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Face Mask Detection System

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Abstract: ***There are many solutions to prevent the spread of the COVID-19 virus and one of the most effective solutions is wearing a face mask. Almost everyone is wearing face masks at all times in public places during the coronavirus pandemic. Coronavirus disease 2019 has affected the world seriously. One major protection method for people is to wear masks in public areas. The risk of transmission is highest in public places. However, there are only a few research studies about face mask detection based on image analysis. This paper aims to present a review of various methods and algorithms used for human recognition with a face mask. The proposed system to classify face mask detection using COVID-19 precaution both in images and videos using convolution neural network, TensorFlow and OpenCV to detect face masks on people. This system has various applications at public places, schools, etc. where people need to be detected with the presence of a face mask and recognize them and help society.***

Keywords: COVID-19, Tensorflow, OpenCV, Face Mask, Image Processing, Computer Vision

I. INTRODUCTION

The situation report 96 of world health organization (WHO) presented that coronavirus disease 2019 (COVID-19) has globally infected over 2.7 million people and caused over 180,000 deaths. In addition, there are several similar large scale serious respiratory diseases, such as severe acute respiratory syndrome (SARS) and the Middle East respiratory syndrome (MERS), which occurred in the past few years reported that the reproductive number of COVID-19 is higher compared to the SARS. Therefore, more and more people are concerned about their health, and public health is considered as the top priority for governments. Fortunately, studies showed that the surgical face masks could cut the spread of coronavirus.

At the moment, WHO recommends that people should wear face masks if they have respiratory symptoms, or they are taking care of the people with symptoms. Furthermore, many public service providers require customers to use the service only if they wear masks. Therefore, face mask detection has become a crucial computer vision task to help the global society, but research related to face mask detection is limited. However, some difficulties are faced by the authorities in the process of monitoring a large population that has a different habit . The authorities need a solution to be able to validly control the implementation of the law, which begins with the availability of the data quickly and accurately.

One of the solutions is to use a regionally automated face mask recognition to differentiate between people who wear masks and those who do not. The built model in this study can be implemented on the surveillance cameras to impede the transmission of COVID 19 transmission by detecting the people who are not wearing a face mask. Each camera point is supplied with location data, so the data can be used to determine which locations require more attention from the authorities. Creating a system for detecting the face-mask will provide a way for controlling the people who enters any places. At the moment, WHO recommends that people should wear face masks if they have respiratory symptoms, or they are taking care of the people with symptoms. Furthermore, many public service providers require customers to use the service only if they wear masks. Therefore, face mask detection has become a crucial computer vision task to help the global society, but research related to face mask detection is limited. CNN are a kind of deep neural network which is typically used in deep learning to examine visual imagery. A CNN is a Deep Learning algorithm that would take an image as input, assign meaning to different parts of the image, and differentiate between them. Because of their high precision, CNNs are used for image detection and identification.

A. OPENCV

OpenCV is an open-source library which is primarily used for Computer Vision Applications. This contains many functions and algorithms for Motion tracking, Facial recognition, Object Detection, Segmentation and recognition and many other applications. Images and real time video streams can be manipulated to suit different needs using this library.

The library has more than 2500 optimized algorithms, which includes a comprehensive set of both classic and state-ofthe-art computer vision and machine learning algorithms.

These algorithms can be used to detect and recognize faces, identify objects, classify human actions in videos, track camera movements, track moving objects, extract 3D models of objects, produce 3D point clouds from stereo cameras, stitch images together to produce a high resolution image of an entire scene, find similar images from an image database, remove red eyes from images taken using flash, follow eye movements, recognize scenery and establish markers to overlay it with augmented reality, etc.

B. Tensor Flow

It is an open-source machine learning framework to build and train neural networks. and is also used for machine learning applications such as neural networks. Itis used for both research and production at Google, TensorFlow is Google Brain's second-generation system. It has a collection of tools, libraries and community resources which helps in easy building of deployment of ML powered applications. This is developed and maintained by Google and was released in 2015.

Tensor Flow is available on 64-bit Linux, macOS, Windows, and mobile computing platforms including Android and iOS. Its flexible architecture allows for the easy deployment of computation across a variety of platforms (CPUs, GPUs, TPUs), and from desktops to clusters of servers to mobile and edge devices.

II. RELATED WORK

Whenever there are multiple objects in an image or frame of the video and we want to localize and classify them all, we look for an object detection algorithm. Over the decade, lots of algorithms and techniques have been developed for object detection. Face detection is defined as the procedure that has many applications like face tracking, pose estimation or compression. Face detection is a two-class problem where we have to decide if there is a face or not in a picture. This approach can be seen as a simplified face recognition problem.

