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Automated Social Distancing and Face Mask Detection System

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Abstract: COVID-19 epidemic has fleetly affected our day-to- day life dismembering the world trade and movements. Wearing a defensive face mask has become a new normal. In the near future, numerous public service providers will ask the guests to wear masks rightly to benefit of their services. Thus, face mask recognition has turn out to be a pivotal task to help global society. This paper presents a simplified approach to achieve this purpose using some introductory Machine Learning packages like TensorFlow, Keras, OpenCV and Scikit- Learn. The projected system detects the face from the image appropriately and then identifies if it has a mask on it or not. As a surveillance task executor, it can also distinguish a face along with a mask in motion. The system attains precision up to95.77 and 94.58 independently on two different datasets. We discover optimized values of parameters using the Convolutional Neural Network model to spot the presence of masks rightly without causing over-fitting.
Keywords: Coronavirus, Covid-19, Machine Learning, Face Mask Recognition, Convolutional Neural Network, TensorFlow.

I. INTRODUCTION

According to the official World Health Organization (WHO) ’s Situation Report - 205, coronavirus 2019 (COVID-19) infected more than 20 million people worldwide and caused the deaths of more than 0.7 million people. People with COVID-19 had a number of reported symptoms - from mild appearance to severe illness. Respiratory complications such as shortness of breath or difficulty breathing are one of them. People with respiratory problems can expose anyone (close to them) to an infectious bead. To prevent certain respiratory infections, including COVID-19, wearing a clinical mask is very necessary. The WHO emphasizes the importance of prioritizing medical masks and respirators for health care workers. Therefore, the need of a face mask has become an important activity in today's world society. Individuals wear face masks the moment they leave their homes and the authorities strongly suggest that people wear face masks and follow the rules of social isolation while in groups and in public places. To ensure that people stick to this uncomplicated safety principle, a plan must be developed. In this project, we created a system that can spot social distances between people and distinguish between mask covered and uncovered faces. The problem is the acquisition of a common object to determine the categories of objects. Face-to-face is related to the division of a particular business group namely, Face. It has many applications, such as automatic driving, education system, surveillance system etc. This paper presents an easy way to achieve the above target using basic Machine Learning (ML) packages such as TensorFlow, Keras, OpenCV and Scikit-Learn.

II. LITERATURE SURVEY

Rapid object detection using a boosted cascade of the simple features by Paul Viola, Michael Jones we will conclude that the model of the face mask spotter is made using algorithms of decision trees. Face mask recipients in this category were very effective in locating a face mask [1].

An approach to face detection and recognition method by D. Meena and R. Sharan we can conclude that in the face-to-face approach, the face is found in a picture that has a few features in it and the facial detection study requires facial recognition, facial tracking, and measurement of shape [2].

Detecting the Faces with Masks in the Wild by S's LLE-CNN. Ge, J. Li, Q. Ye and Z. we conclude that the blurring of facial recognition comes with two major challenges: 1) the unavailability of large databases containing both covered and uncovered surface, and 2) removal of the surface from the covered area [3].

Plant Leaf Recognition and Disease Detection using Deep Learning by Sammy V. Militante1, Bobby D. Gerardoij, Nanette V. DionisioĴ can conclude that Deep Learning covers a very large number of sensory networks that use multiple processor cores for computer processing and video cards [4] [5].

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III. PROBLEM DEFINITION

In this new era when we are facing an epidemic and people around us are being advised to wear a mask, some people are unfamiliar with it and avoid wearing a mask. The purpose of this project is that if we can get Al's help to find people wearing or not wearing masks in public places, it would be supportive to increase our safety. Used properly, masks can be used to help ensure our safety. Also, it is very stressful to live in this time, to see so many things happening in his world, we decided why we should not do something in it that is, to change the problem of the real world where we humans have to wear a mask to get out into a machine learning problem. The task here is to detect whether people are wearing a mask or not, if a photo or video is provided. It is a problem of classification and a problem of dividing into 2 different categories (Mask and Without Mask).

