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CSE 40535

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Semester Project Part 3: Preprocessing and Feature Extraction

I began preprocessing by narrowing down the range of my dataset. Initially, my dataset contained over 13,000 images of faces scraped off of the web. I believe that 13,000 images would have been too many to begin with, but perhaps can be expanded upon later. Therefore, I currently am only using the first 500 faces in the dataset.

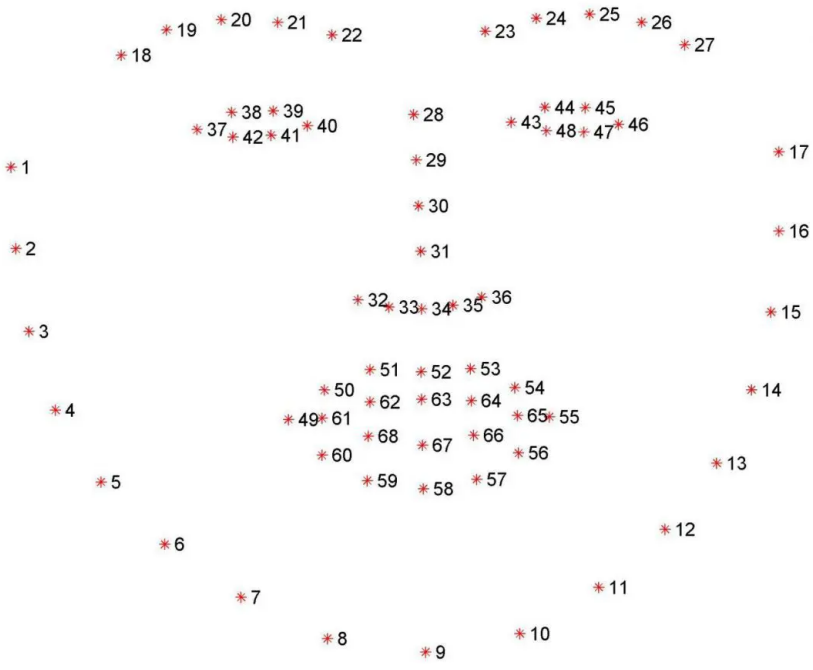
Additionally, I noticed that not all of the 500 faces would make subjects to run a facial attribute detection algorithm on. The main reason that disqualified a subject from being a good candidate for detection was the orientation of the subject's head. If the subject's head was twisted, turned, or faced in a direction that was not relatively head on to the camera, then detection would prove to be very difficult.

This led to lots of research into how to skip the faces from the dataset that were not oriented in an ideal manner. Through my research, I discovered that using a Haar Cascade model could be very useful. Haar Cascade is an algorithm that can be used to detect objects in images. Many different Haar Cascade models have been trained to detect different types of objects. Each model is trained by aligning thousands of different edges and lines on positive and negative subjects. A positive subject is an image that contains the object that the model is being trained on, while negative subjects are images where the object is not present. After being trained, a Haar Cascade model becomes incredibly efficient and accurate at detecting the desired object.

For my project, I found a pre-trained Haar Cascade model that is highly efficient and accurate at detecting faces from images. Not only can the model identify whether a face is present in an image, but it can even detect multiple faces in a single image. However, for the scope of this project, I am only interested in images with one subject, so I utilized the Haar Cascade model to eliminate any sample that did not contain one, singular subject.

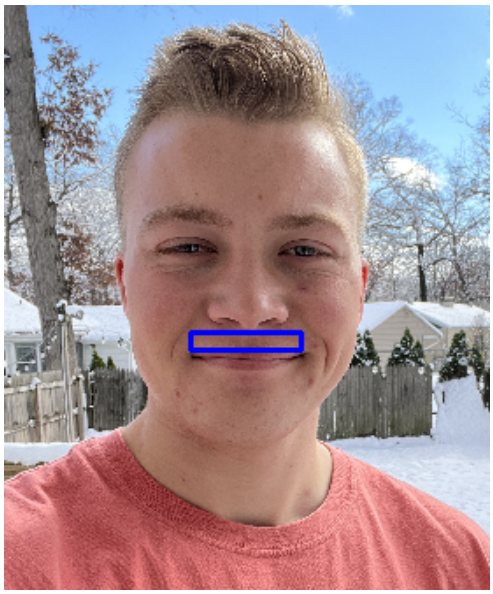
The next step is the feature extraction. For my project, I want to classify whether a subject has a mustache, a big nose, an open mouth, and/or bushy eyebrows. In order to make predictions on the presence of these attributes, I would need to identify the regions of each subjects' face that correspond to these attributes. In order to do this, I start by using DLIB, a facial mapping library. DLIB provides the location of 68 different "landmarks" on a subject's face, which makes it easy to locate desired facial features.

DLIB Landmarks



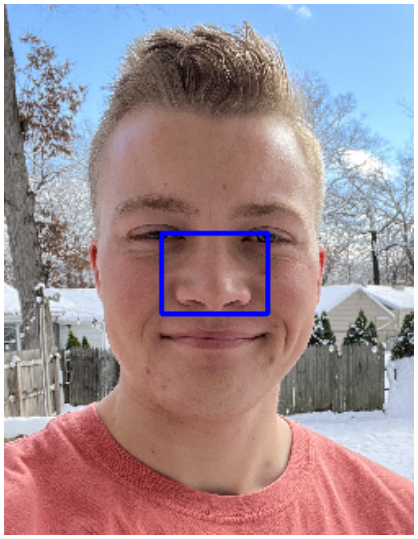
Given the DLIB landmarks, I was able to detect the region of the face where a mustache would be expected by using the coordinates of the upper lip and the lower nose.

Mustache Extraction



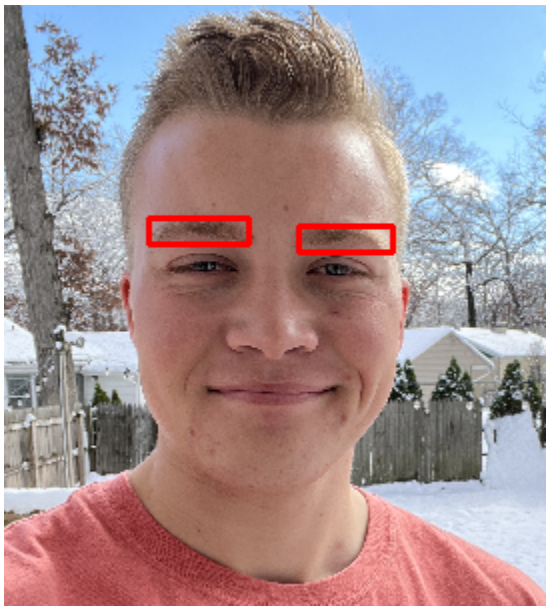
Using the DLIB landmarks of the bridge and width of the nose, I was able to extract the nose.

Nose Extraction



Using the DLIB landmarks of both the right and left eyebrows, I was able to extract them individually. Although, I only plan to use one eyebrow for making predictions on whether the subject has bushy eyebrows.

Eyebrow Extraction



Using the DLIB landmarks of both the upper and lower lips, I was able to extract the mouth of the subject.

Mouth Extraction