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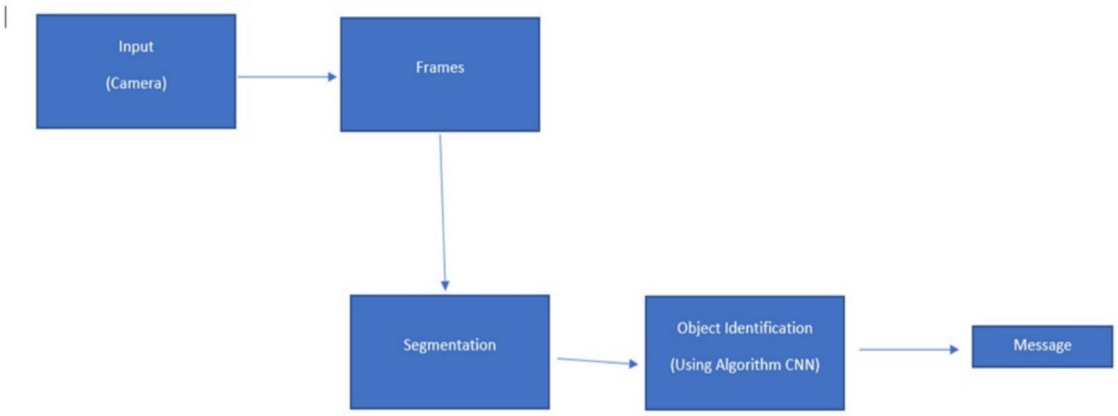
III. SYSTEM ARCHITECTURE



IV. PROBABLE SOLUTION

1) The proposed system focuses on how to identify the person on image/video stream wearing face mask with the help of computer vision and deep learning algorithm by using the OpenCV, Tensor flow, Keras and PyTorch library.

2) Approach –

a) Train Deep learning model (MobileNetV2)

b) Apply mask detector over images / live video stream The majority of the images were augmented by OpenCV. The set of images were already labeled “mask” and “no mask”.

- Face Mask Detection in webcam stream.
- The flow to identify the person in the webcam wearing the face mask or not. The process is two-fold.
  - To identify the faces in the webcam.
  - Classify the faces based on the mask.

V. MODUL DESCRIPTION

A. Modules

1) Admin Module

2) User module

Modules Description

a) Admin Module: Role of admin is to when someone is not wear a mask inside a premises the system can sent the to admin and alarm them with message.

b) User Modules: Role of User modules is when user enter inside a premises Detecting System can detect if user wear a mask or not If it is not then it will generate the alarm and denied the entry permission.

VI. WORKING

This project makes the use of OpenCV, Caffe-based face detector, Keras, TensorFlow and MobileNetV2 for the detection of face mask on humans. The dataset which is being used contains 3835 images out of which 1916 images have people with masks in them and 1919 people without masks in them. The trained model is loaded and image which contains human faces with or without masks or a continuous video stream with humans is given as input. The image or a frame of the video, in case the input is a video stream, is first sent to the default face detector module for the detection of human faces. This is done by resizing the image or the video frame first, followed by detecting the blob in it. This detected blob is sent to the face detector model which outputs only the cropped face of a person without the background. This face is given as the input to the model which we trained earlier. This outputs weather there is a mask or not. When an input image is given to the CV model, it detects the face of a person and asks the user to provide the name and email address of that person which will be stored in the database. The output of the first model is given as the input to this model. This face will be compared with the persons present in the database. And if his face matches, then a bounding box will be drawn over his face with his name on it and an email and Sms will be sent to him that he is not wearing a mask. Else, only the words "Mask" will be present below the bounding box if the person is wearing a mask and "No Mask" if the person is not wearing one.