IV. PROPOSED SYSTEM

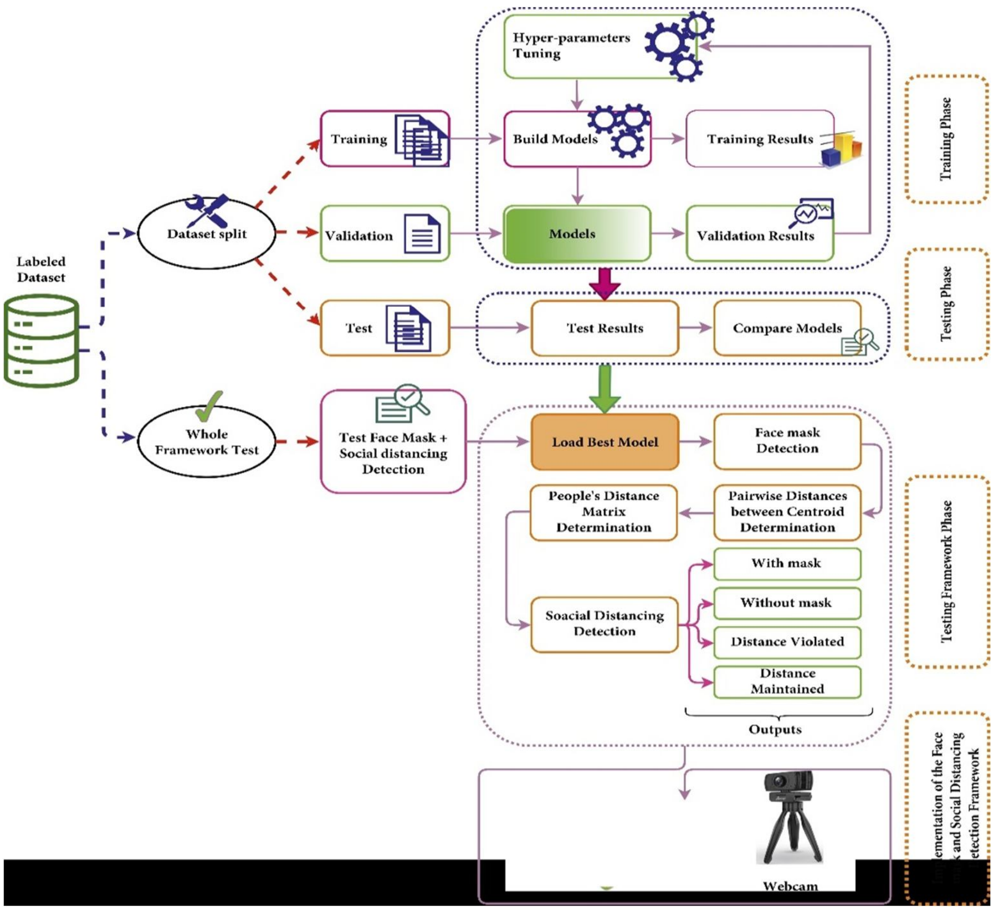

Figure 1. Proposed System

With reference to figure 1

1) Figure 1 shows the whole proposed framework, in this paper, which consists of two main blocks. The primary block comprises training and test models, while the subsequent block holds the entire test framework (the best model with physical distancing).
2) In the first block, our labelled database is divided into three classes. The first class focuses on training and represents 70% of the database images. However, the verification step requires only 10% to ensure the performance of the trained models. 20% of the data is provided in the test phase.
3) In each case, every model is trained in a training database. The results of the training, as well as the accuracy of the training and the loss of training, are given in the form of curves with the figures of "accuracy in terms of epoch" and "loss in terms of epoch," respectively
4) Later After training, each model is verified in a validation database. Similar to the training results, the validation results obtained are validation accuracy and validation loss. Then, the two results are compared with the loss function. The zero level of error-oriented performance refers to a well-trained model.

