Face recognition System

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Project Scope and Analysis

Face Recognition is used for everything from automatically tagging pictures in social media to unlocking our phones. Recent advancements in deep learning have made the accuracy of face recognition better. This project covers face recognition development environment, and training machine learning models to analyze images and identify them next time it sees them.

Project Scope and Analysis

In this project, the ML system was provided examples of image, and then learning algorithms that look at these examples and learn about the visual appearance of each were developed.

Overview of the system pipeline are as follows:

- Generate input which the training dataset with N images, each labeled based on race and gender.
- Use the training set to train a ML system to learn what every one of the images looks like.
- In the end, evaluate the quality of the ML system by asking it to predict images for a new images that it has seen and the one it hasn’t seen before. Compare the true image to the ones predicted by the ML system.

Project Scope and Analysis

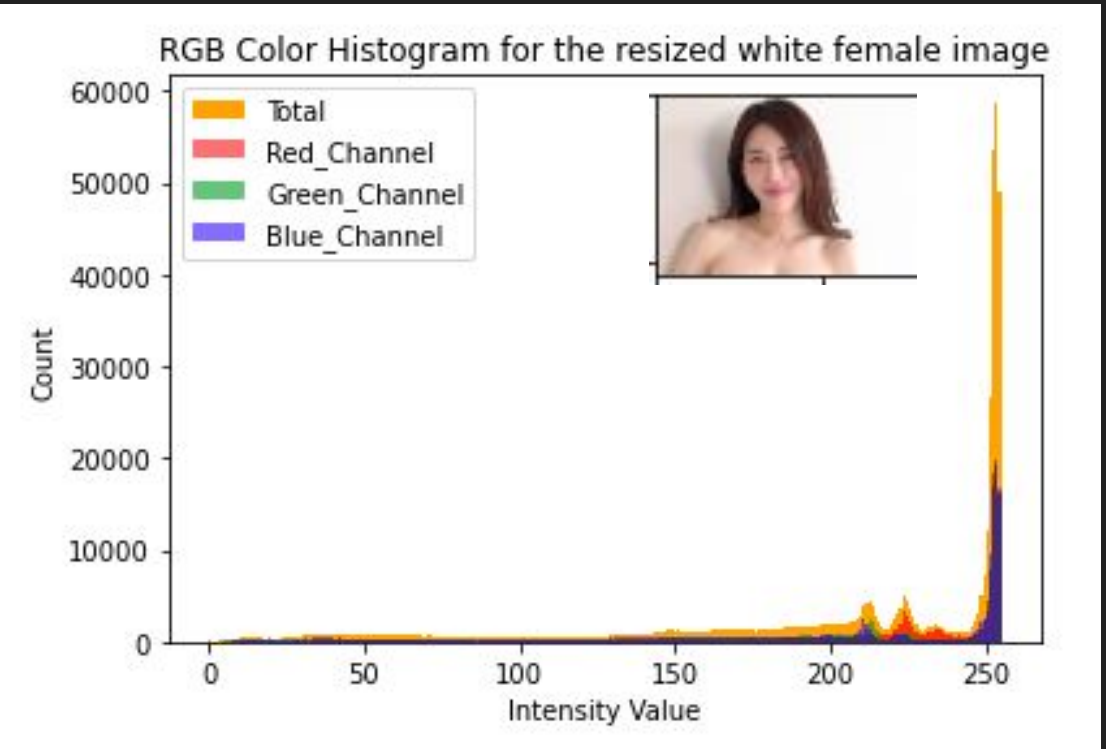
Following the pipeline will ensure that the system can identify facial landmarks automatically, represent a face as a set of measurements, and recognize faces using their face encondings.

To get started I performed data wrangling to remove any file with black images or outliers. I cleaned up the dataset and resize the images to have the same size. I pulled random images from the Hunmns_faces folder, resized them and store them in a new folder called new_images. This provided me with more images to test the model on.

I used the training dataset and new images to perform exploratory analysis as you can see on the next slide. Each image uniqueness depends on the race, background and the outfit the person on it has. I used the the histogram of colors to demonstrate it.