VII. RESULTS

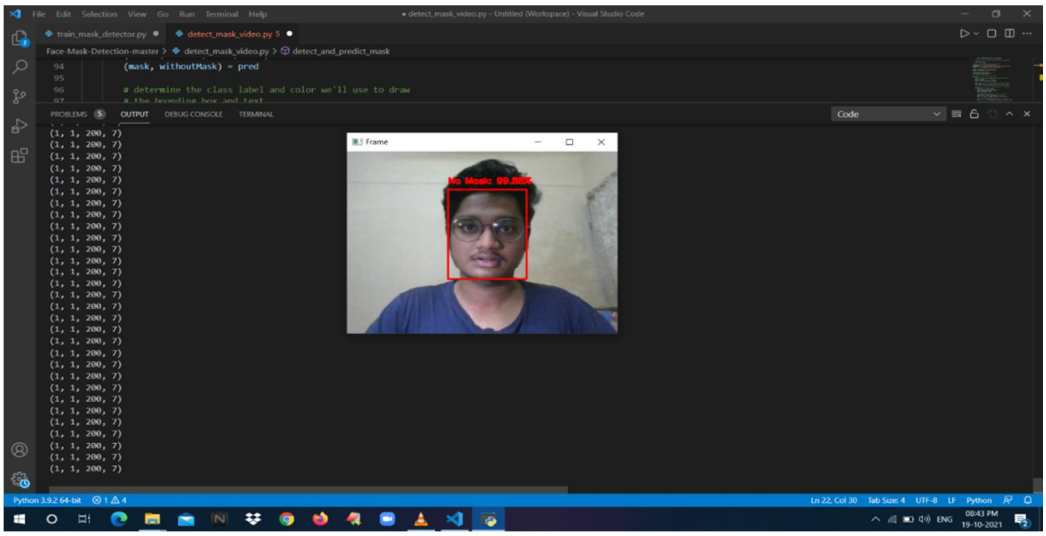


Figure 7.1: When The Person Not Wearing the Mask . A bounding box drawn over the face of the person describes weather the person is wearing a mask or not. If a person's face is stored in the database, it detects the name of the person who is not wearing face mask.

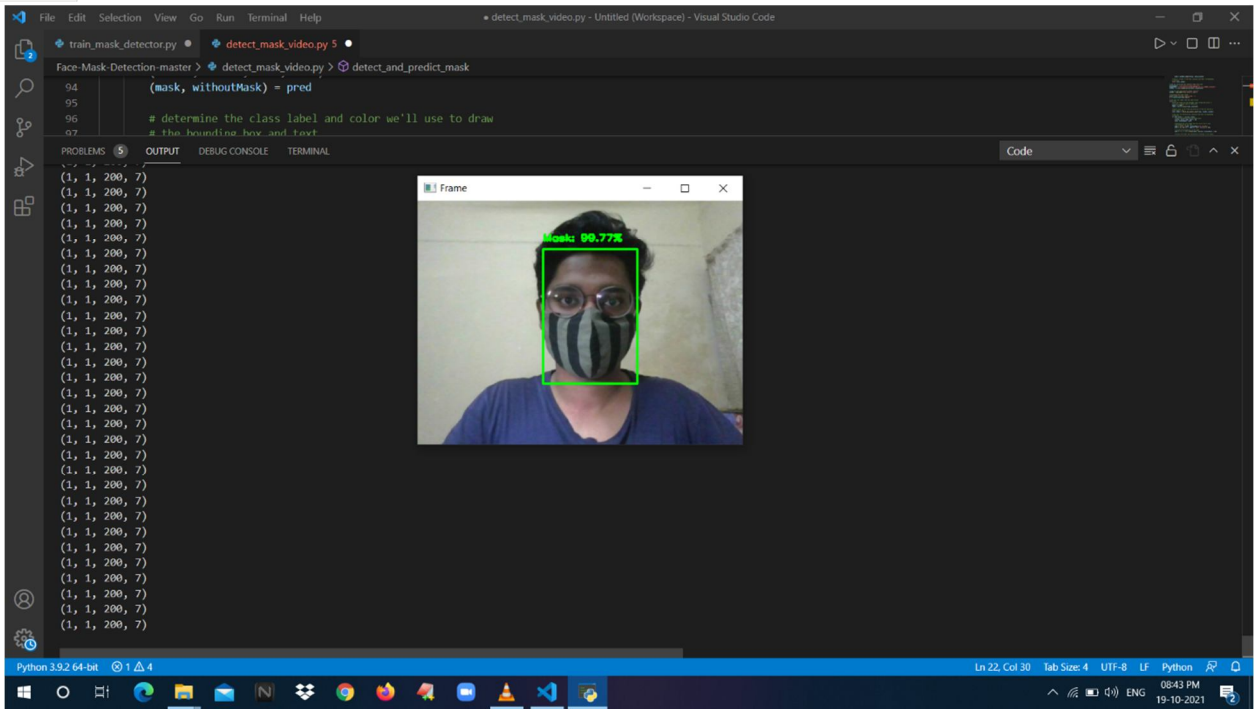


Figure 7.2:When Person Wearing Mask.A Bounding Box Drawn Ove r the Face of the Person Describes The Person Wearing Mask.

