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Face Mask Detection using Deep Learning

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Abstract: *Latterly the widespread outbreak of the Coronavirus (COVID-19) has brought Global crisis with its deadly spread and has put the world to a halt. During this pandemic situation, World Health Organization (WHO)has made masks and social distancing compulsory to protect against the deadly virus. These are the necessities of today's world we lived in a few months prior is completely different than what it is now. Our project mainly focuses on detecting if the people around are wearing masks or not. Due to hardware restrictions, we used video analytics for monitoring people.*

Keywords: Coronavirus

I. INTRODUCTION

COVID-19 comes under the umbrella of diseases caused due to corona virus. This specific virus was first detected in Wuhan, China in 2019 in the month of December. As of now the deadly virus has infected more than 85 million people worldwide and more than 1.83 million have succumbed to death against it. A cure or vaccine for it is yet to be found properly so till then the only option left for the people is to keep themselves safe and healthy away from this virus by practicing wearing masks and following social distancing each and everywhere. Even after the vaccine is invented and supplied to people these two practices will still demand highest priority. So in this paper we present to you an face-mask detection algorithm which when incorporated will detect and warn against the violations of these practices at any place. These systems will be highly efficient and important in crowded indoor premises of any sorts or out in densely populated publicplaces.

II. RELATED WORKS

This section highlights some of the related works about human detection using deep learning and mask detection. A bulk of recent works on object classification and detection involving Deep learning. The state-of-the-art review mainly focuses on the current research works on object detection using machine learning. Human detection can be considered as an object detection in the computer vision task for classification and localization of its shape in video imagery. Deep learning has shown a research trend in multi-class object recognition and detection in artificial intelligence and has achieved outstanding performance on challenging datasets.

Object detection from a image is probably the deepest aspect of computer vision due to being widely used in many cases. There has been two types supervised or unsupervised based learning in the field of computer vision to outfit the work of object detection in an image. Most mask face detection focuses on face construction and face recognition based on traditional machine learning techniques. In this research paper, our focus and spotlight is on detecting and finding the human who is wearing a face mask to help in decreasing the spread of the COVID-19.

III. METHODOLOGY

In recent corporate world, a face mask is made compulsory and without it no one is allowed to enter the premises. Even in the public as well as private sectors, mask is a must. So here questions arise: who is giving to monitor every entry? If it is a machine, then how will that system be efficient and reliable? and the answer we give is YES! Our technique which when incorporated with the existing surveillance system will give utmost results.
In each section we will see how those mechanisms work.

3.1 Mask Detection through Video Analytics.

We proposed a smart approach for detecting a human face from the sea of pixels and distinguish them between the masked face and without a masked face. The cameras are used to capture images from public places; then these images are

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fed in to a system that identifies if any person without a face mask appears in the image. If any person without a face mask is detected then this information is sent to the proper authority to take necessary actions.

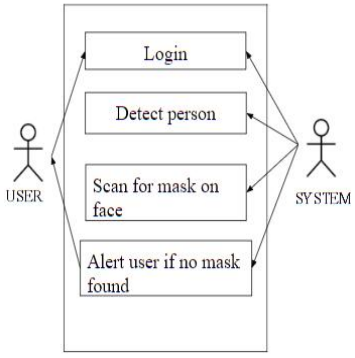

Figure 1: The Developed Framework

Techniques Used:

1. OpenCV
2. caffe-based facedetector
3. keras
4. Tensorflow
5. MobileNetV2

OpenCV

OpenCV is a cross-platform library using which we can develop real-time computer vision applications. It mainly focuses on image processing, video capture and analysis including features like face detection and object detection.

Used OpenCV Library Modules:

- dnn module: We build deep neural network models in OpenCV with its dnn module, using which we set up external models for tensorflow, caffe.
- cvtColor: used this method to convert an image from one color space to another. cv2.cvtColor(face, cv2.COLOR_BGR2RGB) face* is the image whose color space is to be changed, and we used color space conversion code to BGR to RGBchannel
- resize: to resize the image to perform the forward operations. we get the width,height for eachpixel.
- rectangle: we used cv2.rectangle feature to draw bounding box rectangle on the output frame where the label is displayed.

