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Face Mask Detection and Alert System

Shreya Khare*, Shreya Mukherjee, Nifa Kausar, Urvashi Ganesh Patkar

Computer Science, SIES Graduate School of Technology, University of Mumbai
*Corresponding Author:

ABSTRACT

In today's era, as we all know how the year 2020 has brought an alarming pandemic with it and day by day, we are reaching a new peak of COVID cases. And due to which a main contribution asked from all the citizens is to follow all the safety norms to soothe the condition. One of the norms states to wear facemask all the time immediately after stepping out of their home. This paper proposes one of the methods to ensure that at least all people coming under any Closed-Circuit Television (CCTV) surveillance wears masks and that too properly. In this system we are using locally linear embedding (LLE) algorithm for face detection and convolutional neural network (CNNs) to reconfigure the image to fit into the network. And the neural network is trained with the help of image dataset. The method attains training accuracy and validation accuracy up to 99.87% and 93.41% respectively on two different datasets. If the system found out a person with no mask or not wearing it properly an alarm buzz outs to alter.

Keywords: Covid19, Mask Detection, Alert, CNN, Machine Learning.

1 Introduction

COVID-19 pandemic caused by coronavirus is continuously spreading all over the world. People all over the world are facing challenging situations due to this virus. As of now the 2021 situation in some countries gets even worse day by day whereas in some countries the situation is under control due to most of the citizens of that country having been vaccinated and they are still falling up to the COVID norms. According to the WHO in this pandemic approximately 114+ countries are being affected by this viral flu which start showing indication lasting more than 2-14 days. It has globally infected over 20 million people causing over 0.7 million deaths still the count rises. Reported symptoms for infected COVID-19 patients include going suddenly seriously ill along with respiratory problems like shortness of breath or difficulty in breathing is one of them. Every day many people are being infected and died. The spread of this virus can be stopped if proper precautions are taken, wearing mask is one of them. But sadly, many people are not wearing masks in public places which rises the need for monitoring.

We propose a system that restrict the growth of COVID-19 by finding out people who are not wearing facial mask. The Camera will detect the mask on the person's face and if that person is not wearing a mask at all or not wearing it properly, he/she is denied access until they put on a mask. An alarm starts beeping which will bring people's attention to properly follow the measures taken to stop Covid19.

The system will be deployed using a CCTV camera. The camera will capture real live footage of public areas from which facial images are extracted and these images are used to identify the mask on the face. The

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Convolutional Neural Network (CNN) learning algorithm is used for feature extraction from the images then these features are learned by multiple hidden layers. Whenever a person without mask is extracted the alarm that is set up using pycharm library starts beeping. The proposed system appraises promising outputs with training and validation accuracy more than 90%.

The paper is arranged accordingly. Firstly, the Research Methodology is described in section **2**. Next, we have mentioned all the related works in section **3**. Then we have mentioned all the Results and Discussion in section **4**. Conclusion is written in section **5**. Lastly, we have concluded our work by discussing Future Scope in section **6**.

2 Research Methodology

In this paper, we propose a mask detection and alert system for screening people who are not wearing a mask. Most public places today have security cameras at the entrance. These cameras are used to maintain a log of people entering and leaving the premises. Our system uses the images captured by the camera, runs it through an algorithm and detects if the person is wearing a mask or not. If one is not wearing a mask, an alarm starts ringing and it continues till the time the person does not wear a mask. The parts of our system are described as follows:

2.1 Data collection and pre-processing

We have used Prajna Bhandary's dataset [1] for training and testing the model. The dataset contains 690 images of people with masks and 686 images of people without masks. 75% of the images were used for training the model and the remaining were reserved for testing. The figure below shows a glimpse of the dataset.

The data pre-processing step involved converting all images to grayscale and resizing them to 56x56 for consistency. One hot encoding was then performed, and the data was split into the training and testing set.

2.2 Building the CNN classification model

A CNN model was built using the sequential API. The network consists of an input layer, multiple hidden layers, and an output layer. The architecture contains two groups of convolution layers followed by an activation and max pooling layer. This results in a simplified network. A flatten and dropout layer reshapes the information and prevents the network from overfitting. Finally, a dense layer distinguishes the classes.

2.3 Mask detection and alarm

The main goal of our system is to make sure that no person enters a public place without wearing a mask. Our model identifies such people and starts ringing an alarm. The alarm works as a denial for the person, and it continues till (s)he does not wear a mask.

3 Related Work

Many systems have been developed till date. BlueDot method was used in Wuhan to mark the cluster of unusual pneumonia. San Francisco based HealthMap spotted people with a cough as an initial sign of COVID-19, using AI and big data. Allam and Jones [2] proposed a framework on smart city networks discussing how data sharing should be done during the outbreak of COVID-19.

