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Facial Mask Detection System based on COVID-19 Protocol

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Abstract:- In the midst of the ongoing COVID-19 pandemic, adherence to safety measures such as wearing masks has become crucial. To assist in enforcing mask-wearing norms without relying on manual intervention, we present a mask detection system that utilizes a Convolutional Neural Network (CNN) and facial recognition algorithm. Our system compares images of faces with and without masks, automatically detects the presence or absence of masks, and triggers an alert mechanism for the general public.

In this report, we address the challenge of detecting masked face regions by proposing a novel approach that involves discarding the masked region and leveraging deep learning-based features. By focusing on the uncovered facial areas, our model aims to improve accuracy and efficiency in mask detection.

Through the utilization of CNN, our system learns discriminative features from the face images, enabling it to accurately classify whether an individual is wearing a mask or not. The facial recognition algorithm further enhances the system's ability to identify and track individuals in real-time, facilitating quick and reliable detection.

To evaluate the effectiveness of our proposed model, we conducted extensive experiments on a diverse dataset containing images of individuals wearing masks. The results demonstrate the system's high accuracy and efficiency in detecting masks, even in challenging scenarios such as varied lighting conditions and different mask types.

Our mask detection system holds significant potential for deployment in various public spaces, such as airports, train stations, and shopping malls, to help ensure compliance with mask-wearing guidelines. By automating the detection process, the system can contribute to reducing the spread of COVID-19 and protecting public health.

Keywords:- *Mask Detection, Convolutional Neural Network (CNN), Facial Recognition, COVID-19, Safety Measures.*

I. INTRODUCTION

Over the past three years, the world has been grappling with the devastating impact of the COVID-19 pandemic, and India has been no exception. The country has experienced one of the worst effects of the virus, leading to a significant loss of lives and an immense economic crisis. The imposition of lockdown measures further exacerbated the strain on the global economy.

After enduring two waves of infections, some restrictions were lifted, providing a sense of relief. The World Health Organization (WHO) has consistently emphasized the importance of adhering to precautionary measures to combat the virus. Wearing masks and practicing proper sanitization have been highlighted as crucial weapons in the fight against COVID-19.

Unfortunately, as restrictions eased, we witnessed a lax attitude towards maintaining social distancing and wearing masks in public places. Despite the awareness about the significance of these preventive measures, many individuals neglected to follow them. Surveys indicate that while approximately 90% of people are aware of the importance of masks, only around 40% actually wear them.

This disregard for mask-wearing can be attributed to various factors, including discomfort and skepticism towards the existence of the virus. However, such behavior has grave consequences, as it contributes to the rapid spread of COVID-19. The WHO has reiterated that wearing masks and practicing social distancing are essential to curbing the transmission of the virus.

Public areas where people freely move without masks become hotspots for the spread of the virus. Moreover, there is a pressing need to raise awareness in rural areas where knowledge about preventive measures may be limited. It is crucial to educate individuals residing in these regions about the significance of masks and other precautionary measures to safeguard their health.

The unpredictable nature of the COVID-19 outbreak has underscored the importance of wearing masks in public places. By diligently adhering to these practices, we can protect ourselves and others from the threat posed by such viruses. It is our collective responsibility to prioritize the

health and well-being of our communities by embracing these simple yet effective measures.

II. METHODOLOGY

A. System Design

The software design process involves converting requirements into an appropriate representation on a regular basis. This representation includes the structure and target plan diagrams, as well as the mission method.

B. Existing System

The current system utilizes Yolov3 for mask detection. This system incorporates a backbone network to allocate more resources within the existing framework. Glou and focus loss techniques have been employed to expedite the training process and enhance performance. The accuracy rate achieved is 86 percent. By incorporating different algorithms, the accuracy can be further improved.

C. Proposed System

In the proposed system, mask detection is performed using MobileNet V2. Compared to the previous system, MobileNet V2 offers better accuracy in detecting face masks, even in large groups of individuals. The input dataset consists of segmented photos, including both individuals wearing masks and individuals without masks. The model is then applied using a camera, and the video footage is analyzed frame by frame. Preprocessing techniques are employed to distinguish between individuals wearing masks and those who are not.

