

**Mask Wear Detector**

High Level Design

Technology: Deep Learning & Computer Vision

Creator: Mahammad Ojagzada

Date: 12.11.2022

Baku, Azerbaijan

+994 50 4918219

mahammad.ojagzada@outlook.com

**Document Version Control**

|  |  |  |  |
| --- | --- | --- | --- |
| Date issued | Version | Description | Author |
| November 11, 2022 | 1.1 | First Draft | Mahammad Ojagzada |
| November 12, 2022 | 1.2 | Added unit test cases | Mahammad Ojagzada |
| November 12, 2022 | 1.3 | Correcting font sizes | Mahammad Ojagzada |

Contents

[Abstract 3](#_Toc119162137)

[Introduction 3](#_Toc119162138)

[What is High-Level Design Document? 3](#_Toc119162139)

[Scope 4](#_Toc119162140)

[General Description 4](#_Toc119162141)

[Definitions 4](#_Toc119162142)

[Product Description 4](#_Toc119162143)

[Problem Statement 4](#_Toc119162144)

[Proposed solution 5](#_Toc119162145)

[Further improvements 5](#_Toc119162146)

[Data requirements 5](#_Toc119162147)

[Tools used 5](#_Toc119162148)

[Hardware Requirements 6](#_Toc119162149)

[Constraints 7](#_Toc119162150)

[Assumptions 7](#_Toc119162151)

[Design Details 7](#_Toc119162152)

[Process Flow 7](#_Toc119162153)

[Performance 7](#_Toc119162154)

[Reusability 8](#_Toc119162155)

[Application Compatibility 8](#_Toc119162156)

[Resource Utilization 8](#_Toc119162157)

[KPIs (Key Performance Indicators) 8](#_Toc119162158)

[Conclusion 8](#_Toc119162159)

# Abstract

COVID-19 pandemic has rapidly affected our day-to-day life disrupting the world trade

and movements. Wearing a protective face mask has become a new normal. In the near

future, many public service providers will ask the customers to wear masks correctly to

avail of their services. Therefore, face mask detection has become a crucial task to help

global society.

COVID-19 mask detector could potentially be used to help ensure your safety and the

safety of others.

Approach: A simplified approach to achieve this purpose using some basic Machine

Learning packages like TensorFlow, Keras, OpenCV and Scikit-Learn. This method

detects the face from the image correctly and then identifies if it has a mask on it or not.

The goal in this project is to build a robust solution that should detect and identify the person is

wearing mask or not. With a varying distance and color combination, it should work for

any person.

# Introduction

## What is High-Level Design Document?

The goal of this HLD or a high-level design document is to add the necessary detail to the current project description to represent a suitable model for coding. This document is also intended to help detect contradictions prior to coding and can be used as a reference manual for how the modules interact at a high level.

The HLD will:

* Present all of design aspects and define them in detail
* Describe all user interfaces being implemented
* Describe the hardware and software interfaces
* Describe the performance requirements
* Include design features and architecture of the project
* List and describe the non-functional attributes such as security, reliability, maintainability, portability, reusability, application compatibility. resource utilization, serviceability

## Scope

The HLD documentation presents the structure of the system, such as database architecture, application architecture (layers), application flow (Navigation), and technology architecture. The HLD uses non-technical to mildly technical terms which should be understandable to the administrators of the system.

# General Description

## Definitions

|  |  |
| --- | --- |
| Term | Description |
| IMTVP | Interstate Metro Traffic Volume Predictor |
| Database | Collection of the Information |
| IMFD | Correctly Masked Face Dataset |
| CMFD | Correctly Masked Face Dataset |
| IDE | Integrated Development Environment |

## Product Description

Mask detector is a Deep Learning based Inception model which helps us to do identify if some wear face mask or not.

## Problem Statement

To create an DL based solution for predictive analysis for safety against COVID and to implement the following use cases.

* To detect if a person wear face mask or not.
* How much percentage the face mask is correctly worn.