5) The hyperparameters are adjusted to train the model at another time. The technique of calculating faults and studying network parameters is called backward distribution, which is the following most important method well-defined in the training phase of any neural network, after the forward distribution procedure.
6) Hyperparameters, including collection size, number of epochs, reading level, optimizer, loss functions and work boxes, are tuned to develop an appropriate model. However, the learning percentage is defined as the learning step when the model reviews its studied weights. Combines input algorithm inputs and outputs to analyze errors. Lots size defines the number of tests that must be performed before updating internal model constraints. In other words, the number of trials that will be conducted across the network at the same time.
7) The training data set may be subdivided into one or more volumes. The number of epochs is a hyperparameter that describes the number of times a learning program will work with a complete training database. Enhancements are supported to reduce work losses. They are reviewing the model in relation to the removal of the loss function. Loss work is also called accident work. We can say that the context of the various ML algorithms is a loss function. The loss function can be used to measure model losses. Therefore, the weights can be accustomed to decrease the loss of the next figure. Inside the test segment, several models will be skimmed to select the best one to be utilized in the next step.
8) The subsequent block, which is the framework of the test case, was established to work with the finest model. The finest model is used to determine how to get a face mask. Additionally, the two-step process was modified to calculate the social distance between individuals. However, the distance between the centers of the binding box of the detected persons will be considered. The center point of the binding boxes is measured using a equation as seen in the figure below,

$$C(x,y) = \frac{X_{\min} + X_{\max}}{2}, \frac{Y_{\min} + Y_{\max}}{2}, \quad (1)$$

9) where C is the center of the binding box. Xmin and Xmax are the minimum and maximum values of the corresponding width of the binding box. Ymin and Ymax are the lowest and highest values of the equivalent length of the binding box. To measure the distance C1 (Xmax - Xmin) and C2 (Ymax - Ymin), between the center of each binding box, using the Euclidean formula, see equation (2), where the distance between the pixels is translated into a metric (distance range) and view-covered viewing field and then compared to a threshold value:

$$D(C_1, C_2) = \sqrt{(X_{\max} - X_{\min})^2 + (Y_{\max} - Y_{\min})^2}. \quad (2)$$

10) In the case of color detection, the operator receives 2 binding boxes and with a distance below the threshold value, these boxes can be colored red. If this function finds 2 binding boxes and the distance is above the maximum value, the color will be green on these boxes. Estimated distance (D) between the center of each binding box to the recipient, whereas D is the distance between the centers of the binding boxes.

V. RESULTS

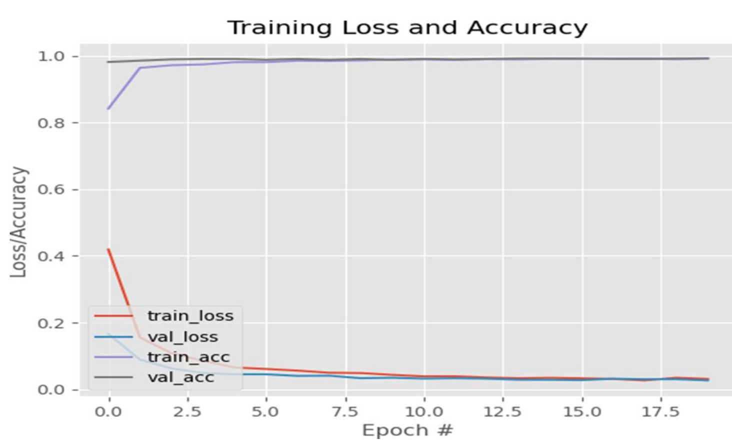

Figure 1.

With reference to Figure 1. The result of the Accuracy/Loss performance test during model training.

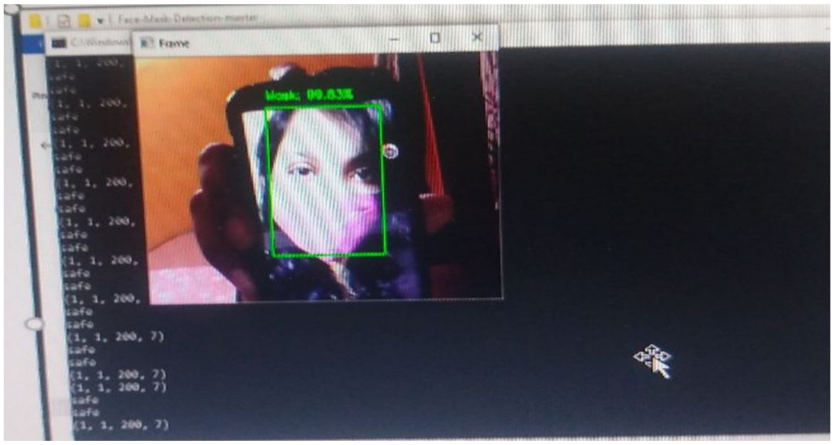

Figure 2. Face Mask Detection

With reference to Figure 2. An individual wearing a face mask is detected by the system.

