Object Detection To Monitor COVID-19 Safety Measures

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ABSTRACT
This research utilizes object detection and machine learning to simultaneously detect face masks and social distance in video feeds. Tensor flow and Keras were used to create a CNN model for identifying face masks. A dataset of about 4000 photos was used to train this model. By marking the centroid and calculating the Euclidean distance between them using the k-means algorithm, an object detection model was utilized to concurrently recognize people in a rectangle frame and check for social distance between two people using their face masks. The backend service was Firebase. If the permissible number of violations is surpassed, the image will be uploaded to Firebase's cloud storage and a warning email will be forwarded to the relevant authorities.

Keywords
Machine Learning, YOLO Object Detection, Tensor Flow, Keras, and Firebase

1. INTRODUCTION
We faced several difficulties in the year 2020, particularly in the working sectors. Many businesses were converting to a work-from-home atmosphere. Restaurants, a few schools and universities, the construction industry, and a few offices are among the still-open enterprises that are carrying on as usual while maintaining occupational safety measures including mask use and social seclusion.

The health authorities are making a lot of effort to make sure that these companies follow all the safety procedures for their staff. These establishments are being regularly inspected, and if they continue to disregard the safety rules, they may even be shut down.

Many of these establishments are striving to automate the process of identifying such violations to save time and labor. The primary goal of this project is to find workplace infractions, including failing to wear a mask. Or observe social distance, and alert the authorities using an Android app.

The Internet of Things (IoT), machine learning, and deep learning are only a few examples of how far technology has come in the last century (Raj, 2021). CNN has emerged as a significant machine learning subfield with applications in a variety of industries, including medical (Duran-Lopez, 2019), marine science (Sung, 2017), and many others (Hansen, 2017).

The CNN (Convolutional Neural Network) model was trained for face mask detection using Keras and Tensor Flow, and the YOLO Object Detection model was employed for social distancing recognition.

With the aid of Firebase, a backend service used for notifying users and maintaining records of these violations, an email alert system was created.

The remainder of the essay is structured as follows: The project is briefly introduced in Section 1. The work linked to this project is reviewed in Section 2. The project's methodology and execution are described in Section 3. The identification of social distance violations is covered in Section 4. Firebase is the back-end service used to store identified images and deliver email notifications. It is discussed in Section 5. The applications are covered in Section 6. Conclusion of Section 8 and future work scope it refers to Section 9.

2. RELATED WORK
This part will cover the research we did for this project, some related works that employed Keras, Tensor flow, and YOLO Object Detection to create Convolutional Neural Networks (CNN), as well as advancements in object detection. Tensor flow was used to create a model by S. Chen et al. (Chen, 2020) that can recognize ID card numbers. With the aid of a trained CNN model, the ID card picture was recorecognized preprocessed, and the number of an ID card was recognized and provided as an output Test results indicate that accuracy and speed were both quite good. In order to ascertain whether someone was wearing a helmet in real time and to identify any infractions, Akanksha Soni et al. (SoniSoni, 2020) developed a model. The model in this project was given training using Tensor flow, Keras, and OpenCV. When compared to previous models, their proposed model demonstrated significant advancements when a person covered their face with an air face mask. When tested, they had a 98 percent accuracy rate. Tensor flow Data Validation (TFDV), a model created by Caveness et al. (Caveness, 2020), offers a scalable method for data analysis and validating for machine learning. Their machine learning technique, which is integrated with the end-to-end platform Tensor flow Extended (TFX), has been put into use. It was integrated with the end-to-end supervised learning platform Tensor flow Extension (TFX). Since they opened sourced their project, their system has experienced significant growth. Other source data validation tools, like Apache Spark, are quick and easy to use in large data processing systems and are employed as built-in modules for streaming. A non-GPU computer has been proposed by M.B. Ullah (Ullah, 2020). On machines without GPUs, his technique uses the CPU-based YOLO object detection model. The creator of the model optimized the YOLO using OpenCV so that it can recognize real-time objects on a computer connected to the CPU more quickly. Their network architecture comprises three fully linked layers, two pooling layers, and two convolutional layers. Their model accurately detects objects in pre-recorded films at 10.10 to 16.30 frames per second with 80–90% confidence on CPU-based machines. (Nair, 2018). For real-time single category identification, Yonghui Lu et al. (Lu, 2020) suggested a useful YOLO architecture called YOLO-compact. The authors sought to improve object detection quicker and more effectively for these cases since, as we all know, there is only ever one category in practical implementations of object detection. The authors used YOLOv3 to conduct a number of tests and develop an effective small network. YOLO-compact was found to be just 9 MB in size, which is much less than

YOLOv3, tiny-yolov2, and tiny-yolov3, which are all larger. The YOLO-compact has a substantially greater average accuracy than other YOLO models, at 86.85 percent.

