# Final Project Report

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## Abstract

Recognizing emotions through facial expressions is a vital skill required for basic human communication. However, it can be a harder task for some people than others, such as individuals with autism spectrum disorder. We sought to resolve this problem by making Gretchen capable of human emotion recognition. This was implemented through Yolov5 image model training with customized datasets of human faces on the internet. With minimal training, we found we were able to create a somewhat accurate emotion recognition model.

## Introduction

The objective of this project was to create a facial emotion detection system using Gretchen's webcam. The computer would display Gretchen's camera output and the detected facial emotion when presented with a face. We decided to detect only 4 emotions (happy, sad, angry, and neutral) to simplify the process. Our project process was similar to that of the object detection classwork, and we used facial recognition with landmarks provided in the additional materials, as well as datasets of faces with enough variety to be able to detect emotions for all different types of faces. The outline of the source code would be as follows:

- class Emotion Detector:
    - initialize face detection, load model and datasets
    - use loaded model and detector to detect and recognize facial emotions
    - label camera output with detected emotion
- main:

- initialize Emotion Detector
- receive camera input
- display prediction

**Description of Technologies Used**

Firstly, we used Python as the programming software that would facilitate instructions and commands to our robot. LabelImg was used to annotate and classify our dataset of images, from which were able to produce our training and testing files. Yolov5 was used as the main algorithm for classification and detection through our robot's camera. The image datasets for each facial emotion were individually created by selecting and downloading from Google Images.

**Description of Project Implementation**

Our group started out on this project by collecting several sets of images that portrayed the human emotions of: Happy, Sad, Angry, and Neutral. These images were then uploaded to LabelImg where we fixed bounding boxes and classified each image. The resulting Training and Testing datasets were uploaded to Google Colab, where we were able to train the model and download weights. These customized weights were then used with the image detector algorithm Yolo. The trained model was inferred in our Python code, where we received camera input from gretchen, used the model to detect emotion, and displayed camera output with a label of the detected human emotion.

**Results**

Our end result was a program that could somewhat accurately detect each emotion. For the most part, Gretchen was capable of classifying the facial emotion she was presented with correctly. There were certain errors in discerning the happy and neutral emotion faces, and for anger, Gretchen was only capable of detecting it if there was a fist in the image as well. This was most likely due to bias in the dataset.

**Discussion**

We chose to pursue this project objective because we wanted to create something that would be useful in the real world, as well as something we were capable of completing within the given time. The idea seemed simple at first but we did end up running into multiple problems and the end result was not completely satisfactory. Although the model training was simple (though a bit tedious), using the model with Gretchen through python programming proved to be more challenging than we thought. Nevertheless, we were surprised to see how well the trained model itself worked considering the minimal data we were able to provide.

**Conclusion**

Overall, our project was interesting to work on and challenging at times, which allowed us to learn from the experience. If we had the opportunity to work on it again, we would have improved the model by training it with larger and more complex data, and also added additional features involving usage of Gretchen's motor capabilities.