**Technical Approach**

Python Libraries Used

* OpenCV
* Deepface

I have used OpenCV Python Library which is a library of Python bindings designed to solve computer vision problems. The OpenCV library will help in facial detection and capturing live video feed from computer webcam.

DeepFace Library [face recognition](https://sefiks.com/2018/08/06/deep-face-recognition-with-keras/) and facial attribute analysis ([age](https://sefiks.com/2019/02/13/apparent-age-and-gender-prediction-in-keras/), [gender](https://sefiks.com/2019/02/13/apparent-age-and-gender-prediction-in-keras/), [emotion](https://sefiks.com/2018/01/01/facial-expression-recognition-with-keras/) and [race](https://sefiks.com/2019/11/11/race-and-ethnicity-prediction-in-keras/)) framework for python. I have used this library to implement a facial analysis based on the live feed from webcam.

I have used Anaconda to create a Python Virtual Environment for Python Version 3.7 where all the python libraries have been installed. Visual Studio Code and Jupyter Notebook have been my python editors.

This program has been successfully tested and executed in two different computers running different operating system versions (Windows 10 and Windows 11). This program is successfully detecting objects using a live feed from a portable webcam as well a fixed webcam.

I first tested the program using still images and ensured facial analysis and face detection worked as expected, then I moved on to working for the real time detection. OpenCV has modules for both real time and still images.

**Use Cases**

**Challenges**

This program uses pre trained models provided by the library. The accuracy for object detection is good. However, the accuracy for facial analysis is average. The DeepFace library’s pre trained model can perfectly identify gender, however, its ethnicity and emotions predictions are decent. DeepFace works way more accurately on still images compared to real time live feed.

Location and lighting are a key aspect for this program to run smoothly and accurately. When tested in an office environment, I found many irregularities in the detection. I found the OpenCV library to detect objects such as lights, walls, and ceiling as faces. However, the DeepFace library was accurate and intelligent enough and kept giving face error.

I have found that this program takes a while to detect faces and the distance from the camera is key factor. However, this program hasn’t been tested yet to its full capacity. It can detect multiple people but I haven’t tried a large sample yet.

I have faced many issues regarding the installation of these libraries, and I have referred to many developer forums and YouTube videos to fix bugs and installation error. The major challenge is this program is currently compatible with Python 3.7. I tested python 3.9, 3.10, 3.5 but the libraries seem to have installation errors.

The live feed wouldn’t be able to start if any third-party app is using the camera. Furthermore, the compile and execution time is very slow. The app takes on an average 15 - 30 seconds to start depending on the processor speed and available ram. The program uses a lot of compute resources and memory. Below attached are the results. Furthermore, I was facing overheating issues on my AMD pc when running Visual Studio Code, Anaconda Prompt, and the program itself.

A screenshot of a computer

Description automatically generated

*8 GB RAM AMD RYZEN 5500U 2.1 GHz (6 Core 12 Thread) (Windows 11)*

*Chart, treemap chart

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*8 GB RAM i5-8400 2.80 GHz (6 Core 6 Thread) (Windows 10)*

**Risk Attached**