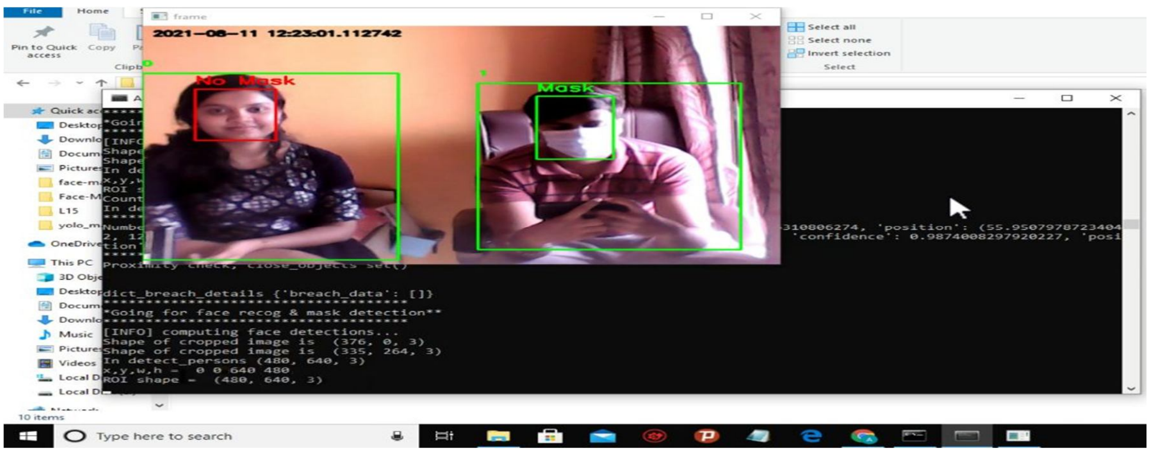

Figure 3. Social Distance Detection

With reference to Figure 3. The figure shows Safe distance between two individuals.

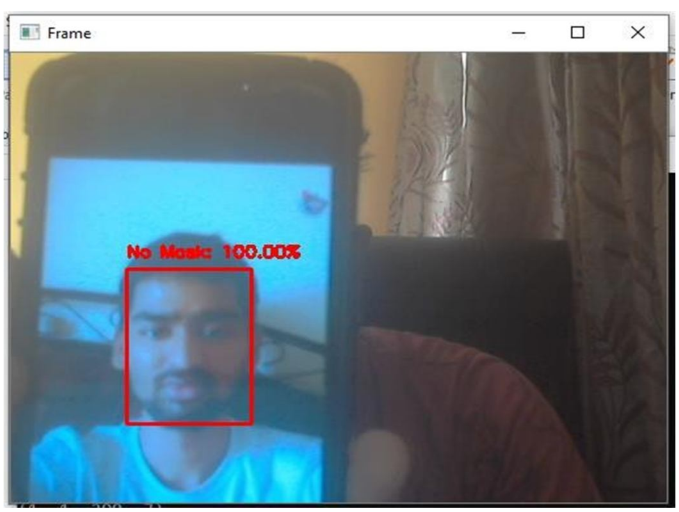

Figure 4. Face Mask not detected

With reference to Figure 4. An individual not wearing a face mask is detected by the system

VI. CONCLUSION

This manuscript has presented research on the facemask of real-time and social distance acquisition through in-depth learning strategies in the form of Convolutional Neural Networks. This process provides accurate and fast results for facemask detection. Test results show a degree of accuracy in determining people who wear a face mask and who do not wear a face mask. The trained model was able to perform its function using the VGG-16 CNN model and achieved a result of 96% operational accuracy. In addition, research shows a good tool for combating the spread of the COVID-19 virus by finding someone wearing a mask or not. Future works include the integration of physical distancing, wherein the camera detects the person wearing a facemask or not and at the same time measures the distance between each person and creates a red bounding box if the physical distancing does not observe properly. Also, the researchers suggest a different optimizer, improved parameter settings, fine-tuning, and use of adaptive transfer learning models.