Keras

It allows use of distributed training of deep- learning models on clusters of Graphics processing units (GPU) and tensor processing units (TPU).

Caffe

We made use of caffe implementation of resnet10 architecture to detect the faces in the images.

Tensorflow

It is an end-end open source machine learning platform. It has flexible tools, libraries and community resources.

MobileNetV2

It is a convolutional neural network architecture that seeks to perform well on mobile devices. MobileNet V2 is based on an inverted residual structure where the residual connections are between the bottleneck layers.

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Our face mask detector didn't use any morphed masked images dataset. The model is accurate, and since we used the MobileNetV2 architecture, it's also computationally efficient and thus making it easier to deploy the model to embedded systems (Raspberry Pi, Google Coral, etc.).

There are several neural network architectures for detection such as R-CNN , single shot detectors , YOLO. We used and implemented YOLOv3 for detection. Which is the variant of original YOLO architecture. YOLO means you only look once. The choice of language for this is python, because of it's huge support from libraries such as openCV, keras, tensorflow etc. Another reason behind using YOLOv3 is the YOLO models are not as accurate as R-CNN but they are swift and are easily suitable for real time application.

3.2 Result Images

Our first image is the result of successful face mask detection, when the mask is on the face . Here in this result image you can see the green bound box around the face and also probability percentage.

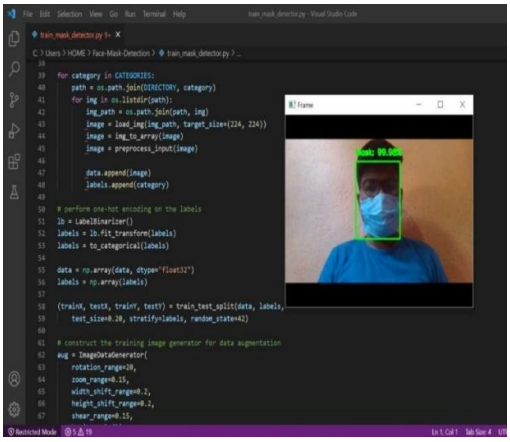

Fig. 1 Example of fully masked person image

Now the second case of the resulting image is when there is no mask on the face. If the system did not detect a mask on the face then the red bounded box formed around the face.

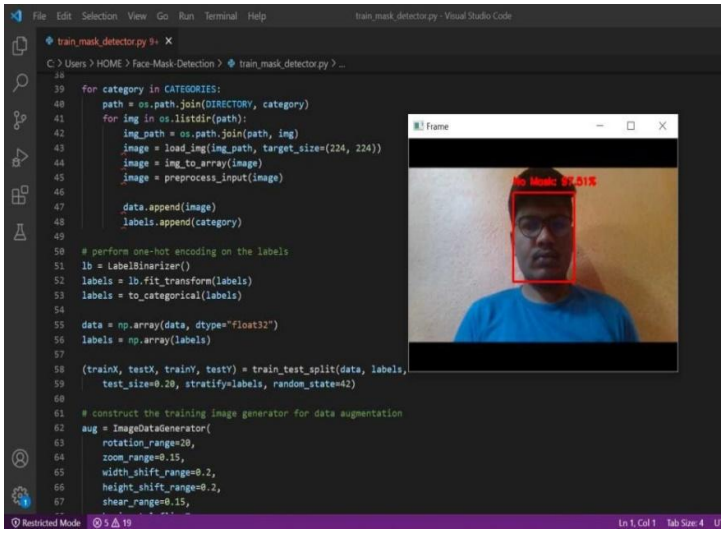

Figure 2: Example of unmasked person image

IV. CONCLUSION

So in this paper the algorithm that we have proposed on face-mask detection and social distancing detection will help in keeping people safe and aware of their surroundings from the deadly Covid-19 corona virus. There might be a lot of

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research going on but the algorithm proposed above will definitely let us know whether people are following the Covid-19 safety guidelines or not. To further strengthen the accuracy of the algorithm, many different permutations and combinations of varied features can be implemented to boost the performance.

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