Project: Custom StarGAN
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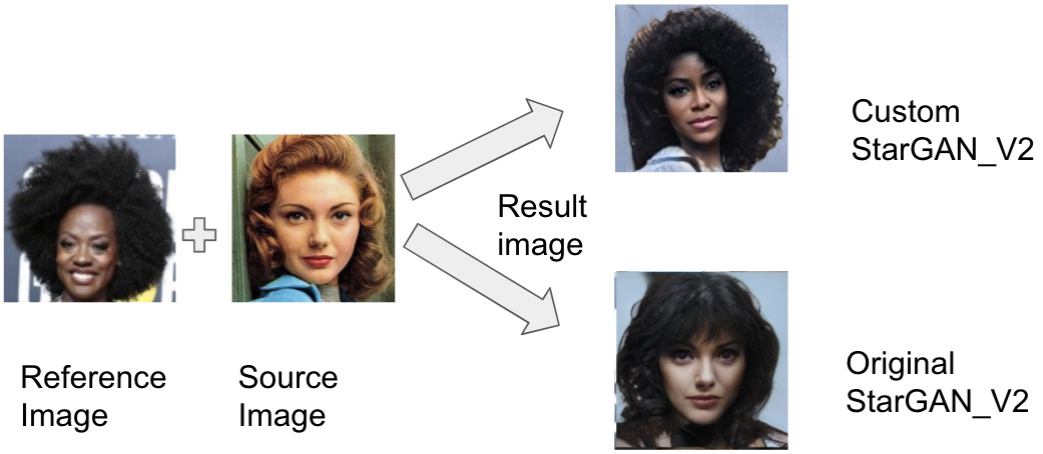
## Data

The data for this project had been collected ahead of time. It contains images of faces from 4 different domains: Black Women, Black Men, White Women, White Men
The data used for training the GAN is available online on the SCC and will be made public after the completion of the project. The data for the experiments performed is also on the SCC due to the size limitations on GitHub. The python scripts used for the different experiments are currently available on GitHub in my project repository.

## Problem Statement

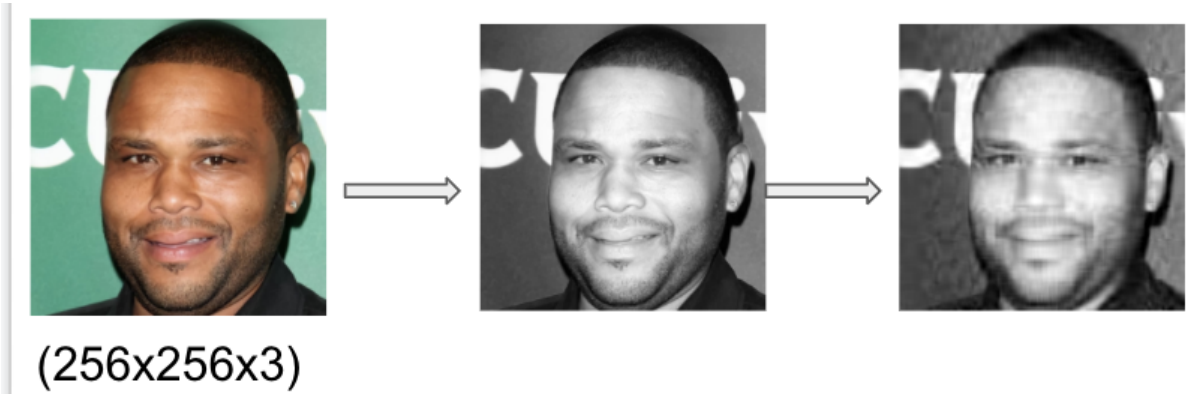
Can we quantitatively measure an improvement or discrepancy between the performance of two GANs. These GANs are custom_StarGAN_V2 and original_StarGAN_V2. In order to measure the performance, we would need to examine the similarity of the generated images to the reference domain. To do this I trained a classifier using KNN and Neural Networks to classify the GAN generated images into their respective domains. The images from the GAN with the smaller classification error indicate better performance of the respective GAN.




## Experiments and Results

1. Classifier on KNN

I decided to train a classifier based on the KNN algorithm we learned in class. Because KNN fails with high dimension inputs, I decided to downsize my data using SVD. The images went from (256*256*3) vectors to (256*20) vectors. I wanted to keep only 20 singular values because with 20 singular values it is possible to still visualize the image. Below is a projected version of the data on a 256*256 matrix.




After training the classifier based on the rank_k_stargan.ipynb notebook I got a accuracy levels below 0.4 despite trying different values of K (2,5,10). I ultimately decided that it was not feasible to measure the performance of the GANs on my KNN model since it had such poor performance on my data.

2. Classifier Using Neural Networks on Colored Images

I decided to train a classifier using a deep neural network. Neural networks have a better way of understanding complex data like images because we don't explicitly define the features to be used. The python script used was classifier.py which is available on GitHub. Based on the screenshot below my classifier is again underperforming.

```
454/457 [============================>.] - ETA: 0s - loss: 1.3858 - acc: 0.2609
455/457 [============================>.] - ETA: 0s - loss: 1.3858 - acc: 0.2609
456/457 [============================>.] - ETA: 0s - loss: 1.3858 - acc: 0.2610
457/457 [==============================] - 28s 61ms/step - loss: 1.3858 - acc: 0.2608 - val_loss: 1.3863 - val_acc: 0.2532
```

[There are several versions of this classifier training on the SCC but none of then promise an accuracy high enough for the task at hand]

In order to perform this experiment, I ran my GAN model and the original StarGAN_V2 model on a set of source and reference images belonging to each domain. I cropped these generated images from the matrix and saved them in a folder to be used when the

3. Classifier Using Encoded Images

The plan for this experiment was to use a deep learning model, an autoencoder, to compress the images in order to use them with simpler classifiers i.e. KNN, logistic regression. By the time the fourth deliverable was due. I had successfully trained 4 autoencoders (one for each domain). Here are some of the results from the various autoencoders from the different domains. I am only showing the decoder output because the inputs were identical. The auto encoder was trained using the auto_[domain].py files available on github and the image data available on the SCC.

The classification results will be included in the final version of the paper.

4. Academic Paper

Because this project was a continuation of a project that started in the summer some sections of the paper relate to work I had done previously. The final draft of the paper will have the sections clearly marked out and the results from all the experiments (included the classifier based on GANs). At the moment it contains the parts: Abstract, Introduction, Related Work, Experiments. The draft of my paper is linked here