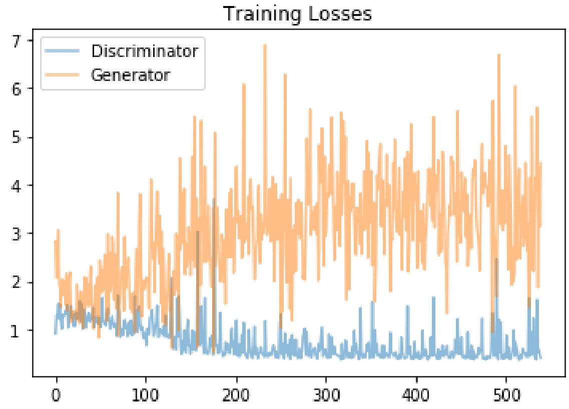
After Epochs-20, the newly generated images are :



After Epochs-30, the newly generated images are :



The Loss function of generator and discriminator graph is obtained as follows. Here orange color represents Generator loss and blue represents Discriminator training loss of the DCGAN model when training on human faces as shown in below:



6. Conclusion :

From the training on two datasets, we conclude that :

- In this project, when we are taking learning rate as o.ooo2 and 0.0005 it produces new images with good quality. But when take learning rate value as 0.1 it produces noise image.
- Number of epochs value should be taken in higher value to produce the images with good quality. It's better to take minimum 50 epochs to the model to get the better result.
- Number of channels(nc) should be taken three for color images and two for black and white images.
- Beta1 hyperparameter for Adam optimizers should be 0.5 to get the better output.
- Training for longer will probably lead to better results but will also take much longer.
- Finally the generator loss and discriminator loss should be approxiamtely equal to each other and it should not be more than 10. Then only we get better result.

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