Project Scope and Analysis

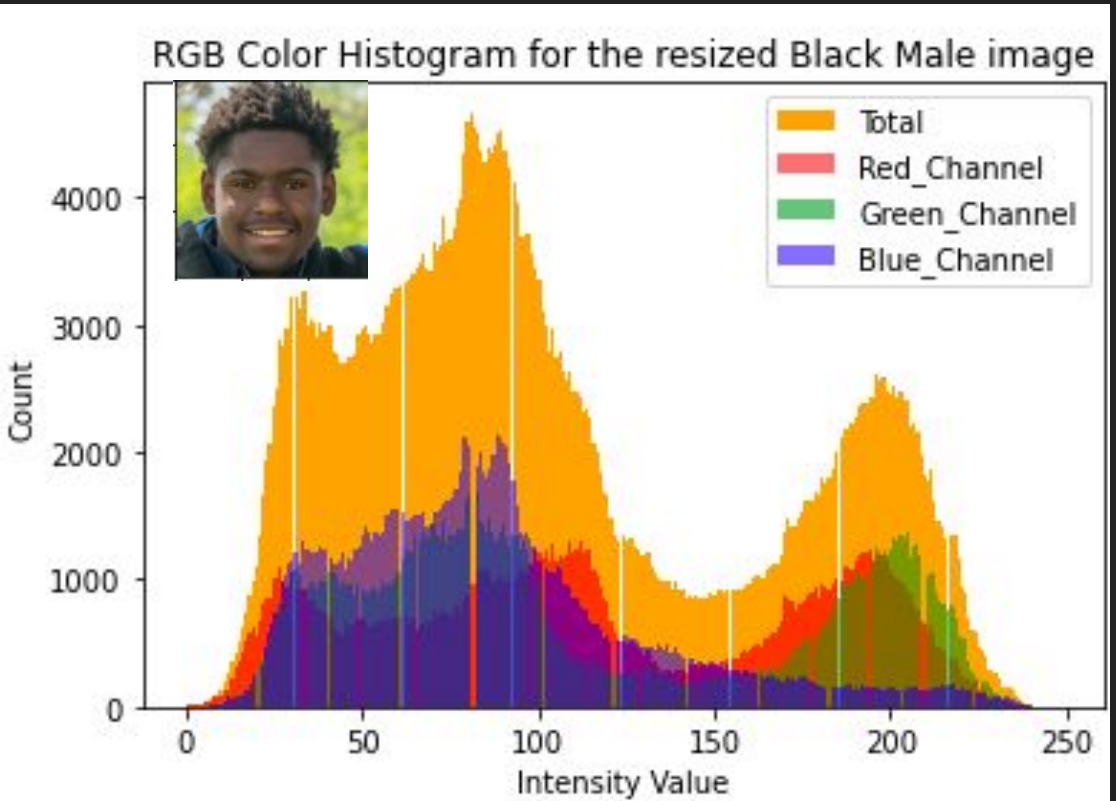
Exploratory Analysis



- The intensity of blue channel were higher than the rest of the channel. The green channel was the least.
- Less color were detected because of the white background.