III. DISCUSSION

The primary goal is to come up with an idea that can motivate people to wear masks in public places by detecting the people who are not wearing masks. In order to address the issue of the masked face region, we are proposing a model based on discarding the masked region and deep learning-based features. We will detect the people who are not wearing masks by eliminating the masked faces using the Neural Network algorithms. After recognizing the facial features and checking if the faces are with or without mask, an alert can be triggered to them for following the covid rules and regulations.

A) Image Segmentation using Mask CNN

The Mask R-CNN is a CNN for image segmentation and event segmentation that is built on top of a quicker R-CNN that can come across objects and limits. Instance segmentation or instance recognition is the process of detecting all objects in a photograph and segmenting each event. It emerges as a result of the harsh realities of object detection, localization, and classification penalties. During this method of segmentation, a clear separation between each item classified as a similar circumstance is noted. Everyone is treated as a single entity during the event segmentation process. It's also known as foreground segmentation because it works on the picture's subject matters rather than the background-CNN and can produce two outputs for each object, a class label, and a bounding field offset, whereas Mask R-CNN can produce three outputs, including article masks in addition to the class label and bounding container offset. The more masks output is exclusive from the opposite two outputs, implying that the finer the spatial design of an item, the more masks output is required. Mask R-CNN is a faster version of R-CNN that includes an output for object masks in addition to current outputs such as classification labels and bounding boxes.

B) Implementing the Model in OpenCV

The model will be constructed with the help of a webcam, which reads the video frame by frame and resizes it as needed. Then, in connection with the accuracy in %, the preprocessing feature is known as achieving the final result of human people wearing masks and now not wearing a mask.

C) Implementing the Face Recognition

The method of detecting a human face using technology is known as facial reputation. Biometrics is used in a facial reputation device to map face functions from a picture or video. To find a match, it compares the information to a database of known faces.

- *Step 1: Detection of Face*

Both by myself and in a crowd, the digital digicam recognizes and locates a snapshot of a face. The image might also show the character searching ahead of time or in profile.

- *Step 2: Analysis of Face*

Following that, a snapshot of the face is taken and examined. Because it may be simpler to integrate a 2D image with public photographs or those in a database, most facial interest period is based on 2D as a potential rather than 3D images. The gap between your eyes, the depth of your eye sockets, the space from the forehead to the chin, the form of your cheekbones, and the outline of your lips, ears, and chin are all crucial factors that the program interprets. The objective is to learn the facial landmarks, which are perhaps the most important aspect of facial recognition.

- *Step 3: Converting the image to data*

Face capture mode converts analog facts (a face) into a collection of digital data (data) depending on the person's facial traits. The appraisal of your face has evolved into a mathematical formula. A face print will be the name for the digital code. Every character has their own faceprint in the same manner as thumbprints are unique.

- *Step 4: Finding a match*

After that, your faceprint will be compared to a database of other recognized faces. Any photo tagged with a person's name on Facebook becomes a part of Facebook's database, which may be used for face recognition as well. Self-discipline is achieved when your faceprint matches an image in a facial interest database.

The face center of attention will be the most natural of all the biometric measures. This makes intuitive sense because we normally recognize ourselves and others by gazing out at faces rather than thumbprints and irises.

