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MAIS 202 – Deliverable 2: Progress Report

I. Problem Statement

The most basic intent of this project is to utilize a Generative Adversarial Network to generate artificial non-existent faces using a widely popular dataset known as CelebA, which contains over 200,000 photographs of celebrities' faces. If time and resources allow for further exploration, additional functionality should be added to the project such as the ability to generate faces based on the user's liking (ex: eye distance, nose shape, mouth size, face shape, etc.)

II. Data Preprocessing

The dataset selected for this project is the well-know CelebA dataset. There is no change from the original dataset that was chosen. This dataset was chosen particularly because of three main reasons. Firstly there are 202,599 images of celebrities in the dataset to utilize, which are all very well organized. Each face is well centered in the photograph and facial features are well visible. In addition, every photo is the same resolution, which reduces the amount of preprocessing that needs to be done in order to resize the photos. Lastly, there are 4 additional .csv files included in the dataset which include various attributes about the images should the developer choose to utilize them. These attributes may later be used to create additional functionality.

In terms of preprocessing, images with the celebrities wearing sunglasses were removed since it could confuse the model. The same goes for celebrities who are wearing hats. In addition, the resolution of each photo was resized to 80x80 from 178x218. This was done because of hardware limitations for computation. After doing some preprocessing, the number of images in the dataset was reduced to 180,989.

III. Machine Learning Model

This project utilizes a basic Generative Adversarial Network (also known as GAN). This is the industry for generative machine learning. For a GAN, a generative network and a discriminative network is constructed. The generator creates novel instances based of the training data and the discriminator evaluates the generator's creations. The training/validation/test sets were split 75:15:10 respectively. Since the dataset contained very many images, a higher percentage of images were allocated as training set data to expose the model to as many different faces as possible while leaving some images for validation and testing.

There were many challenges in implementing the model. In fact, the model has not yet been fully implemented due to lack of knowledge regarding CNNs, various Keras layers, models, optimizers, etc. which are crucial for building GANs. In addition, preprocessing presented many problems as well. Firstly, the computing power of the computer that the model is being run on is not powerful enough to compute the 3 RGB values for each of the 38804 (178x218) pixels for each of the 180,989 photos. After reading in each image and turning them into a NumPy array, the data for the entire array ended up being around 25GBs of data. Therefore, during preprocessing, the photos had to be resized to 80x80, and even then, the data is around 6GBs.

IV. Preliminary Results

Since the model is not yet implemented, there are no preliminary results. According to further research on evaluation metrics for GANs, it seems that one of the simplest metrics that can be used is to utilize the generator and discriminator losses. A good GAN model should look to minimize these losses. By doing so, the generator will be able to generate more realistic images and the discriminator will be able to classify more convincing fake images versus the real ones.

V. Next Steps

The next steps are to first finish the basics of the model after learning about CNNs. Then the rest of the time should be spent fine-tuning the model so that the highest results can be achieved. Perhaps after doing so, the possibility of implementing additional features to the model should be explored.