FACIAL MASK DETECTION SYSTEM

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Abstract : In these tough times of Pandemic (COVID -19) situation, wouldn't it be worthy to do something related to face detection to ensure our safety?

Face Detection has evolved popularly in Image processing and Computer Vision. Face detection is more relevant today because it not only used on images but also in video applications like real time surveillance and face detection in videos. High accuracy image classification is possible now with the advancements of Convolutional networks.

Our aim is to design a *Binary Face Classifier* which can detect any face present in the frame regardless of its alignment.

The purpose of the research is to identify whether the user is wearing a mask or not? It alerts the user if not wearing the mask, and the recorded images are sent to the registered mail-id. The Pandemic Preventer (mask detection system) runs automatically and enforces the wearing of the mask.

The face mask detector system can work on any existing cameras without the installation of any new cameras.

The Face Mask Detection System can be used at office premises to ensure that employees are maintaining safety standards at work. It monitors employees without masks and alert them to wear a mask. It can also be used in schools as well as in colleges, ensuring safety of the students.

Post COVID-19 it can also be put to application in various fields of work.

I. INTRODUCTION

World health organization (WHO) stated that coronavirus disease, 2019 (COVID-19) has globally infected over 2.7 million people and caused over 180,000 deaths. Furthermore, many public service providers require customers to use the service only if they wear masks correctly. However, there are only a few research studies about face mask detection based on image analysis.

Facial recognition systems are an excellent way to improve security and enable touchless access control in buildings and facilities resulting in improving digital world. But in this new world of social distancing, experts increasingly recommend the use of face masks to limit the spread of COVID-19.

Finally, many of the industrialist decided to build system, which detect face mask to alert people.

The virus that causes COVID-19 is mainly transmitted through droplets generated when an infected person coughs, sneezes, or exhales. These droplets are too heavy to hang in the air, and quickly fall on floors or surfaces.

You can be infected by breathing in the virus if you are within close proximity of someone who has COVID-19, or by touching a contaminated surface and then your eyes, nose or mouth. This can be prevented by wearing masks.

Some people may intentionally or unintentionally not wear their masks and can risk their and others life in danger. To prevent this face mask detection is created. The facial recognizing system is an excellent way to find someone without a mask and during these tough times of COVID 19 it can be of a great advantage.

Face Detection has evolved widely in Image processing and Computer Vision. Face detection is more relevant today because it not only used on images but also in video applications like real time surveillance and face detection. High accuracy image classification is possible now with the advancements of Convolutional networks.

I. RESEARCH METHODOLOGY

Initially researchers used pattern recognition model, having a prior information of the face model. Adaboost was a good training classifier. The face detection technology got a breakthrough with the famous Viola Jones Detector, who greatly improved real time face detection. Viola Jones detector optimized the features of Haar (A Haar-like feature considers adjacent rectangular regions at a specific location in a detection window, sums up the pixel intensities in each region and calculates the difference between these sums), but failed to deal with various factors like face brightness and face orientation. Viola Jones could only detect front side of well-lit faces. It failed to work well in dark conditions. These issues compelled the independent researchers to work on developing new face detection models based on deep learning, to have better results for the different facial conditions.

Deep learning technique has been useful for big data analysis and has its applications in computer vision, pattern and speech recognition, etc. Liu's et al. work focuses on some commonly implemented deep learning architectures and their applications.

Khandelwal et al. had stated in his work about a deep learning model that binarizes an image and checks whether a mask is used or not. 380 images had a mask and 460 images had no mask and these images were used in the training of the MobileNetV2 model. The AUROC of the model was 97.6 %. There were few limitations in using the model. Those were: it could not correctly classify partially hidden faces and the model is not able to detect faces if the camera height is greater than 10 feet. A face mask-wearing classification system with the incorporation of image super- resolution using classification network (SRCNet), was made by Qin et al. It quantified mask, no mask, and incorrectly worn masks, based on 2D facial pictures. Image pre-processing, face detection and crop, image super-resolution, and face mask-wearing conditions identification formed the backbone of the algorithm. Similarly, a Retina face mask has been proposed by Jiang et al. which is a high-accuracy and efficient face mask detector.

3.1 Theoretical framework

As face masks become an important tool to combat COVID-19, organizations may wish to be notified when individuals are not wearing a mask. This type of logic is not present in all recognition systems. Since we have used this technology which protects and limits spread of this pandemic. This will be the efficient and convenient use for all industries and public areas. In this system –face mask detection system used to give alert, when recognizing the people not wearing masks. Alert will be the voice message announced in public requested to wear mask so that unwillingly people will cover their face.

The system was built on python 3 and used the following libraries -

1. CV2-
   Designed to solve computer vision problems. Is used here to access the camera
2. Play sound -
   The play sound module contains only one thing - the function (also named) play sound. It is used here to alert the non-mask wearer and give him a warning
3. Time -
   Used here to give pauses between warnings given to the non-mask wears
4. OS -
   The OS module in python provides functions for interacting with the operating system. It is used here to access the pictures captured by the camera
5. Smtplib -
   It is used to send the pictures of the non-mask wearers through mail to higher authorities or the registered mail id in the system.
   Haar Cascade is a machine learning object detection algorithm used to identify objects in an image or video.
   We have used a haar cascade of a mouth to detect mouths.
   Additional objects include Audio files that are used to alert the people.

The following is a step by step process of how it works:

1. The camera constantly scans for an open mouth using the haar cascade
2. Once an open mouth is detected, it will play an audio file asking the person to "*kindly wear a mask*".
3. The person will be notified 5 times
4. The camera will continue its job and scan for other mouths if the person wears the mask
5. If the person ignores the warnings his face is captured and stored
6. The stored image will be sent to higher authorities or the registered mail id so as to take the necessary action for the same.

IV. RESULTS AND DISCUSSION

4.1 Results of Facial Mask Detection System

As a result, Figure.1 shows detection of mouth using the Haar cascade as the user is not wearing a mask.
Whereas in Figure.2 no mouth is detected as the user is wearing a mask. Therefore, in case of Figure.2 there will be no alerts.

Fig.1 - Detection of "NO MASK"

Fig. 2 - Detection of "MASK"

V. ACKNOWLEDGMENT

In this paper, we have proposed a face mask detector, namely pandemic preventer which can possibly contribute to public healthcare. Face mask detector today could potentially be used to help ensure your safety and the safety of others during the tough times of COVID-19.

The architecture of pandemic preventer consists of camera or Mobile Net as the backbone and developed in python with cascading responding even faster than AI. Definitely it will work as a very convenient and efficient system for different purpose in various sectors.

By working on some modules of this system it will be useful in various sectors, including financial and commercial. The system developed in python language answers some of the issues faced in earlier recognizing machines. use of cascade will increase its efficiency to detect faces faster than AI. It will work by detecting human faces, mainly towards the faces not covered with a mask.

As soon as the system recognizes face without mask it will simply give alert in public to cover their mouth thus helps for others also; instead of living with self-consciousness.

Occlusion detection — recognizing when a face is covered — has been a feature of professional face detection platforms for some time. This way in digital world helps to limit covid-19 very far.

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