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Mr. Speice

Independent Study Mentorship

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<div align="center">Facial Recognition Based Attendance Tracking</div>

<div align="center">Assessment 10 - Original Work Assessment</div>

Date: 29 October 2019 to 16 December 2019

Time: 17.5 hours

Materials: External Webcam and Laptop

Objective:

The objective of this original work was to develop a facial recognition-based attendance system that utilized concepts acquired from my research and interviews

Description of Process:

Depending on the application, computer vision may incorporate several different steps. Facial recognition, in particular, has 4 primary steps: face detection, face encoding, face recognition, and optimization. The face detection step utilizes haar cascading to detect features of the face, also known as weak classifiers, in order to combine them into a face, which is known as a strong classifier. The face encoding process utilizes the idea that everything in the world can be turned into data. In the case of images, we can turn this into a data structure in programming known as an array. In doing this, the computer is able to interpret the images numerically rather than look at the images themselves. This allows us to perform operations on the image as necessary. The face recognition step uses these pieces of data and then compares them to the data captured from the webcam and finds the lowest variance among all the data. The final part of this process was optimization. Computer vision, in general, requires a lot of computing power and

high-quality images. While I was not able to do anything in regards to computing power, there was a solution to the higher quality images. In order to optimize image quality, I utilized an external webcam that had much better camera quality. This in turn caused the overall results to be significantly better.

Utilization of Higher-Level Thinking Skills:

A large part of computer science is problem-solving. Throughout the process of the original work, I had to synthesize results and alter the program as necessary. For instance, webcam blurring was a major problem during the facial recognition process. In order to resolve such a problem, I had to first analyze the situation. Upon doing this, I then evaluated for a solution to the problem of blurring. In this case, it was to take advantage of an operator known as the Laplacian operator which allowed me to control the blurriness amount. Then a fix to the problem was created by applying the evaluation into the actual development process. In using these higher-level thinking skills, problems that were previously unable to be tackled were easily solved.

Another instance of utilizing higher-level thinking skills was during the idea brainstorming process. The purpose of the original work is to create something new and not done before. A common problem I always had was to take attendance in an efficient and easy manner. Because of this problem, the idea to create a facial recognition-based attendance tracker was formulated. Additionally, this idea embodied the concept of originality. Facial recognition based attendance tracking is something that has not been done before publically much in the world of computer vision. This project is one of the very first publicly released facial recognition based

attendance tracking systems out there. Through the use of higher-level thinking skills, I have developed something that may ultimately contribute to the world of computer vision.

Results:

The performance of this project was absolutely phenomenal when considering the limited computing power and small optimizations made. The facial recognition process accurately recognized both males and females with perfect accuracy. It also recognized people of the same race with near-perfect accuracy, with the main faults occurring because of the limited computing power. Upon using this in practice, the Radicubs Robotics team was successfully able to take attendance of a meeting through this. Example executions of the project can be found [here](#).

Conclusions:

This project did indeed fulfill the objective set for the original work. It effectively applied areas of my research such as GPU/CPU Utilization, haar cascading, encoding, and much more. Additionally, the original work did indeed perform as intended by recognizing the faces and taking attendance of a group of people through using small data sets. Generally speaking, the original work did turn out to be successful and has set foundations for the future of facial recognition-based attendance tracking.

Future Applications and Extensions:

As the world becomes more automated, work such as facial recognition based attendance tracking will play a larger role in the world. This can not only be used for attendance tracking but may also be used for something similar such as criminal tracking. Going forward, linking this to Google Sheets API and implementing small face detection while also increasing accuracy will prove to be useful in order to apply it in more circumstances with a greater chance of it being

used in reality. All things considered, the future of this facial recognition based attendance

tracking may just be the foundational steps to lead us into a fully automated world where life has

never been easier.

Original Work

Interview Notes

Research Assessments