Project Scope and Analysis

Exploratory Analysis

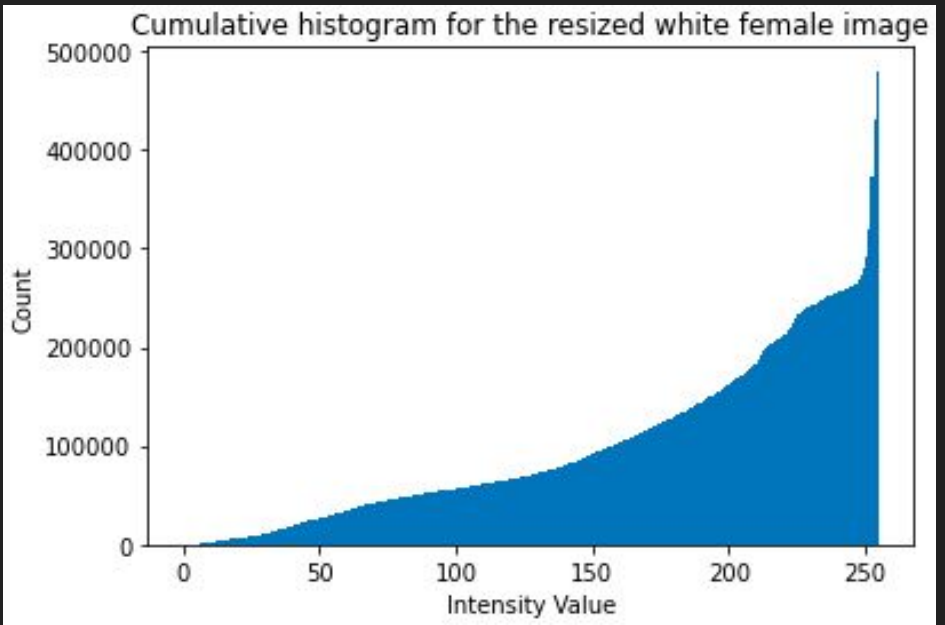


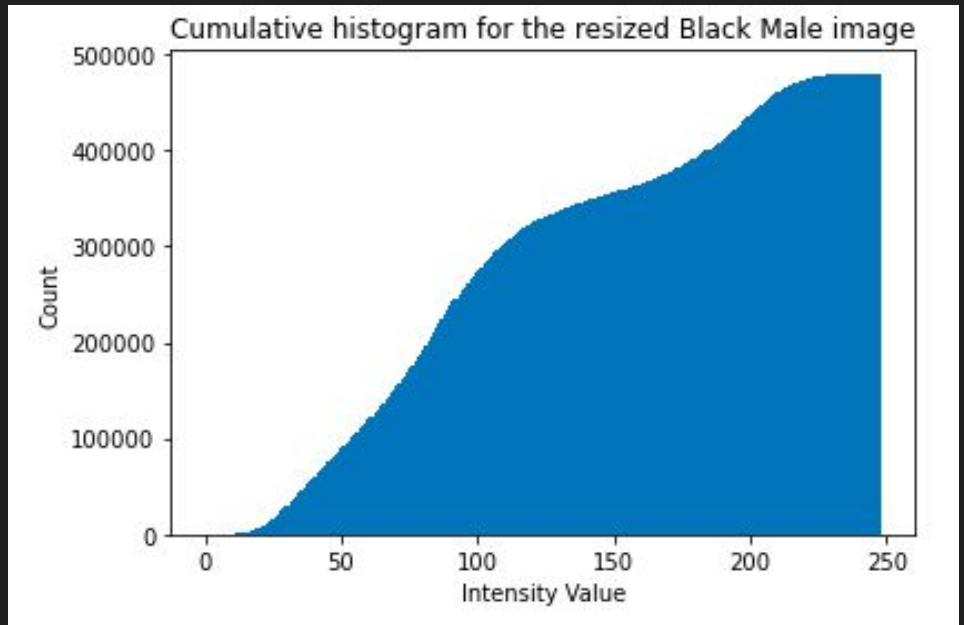
- Lots of color visibility in the black male image due to the outfit and background.
- Although the red channel seemed to be distributed throughout the image, the Blue channel followed a similar distribution with the total color channel at first before fading out.

Project Scope and Analysis

Exploratory Analysis

Both images have different intensity level. The white female image has lowest intensity level at about 10 and highest at about 265. While the black male has its lowest intensity value at about 15 and highest at 245.





Project Scope and Analysis

The next step was training and modeling. I focused on the project deliverables and performed the face detection, locating facial features in images, face landmarking, face encondings, similarities, model tuning, and digital makeup application.

