# Face Detection Report

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## SUMMARY

After the project, the purpose of this report is to analyze the advantages and Disadvantages, problems encountered and solutions found when using facial recognition.

A small introduction will outline the content of the report and will continue with the section Advantages and disadvantages of facial detection and recognition systems compared to systems other biometric authentication methods. Then, describe in detail the two main contents The project's components and how they work will follow, as well as problems encountered along the way projects and how they are resolved. Although it is difficult to build a perfect system, solutions have been found for the most impactful problems and workarounds have been found for problems caused by limitations of the software used.

## INTRODUCTION

### PURPOSE

The purpose of this report is to research and learn about face detection, model training methods and produce high-performance face detection results.

### METHOD

Building such a system from scratch using the MediaPipe programming language helped achieve it better understand this field and its advantages and disadvantages. After a while of research, decided to implement facial recognition .Use OpenCV library for MediaPipe

### FACE DETECTION IN OPENCV

OpenCV (Open Source Computer Vision) is a library of real-time programming functions computer vision. The face recognition part of the project is implemented using the OpenCV Library for MediaPipe. The reason is that most face APIs are limited to only performing detection on images The OpenCV library proved versatile enough for the project as it was able to accurately detect one face in real time and highlight it by drawing a rectangle around the face of a passing subject. This all happens in a window separate from facial recognition so that trackers can tracks both objects passing by while detecting their faces and responding to words system identifier. While the face is being detected, the application will take some time takes a snapshot of the live footage every second and then sends it to the recognition system.

## PROBLEMS ENCOUNTERED AND THEIR SOLUTIONS

It only supports a few programming languages, although OpenCV offers over 3000 optimized algorithms it only provides them for a handful of programming languages, namely C/C++, Python and Java for Android. However, wrapper libraries have been developed for other languages ​​to encourage adoption by a wider audience.

### SOLUTION:

An organisation named Bytedeco, who constantly work on adapting C/C++ libraries to Java, have made an OpenCV library for Java and was later adapted to work with MediaPipe. This ibrary was used for having face detection work in real-time on a webcam feed.

### PROBLEMS ENCOUNTERED AND SOLUTIONS

Face recognition may occur incorrectly or be confused with other objects. It's possible that the model doesn't recognize some faces or doesn't recognize them correctly. The model may be slow to respond to fast video data, leading to poor performance. This isn't a big deal, but a simpler user interface could make user interaction easier.

**Solution:**

**Improve accuracy:**

Accuracy can be enhanced by using a basic face recognition model (pre-trained) and fine-tuning on your own dataset.

**Optimize processing speed:**

Use optimization techniques, such as using GPUs or parallel prediction, to speed up the recognition process.

**User interface improvements:**

Provides a simple and friendly user interface so users can easily interact with the application.

## SWOT ANALYSIS

The following SWOT Analysis outlines the advantages and disadvantages a facial detection and recognition system can bring.

|  |  |
| --- | --- |
| **STRENGTHS**   * The code is written to be easy to understand and packaged into a FaceDetector class, making it easy for users to integrate into their applications. * Using the MediaPipe library, which is a powerful toolkit for computer vision processing, can effectively recognize faces. * Supports multiple input environments: Able to process video from webcam * Provides a simple user interface for monitoring and displaying results, including displaying the confidence percentage of recognized faces. * The source code is organized in a class, which makes it easy to extend or customize according to the user's specific needs. * Indicates the number of frames per second (FPS) of the input video, helping monitor application performance. | **OPPORTUNITIES**   * Integrating security and surveillance applications: The model can be used in security and surveillance systems to identify and track individuals in real time. * Gesture language analysis (gesture description): When combined with other images, the model can analyze gestures or facial expressions, helping applications recognize mood states or intentions of user use. * Integration into social applications: The model can be used to create applications with facial recognition to highlight friends in photos, create interesting effects, or to improve the feature set of social network application. * Game application integration: The model can be used to recognize the user's face and use it in interactive tasks in the game. |
| **WEAKNESSES**   * Model performance can be affected by lighting conditions, shooting angle, sensor, and image quality. This can lead to the model not recognizing faces correctly in all cases. * The model may need to be trained and fine-tuned on representative data to ensure best performance. This requires resources and knowledge about training the model. * Facial recognition can pose privacy and security issues. Use of this model requires compliance with data protection and privacy regulations. * Models can be easily fooled by face spoofing techniques, for example using someone else's image or video | **THREATS**   * Cases of misidentification may occur, when the model recognizes the wrong person or does not recognize the correct person. This can lead to the risk of confusion and unwanted consequences. * There is a possibility that the model can be fooled using images, videos, or other facial spoofing techniques. This can cause dangerous security situations. * If not strictly controlled, facial recognition technology can be used for malicious purposes, including unauthorized surveillance, identity theft and other fraud. * The use of facial recognition technology also raises ethical and moral issues, especially as it relates to privacy and personal freedom. |

## CONCLUSION

The facial recognition model you have provided has many significant advantages. First, it uses MediaPipe and OpenCV's facial recognition technology to identify and draw around faces in the input image or video. In addition, the model still supports displaying signal lights on the face, helping users track the tool location of important points on the face.

Furthermore, this mockup also provides the FancyDraw feature to assist in drawing street auxiliaries, which helps create an iconic face frame and a pleasing interface. Although this model has achieved some achievements, there is still much room for development and improvement.

* **Performance optimization:** Model optimization may be needed to ensure smooth operation on limited resources, especially on mobile devices.
* **Multi-face support:** Expands the model to support simultaneous recognition of multiple faces. Currently, the model only supports single face recognition.
* **Expression and gender detection:** Expand functionality to recognize facial expressions or determine gender.
* **Recognize other objects:** Expand the model to recognize other objects such as eyes, nose, mouth, etc.
* **Increased accuracy:** Train the model on more data to improve recognition accuracy.