VIII. CONCLUSION

In this project, we have proposed a novel face mask detector, namely Face Mask Detection System, which can possibly contribute to public healthcare. With the increasing number of COVID cases all over the world, a system to replace humans to check masks on the faces of people is greatly needed. This system satisfies that need. This system can be employed in public places like railway stations and malls. It will be of a great help in companies and huge establishments where there will be a lot of workers. This system can be employed in public places like railway stations and malls. It will be of a great help in companies and huge establishments where there will be a lot of workers.

IX. FUTURE WORK

Human recognition with face mask has various applications in different domains. The various methodologies discussed in this paper can be based on the particular demands of the application. It can be used at various domains like airports where this system can be of great importance at airports to detect travelers whether they are wearing mask or not. Travellers data can be captured as videos in the system at the entrance

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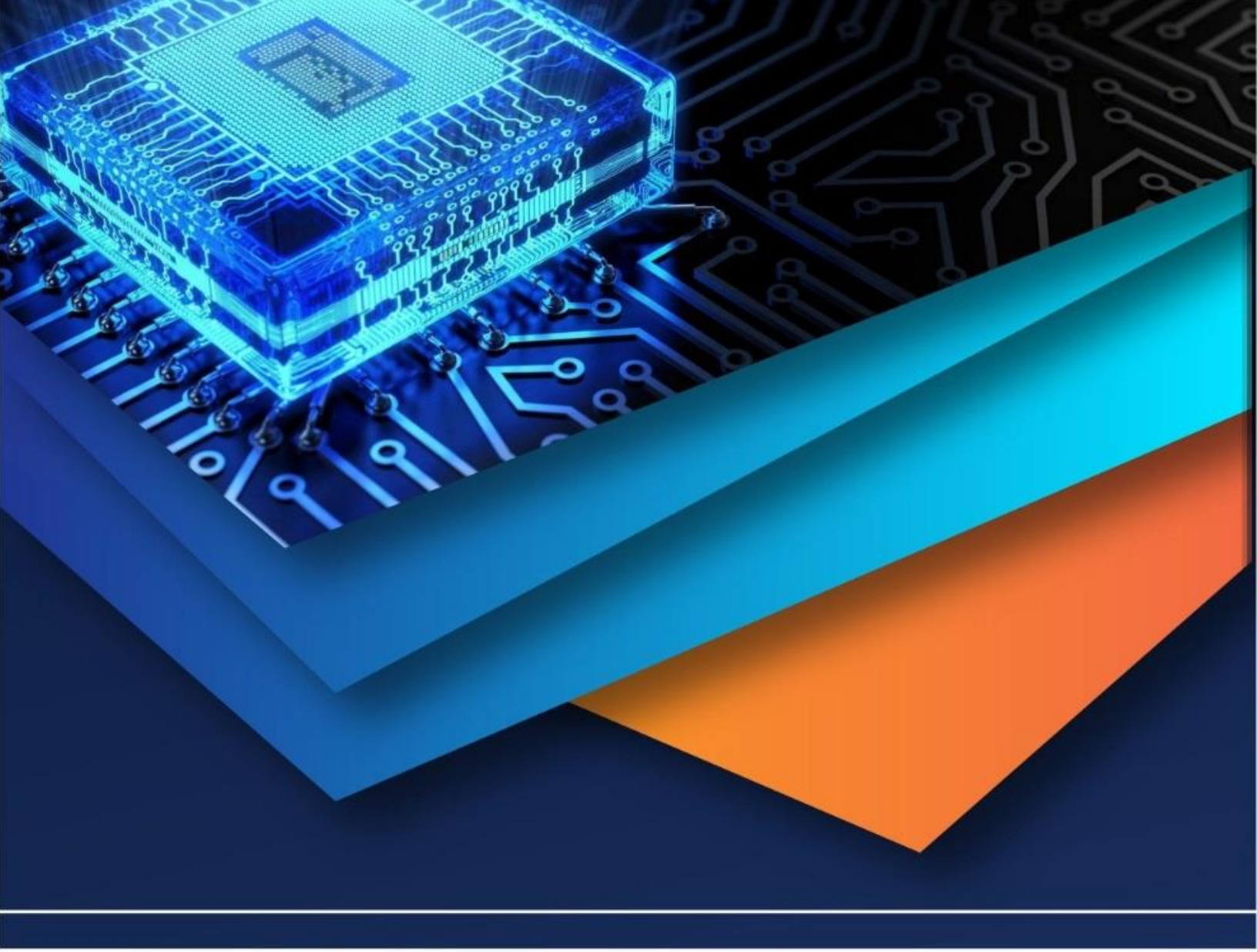

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