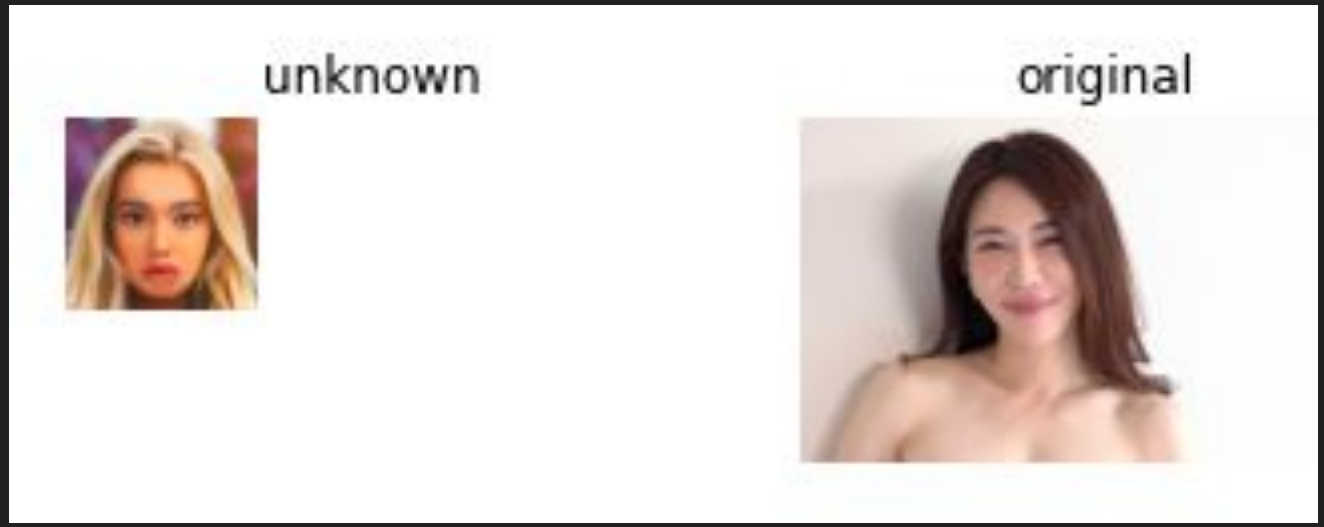
The face encondings turned information like eye, ear, color, size and gaps into numbers. During face landmarkings, information like eyebrows, nose bridges, etc are then grouped together. Unlike the face encondings that return set of measurements without specificity. These helped prepare the the system for tuning and testing.

In the next slide, model was feed with image it has never seen before. As expected, it couldn’t say exactly who that person was but it was able to say it looks like one of the girls the system knows about.

Project Scope and Analysis

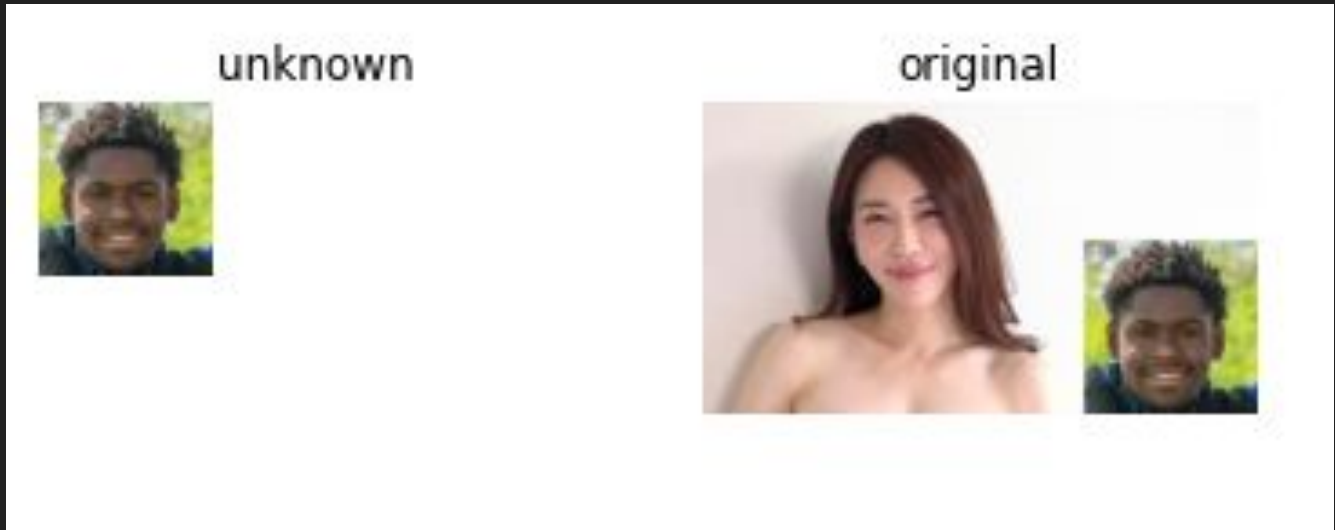
Tuning the Model

Since it hasn’t seen the unknown image before, it couldn’t recognized it. However it does match it with a known girl’s image.