A face mask detecting model, RetinaFaceMask was proposed by Jiang et al. [3]. Another automated system for facial mask detection was proposed by Mohammad Marufur Rahman [4].

4 Results and Discussion

The dataset consists of 1376 images which are categorized as 'with mask' and 'without mask'. The dataset is partitioned into training and testing set. From the dataset 75% samples are used in training phase whereas the rest 25% are used for testing phase. The training and testing dataset contains 1032 and 344 images, respectively. Using the Adam optimizer, the training is done, and the architecture is trained for 50 epochs. Figure 1 and Figure 2 shows graphical view of accuracy and loss, respectively. The training accuracy for the model came out as 99.87% with a loss of 0.18% whereas the validation accuracy came out to be 93.41% with a loss rate as 0.3646.

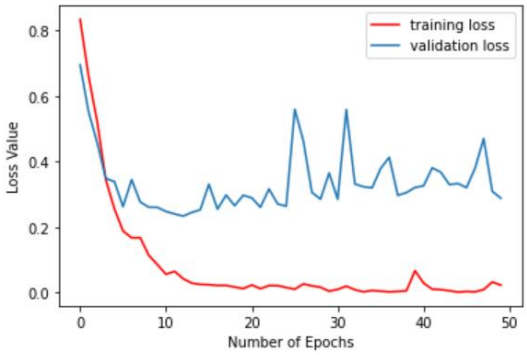

Figure 1: Graphical view for loss

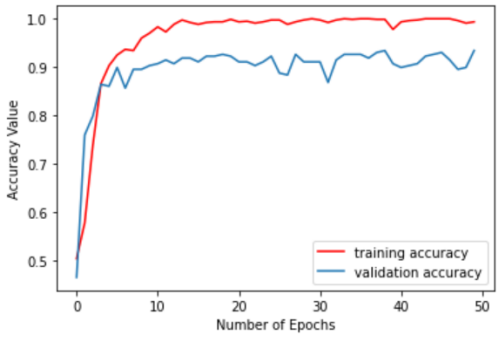

Figure 2: Graphical view for accuracy

4.1 Demonstration

The proposed system detects whether a person is wearing mask or not. Whenever a person with no mask is detected, the alarm starts beeping. The working of the model is as shown below:

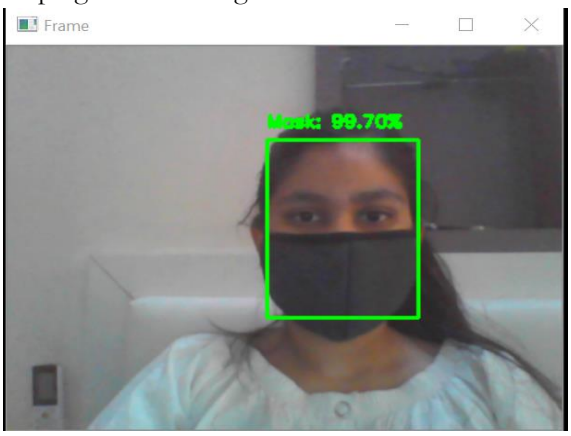

Figure 3: Person wearing mask.

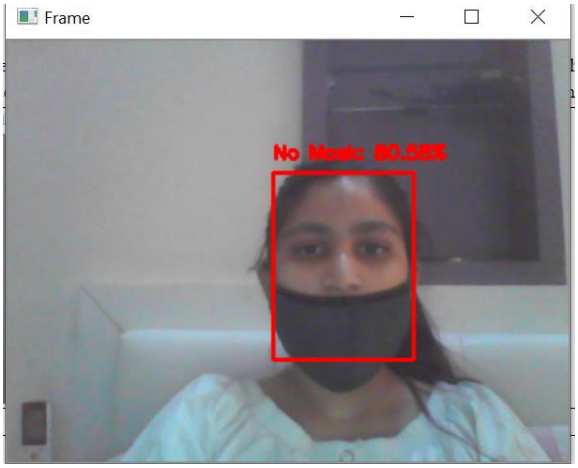

Figure 4: person not wearing mask properly.

5 Conclusions

The proposed system will act as a valuable tool to monitor whether the person is wearing a mask or not. This will lessen the manual work and restrict the entry of people not wearing masks in public areas. The system will generate alerts to ensure that all people wear mask properly. The accuracy of the model is 93.41% which will be helpful to fulfil the motive of the system that is reducing the spread of coronavirus.

6 Future Scope

The gap between the validation and training loss can be reduced by hyperparametric tuning, this will result in increase in the accuracy while validation. By increasing the number of epochs, the accuracy can increase but will result in more training time.

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