## Proposed solution

Using all the standard techniques used in the life cycle of a Data Science project starting from Data Exploration, Data Visualization, Data preprocessing, Model Selection, Model Building and Model Testing and also building a real time test to see if the developed model works fine in real scenarios.

## Further improvements

This Face Mask Detector can be easily embedded inside any website or an application and everybody can get quick answer by inputting required data on friendly user interface.

The model performance can be further improved by training more data in the model. Data can be acquired from [dataset Flickr-Faces-HQ (FFHQ)](https://github.com/NVlabs/ffhq-dataset).

## Data requirements

Data requirement completely depend on our problem statement. We need the dataset which contain masked and unmasked faces to train the model. Dataset should contain the following features:

* Correctly Masked Face Dataset
* Incorrectly Masked Face Dataset

These are the required parameters to feed into model.

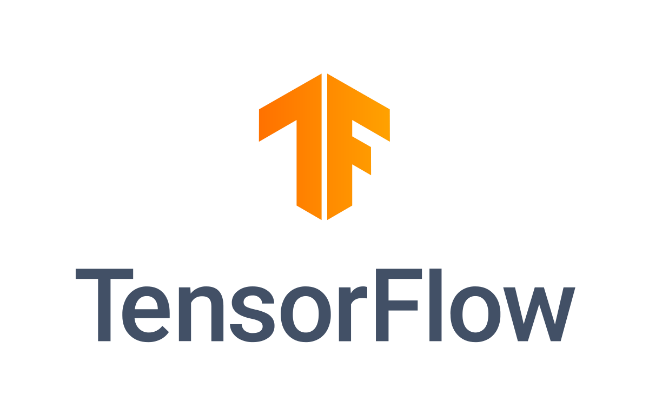
## Tools used

Python programming language and frameworks such as NumPy, Pandas, TensorFlow, Keras, Matplotlib and a few other libraries were used to build the whole model.











* For visualization tasks, matplotlib and Image were used
* GitHub is used as version control system
* Keras was used to create sequential layers.
* NumPy and Pandas were used to clean and interpret data
* TensorFlow was used to build the model.

## Hardware Requirements

* Windows Server, Linux, or any operating system that can run as a webserver, capable of delivering HTML5 content.
* Minimum 1.10 GHz processor or equivalent.
* Between 1-2 GB of free storage
* Minimum 2 GB of RAM
* 3 GB of hard-disk space

## Constraints

Deploying this Real time detection on website requires additional work.

## Assumptions

The main objective of this project is to implement the use case as previously mentioned (2.3 problem statement) for new scenario that comes to the camera. It is assumed that all aspects of this project have the ability to work together as the designer is expecting and also the data on which our model is trained is as correct as possible

# Design Details

## Process Flow

For accomplishment of the task, we will use a trained Machine Learning model. The process flow diagram is shown below:

**Data Preparation**

**Model**

**Development**

# Performance

The Mask Detector tool is used to predict whether a person wear face mask or not. It can be used by various governmental/ non-governmental/ private agencies to provide safety in places; thus it is supposed to be as accurate as possible. So that it doesn’t mislead authorities. Also, model retraining is very important to further enhance its performance.

## Reusability

The code written and the components used should have the ability to be reused with no problems.

## Application Compatibility

The different components for this project will be using Python as an interface between them, each component will have its own task to perform, and it is the job of Python to ensure proper transfer of information.

## Resource Utilization

When any task is performed, it will likely use all the processing power available to it until finished. This model can be deployed to certain devices.



## KPIs (Key Performance Indicators)

* Key Performance Indicators of Real-time detection
* Latency or the amount of time the application takes to display results for some specific input.
* The processing power our application takes to run
* The memory and RAM our application takes to run on a web server.

# Conclusion

All in all, overall project architecture, design details, used technologies and performance were explained in detail. This Face Mask Detection model will detect faces instantly and has the potential to help various government organizations, agencies and etc to provide safety in public.