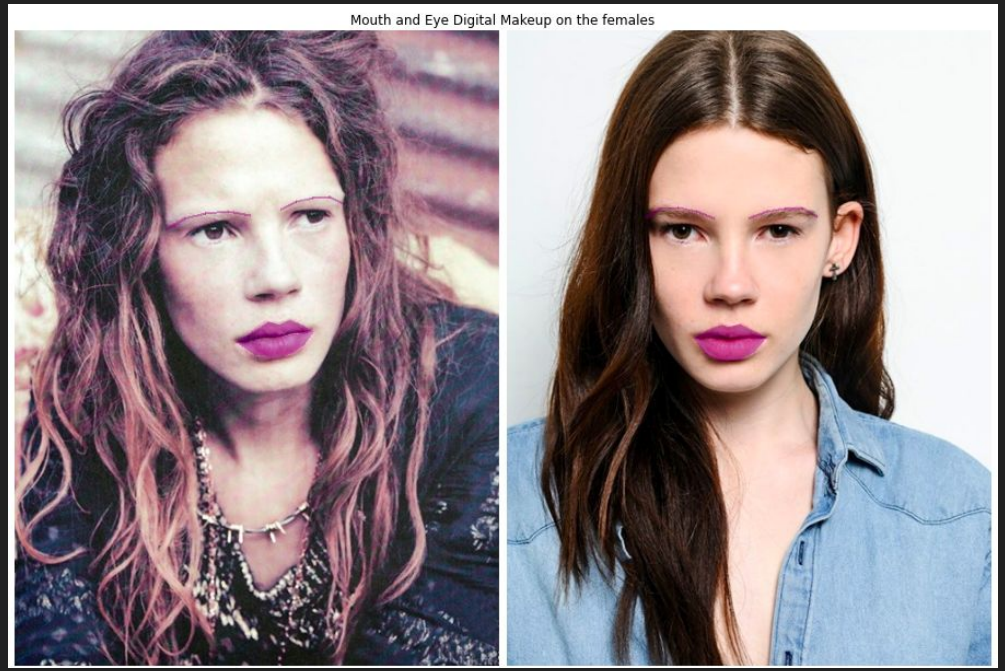
Project Scope and Analysis

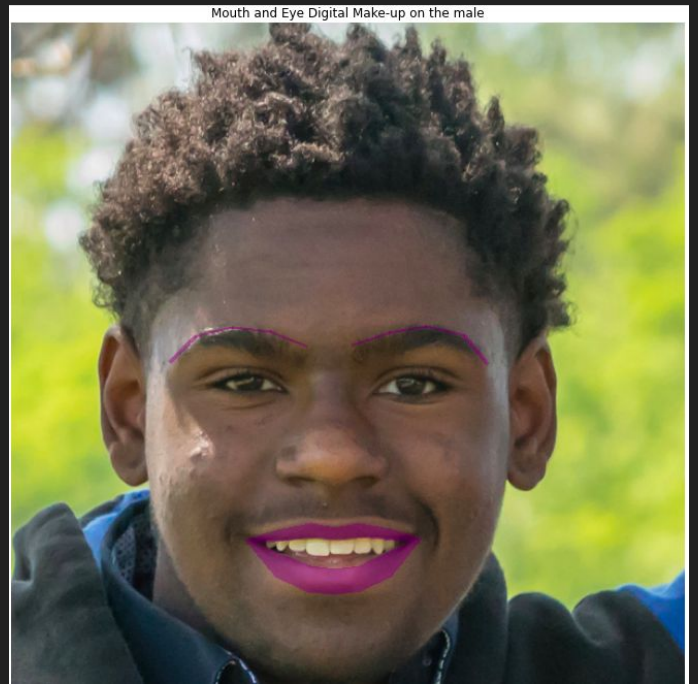
After tuning, the model was tested this time with faces it has seen before. Below, the original image found by the system has two people in it(white female and a black male). The model was asked to find the black male from a pool of six images feed to it. The system accurately detects the black male in the original image shown below.



Project Scope and Analysis

After testing the model and noticed it has 100% accuracy for faces it has seen before, I applied digital make up to the images as seen below





Project Scope and Analysis

The digital makeups were added using the facial landmarks function and imagedraw library. Each eyebrow makeup was a line with 3 as the width and RGBA color. The lips were drawn as polygon using the landmarks of each image.

Summary

The system did exactly what it designed for. It worked 100% on images it has seen before. And could even be used to identify a new image based on their gender dressing. For example, the system detected an unknown female, and matched it with the closest female n the training set. An area of improvement would be to make a small upgrade to the system so that it can classify images as male or female and store them into categories such as young or old.