3. PROPOSED SYSTEM

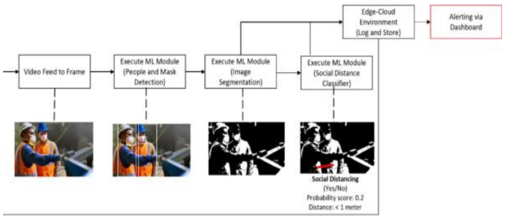

Fig. 1: Flowchart/Working of the Project

This project aims to identify the face mask and social distance using YOLO and OpenCV. The camera, saved movies, photographs, and CCTV images are used to build the test situations. Automatic test case generation will help the developer test the product more rapidly because, as was already said, the testing process takes more time. The answer to the issue statement is to utilize software to quickly identify the violation state, which can then be saved as a.jpg or sent through email to registered mail to alert the appropriate authorities. Making a graph and testing the test cases that the graph can handle will be easy using the.jpg file. The quantity of instances, the Red Zone Area, future plans to end violations, etc., may all be calculated. Making automated test cases is one of the most challenging aspects of testing. The state of the violation is displayed graphically. It's challenging to read data from an email and translate it into a graphic form. Other strategies to stop the infraction.

4. ARCHITECTURE

The system's quick approach is shown in the flow chart. It outlines the components and the implications of each one.

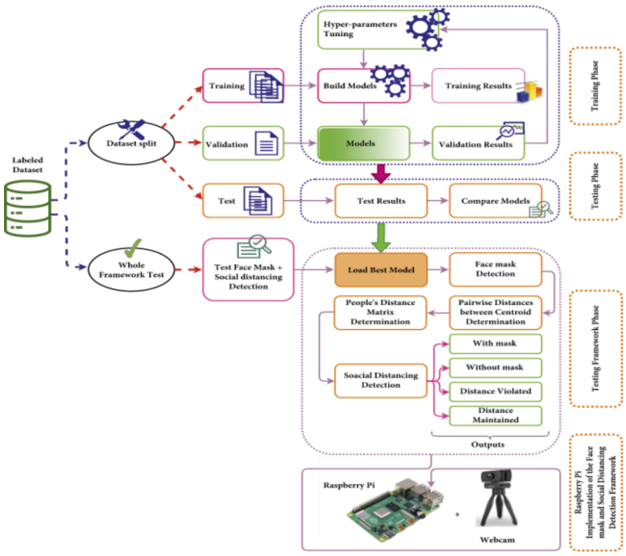

Fig. 2: Architectural Diagram

The system's quick approach is shown in the flow chart. It outlines the components and the implications of each one.

4.1 Face Detection Size

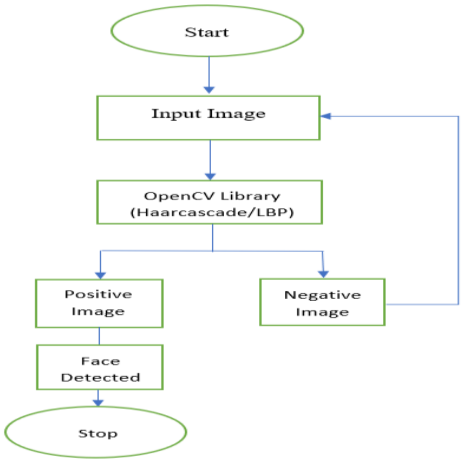

Figure 3: Flow Chart for Face Detection

The method of face detection is depicted in the flow chart. A large number of positive facial images with masks—and negative images—pictures of faces without masks—are required by the Haar cascade to train and validate. We can then identify the faces in an input image by using this trained classifier.

4.2 Face Mask Detection Basedon Facial Expression

The two states of the face generated by face tracking are covered and uncovered.

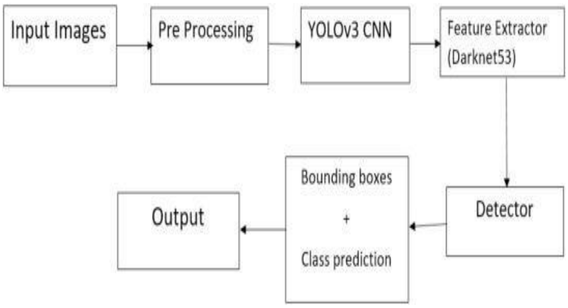

Figure 4: Flow chart diagram to detect face mask from mouth/lips tracking

Based on where the condition of the mouth is evaluated, the nose is computed. NTH is used as a comparison. This is done for a few precise video frames that follow one another. This is done. We then determine whether or not the person wears a mask based on this.