VII. ACKNOWLEDGMENT.

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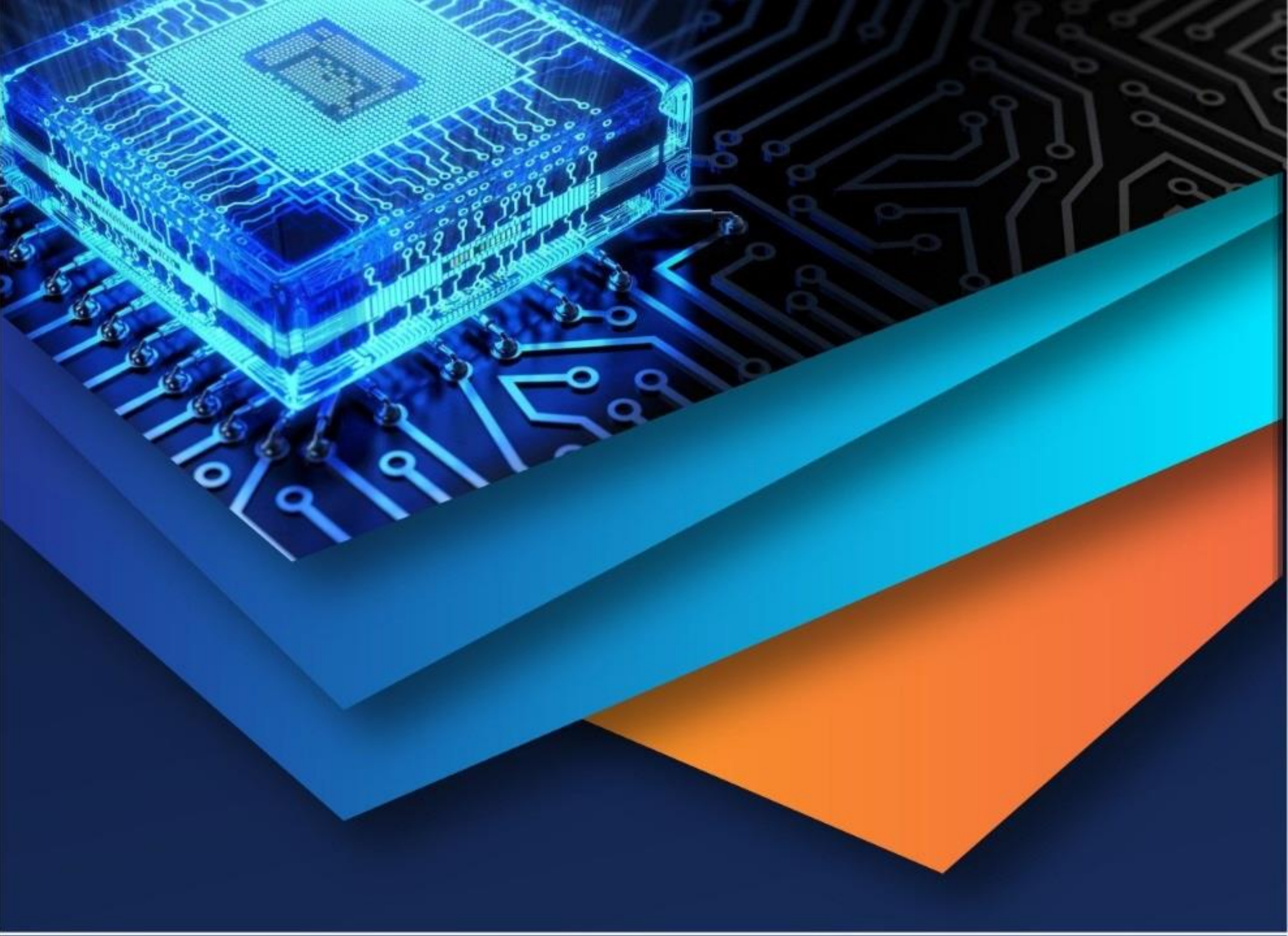

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