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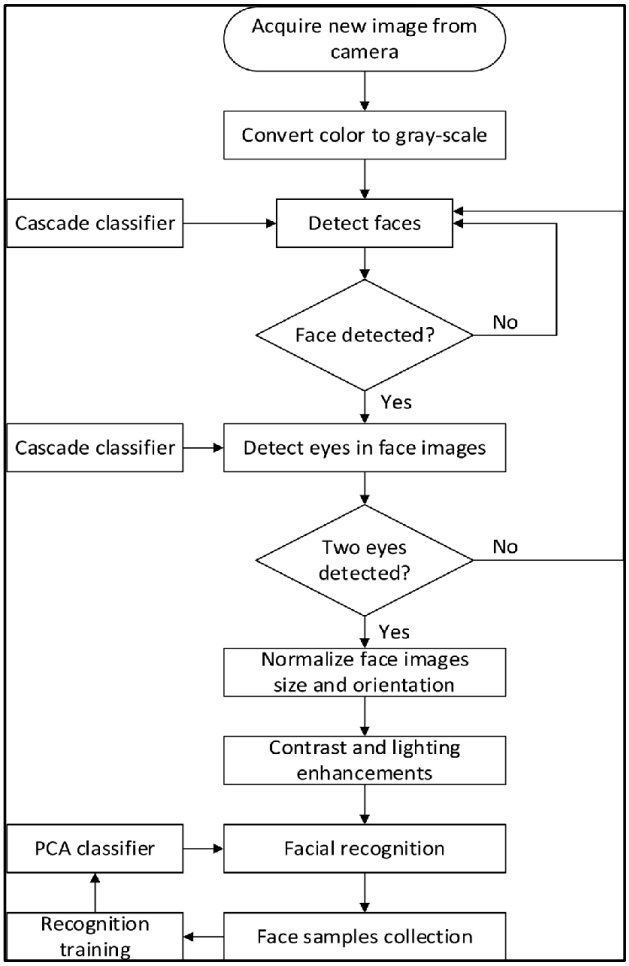

Fig 1: - Flow chart for implementation of facial recognition.

D) Sending SMS and Email to Person who is not wearing Mask

We're employing a face recognition system to identify folks who aren't wearing masks, which will aid us in locating their information. We will send a preventive message in the form of SMS and email to such persons in order to reward them, advising them to wear masks in public. We utilized Twilio for delivering SMS, which provides programmable communication tools for sending and receiving text messages via its web service APIs, and the smtplib module for email, which simply establishes an SMTP session for the client object and can then be used to send mail to another computer.