4.3 Social Distance Detection basedon Centroid Analysis

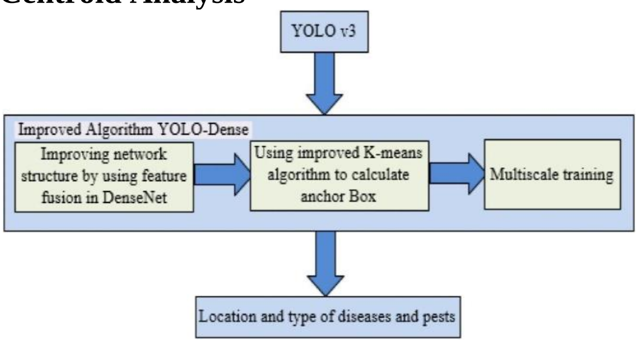

Fig 5: Yolo V3 Flow Chart

According to distance analysis, a person is either in a safe (green), abnormal (orange), or violating condition (red). The K-means technique is used to determine the anchor box and the centroid. It is contrasted with a safe distance. The box will be green if the individual is keeping their distance. The box will become orange, signifying an abnormal condition, if the individual is on the verge of breaking the distance. When someone crosses a line, it turns red.

4.4 Firebase Cloud is Sendingan Email Alerttothe Registered Email Address

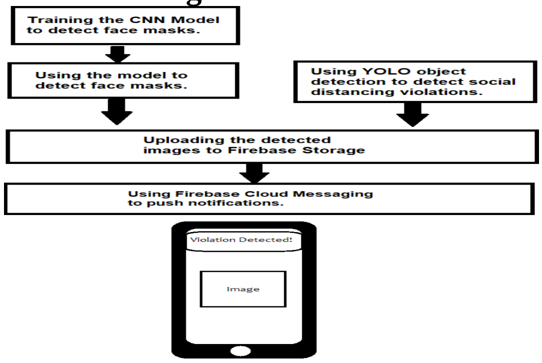

Figure 6: Flowchart Diagram For Email Alert

The emergency alert of the person violation has a designated email address. This contact receives an alert message with location information whenever a group of people is discovered to be violating according to the system's components upon that registered email.

5. IMPLEMENTATION

5.1 Wearinga Face Mask

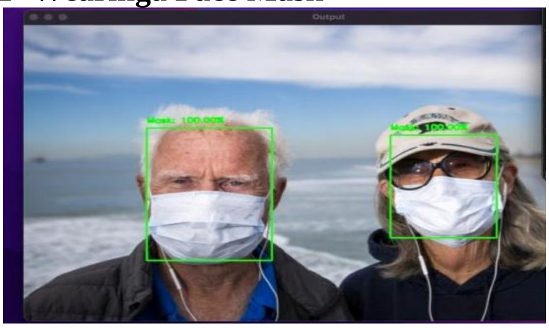

Figure 7: Wearing a face mask

The image obtained from the video through the webcam is evaluated to determine the person's face. As can be seen in this picture up above, the face appears hidden. The YOLO V3 and Tensor flow decide it.

5.2 Not Wearinga Face Mask

Figure 8: No face mask on

The snapshot obtained from the video through the webcam is analyzed to determine the person 's facial. As can be seen in the picture up above, the face is hidden. Tensor flow and YOLO V3 both have a role in determining it.

5.3 A Few People Wear and a Few Do Not Wear Face Masks

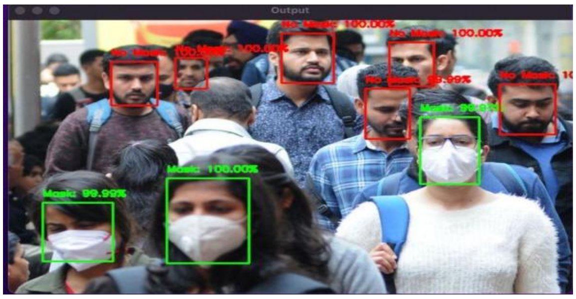

Figure 9: Some people are wearing face masks, while others are not

The snapshot obtained from the video through a webcam is analyzed to determine the person 's facial. As can be seen in the picture up above, the face is masked. The YOLO V3 and Tensor flow decide it.

5.4 Social Distance

Figure 10: Social distance detection.

The frames from the video that were recorded using a webcam are used to assess the person's moments. According to the status of the violation, the distance is calculated and marked: if the person is violating, it is indicated by the red layer panel; if they are about to violate (i.e., in an abnormal condition),it is indicated by the orange layer panel; and if they are keeping a safe distance, it is shown by the green layer panel. The CNN model, Relu function, and OpenCV are the factors that decide it.

5.5 Social Distanceand Face Mask

Figure 11 (a,b): Face mask-wearing

The snapshot obtained from the webcam footage is analyzed to determine the person's face and the social distance between them. As shown in the photograph above, the distance and the condition of the face are both noticeable. The YOLO V3, CNN model, Relu Function, OpenCV, and Tensor flow all play a role in determining it.

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7. AUTHOR'S PROFILE

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