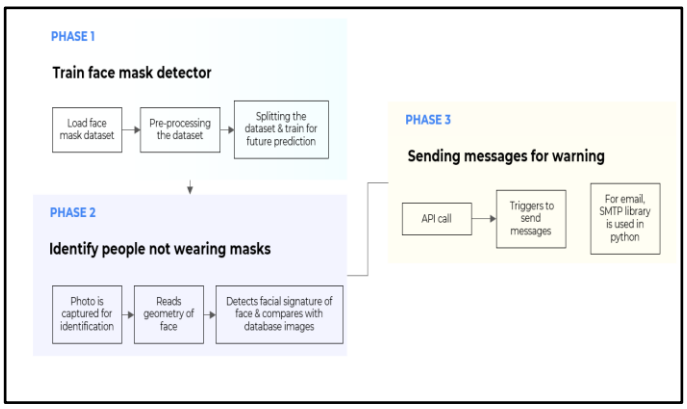

Fig 2: General Frame of connection of the above modules

IV. RESULTS

A. *Testing the Model*

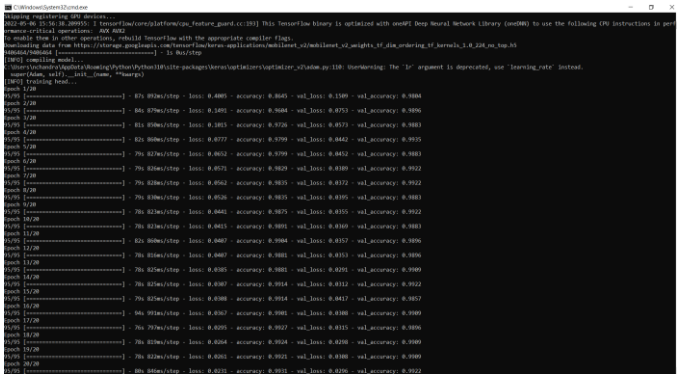

Fig 3: Testing the Model

B. *DETECTING FACE MASK*

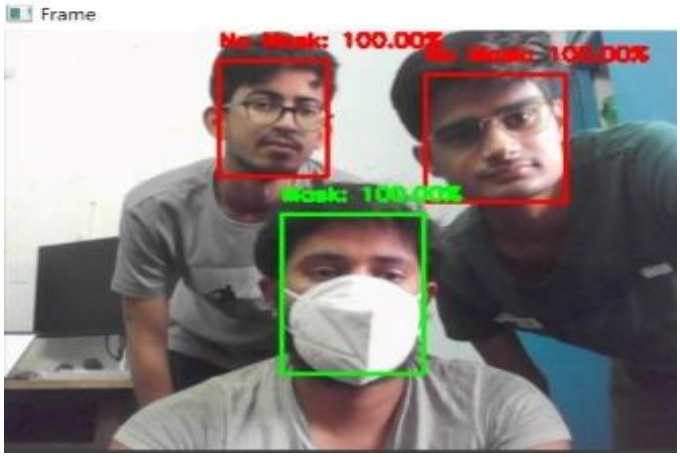

Fig 4: - Detecting people wearing masks (sample audience)

C. *SENDING MESSAGES VIA SMS/EMAIL*

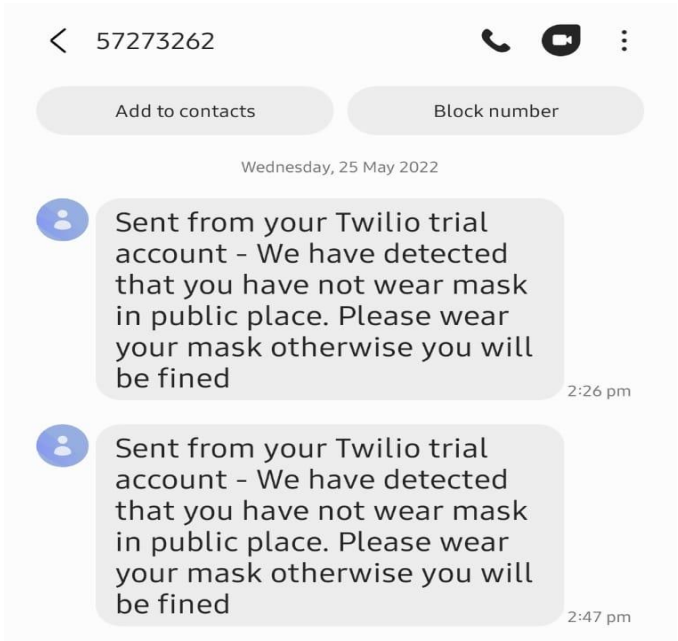

Fig 5 :- Sending text messages to people not wearing masks

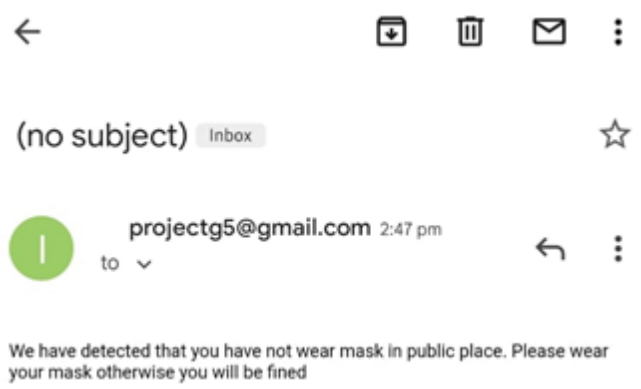

Fig 6:- Email template sent to people

V. CONCLUSION

In this mask detection, we used the MobilenetV2 set of rules to correctly distinguish persons wearing masks and those without masks, as well as send an email to those involved. Its overall performance in photographs is generally accurate, and our detecting effects were also rather accurate. This detection will be utilized for video flow or digital digicam-fed inputs, as well. This can be used in places of work and establishments by way of training the database with personnel photos or students' photos and by way of face reputation, and the character is diagnosed by way of a mobile number that is unique for each person, and other information about the individual is obtained from the database, and it will be simple to tell that specific character or beneficial for taking any actions concerned. The suggested version can be improved by including other aspects such as the number of persons and the social distance between individuals.

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