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# COVID-19 Mask Detection

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**ABSTRACT**

Coronavirus disease (COVID-19) has become a pub- lic health issue around the world. The COVID-19 pandemic has quickly impacted our daily lives, affecting global market. Wearing a face mask for protection has become part of a new lifestyle. Many public service providers may soon need clients to wear masks correctly in order to use their services. detecting face masks has become extremely important in aiding worldwide society.Wearing a face mask has been scientifically confirmed to be the most efficient way to combat the infection. The goal of this work is to create a face mask detector that can be utilized by authorities to establish COVID-19 pandemic action plans. In this research paper we suggested a method that successfully detects the face in the image and then determines whether or not it is covered by a mask.

## I. INTRODUCTION

The COVID-19 epidemic is spreading all over the world. In this situation, everyone must adjust to the new normal, for example, work from home, online communication, and keeping clean to reduce transmission of COVID-19. Further- more, studies have shown that wearing a mask can minimize the chance of viral transmission. Many public places now have policies requiring customers to keep a safe space be- tween them and wear their face masks correctly. However, public service providers are unable to adequately monitor whether all customers are wearing masks. As a result, we propose face mask detection using webcam cameras utilizing image recognition, which is one of the most accurate and efficient face mask detectors available. There was no solid data supporting the use of community masks to prevent the spread of respiratory diseases prior to the coronavirus disease 2019 (covid-19) pandemic. The primary purpose of a mask is to keep the wearer from transmitting the virus (source control). Inhalation of respiratory aerosols produced by coughing, sneezing, talking, or breathing is the primary mode of transmission for Covid-19 and other respiratory illnesses. The virus spreads across the respiratory tract, causing pneumonia, ARDS, and even death. This respiratory ailment has become a daily headline due to the ongoing epidemic and the quickly evolving variations. Face masks should be worn as part of personal safety equipment and as a public health strategy to prevent the transmission of infection. Face mask detection includes identifying the location of a person's face and then assessing whether or not they are wearing a mask. The problem is related to general object detection, which is used to identify different types of things. Face identification is the process of identifying a certain collection of entities, namely faces.

It has a wide range of uses, including autonomous driving, education, and surveillance. The Machine Learning (ML) packages such as Keras, TensorFlow, Scikit-Learn, and OpenCV are used in this research to propose a simpler solution. The suggested work will be carried out in certain locations such as schools, colleges, universities, mosques, and supermarkets. It will be installed at the main entrance, where the system will verify each person's identity. Any person without a mask will be denied entry if the system detects them.

## II. PROPOSED METHODOLOGY

### A. Preprocessing

Dataset consist, two folders with mask and without mask containing 3725 and 3828 colored images respectively. This dataset is taken from the Kaggle. Preprocessing is convert- ing complex data into simpler and more meaningful forms. Preprocessing is a very crucial step in the machine learning. The proposed method deals with preprocessing using NumPy and OpenCV. The proposed preprocessing pipeline converts colored images into grayscale images. After converting colored images into grayscale images this method resizes those images into the size of 100*100. After resizing we converted those images into a NumPy array and normalized the images by dividing them by 255. After performing normalization data is saved in the NumPy file. Then that numpy file is fed to the model that to train CNN model.

### B. Model Architecture

The proposed method makes use of sequential CNN. The first convolutional layer consists of 96 filters and kernel size is set to 3*3 and it is followed by the MaxPooling layer.

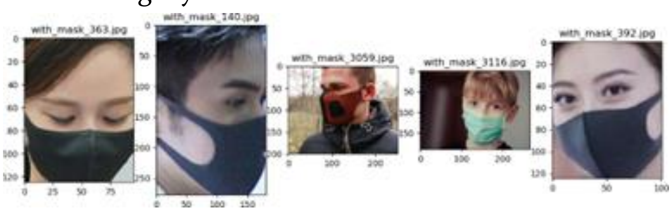

**Fig. 1. Example of with mask images**

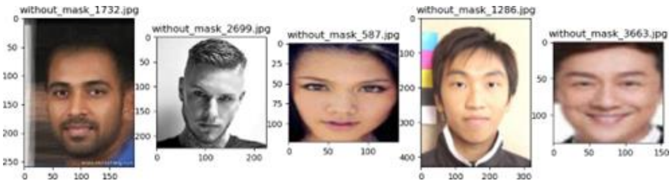

**Fig. 2. Example of without mask images**

MaxPooling is used to reduce the dimensions of the feature map. As the model should know the input so it also includes the input shape and the ReLU is used as the activation function. ReLU eliminates all the negative values to avoid the zero gradient problem. To overcome the overfitting dropout layer with a 20The second CNN layer contains 128 filters and it is followed by ReLU and MaxPooling layers and third and fourth layers contain 192 filters each and both of them are followed by ReLU and MaxPooling layers, dropout is added to the fourth convolutional layer. Then this multidimensional input is passed through the Flatten layer which will create this multidimensional data into a 1D array that can be used to feed a fully connected neural network. Then two Dense layers with 100 and 50 neurons are added with activation function ReLU. The final Dense layer with two classes uses the softmax activation function. Here to optimize the loss function ”adam” optimizer is used and ”categorical crossentropy” as a loss function is used the problem is the classification problem so ”accuracy” as a metrics is used.

- Convolutional Neural Network(CNN): CNN's are special neural networks that are widely used for analyzing image data. CNN's are good at extracting patterns from the images, they learn different features at each layer and recognizes complex features as we go deeper.
- Activation Function: In neural networks, activation func- tions compute the weighted sum of input and biases, which is used to determine whether a neuron can fire or not. It manipulates the provided data using gradient processing, most commonly gradient descent, and then produces an output for the neural network that contains the data's parameters. Activation functions are

utilised to control the outputs of our neural networks and can be either non-linear or linear.

- Max Pooling: Max Pooling is a operation that computes the maximum value for a feature map and uses it to create a downsampled feature map. It is typically used following a convolutional layer.

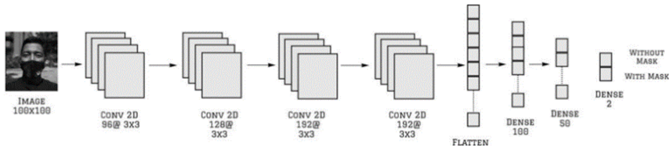

**Fig. 3. CNN Architecture**

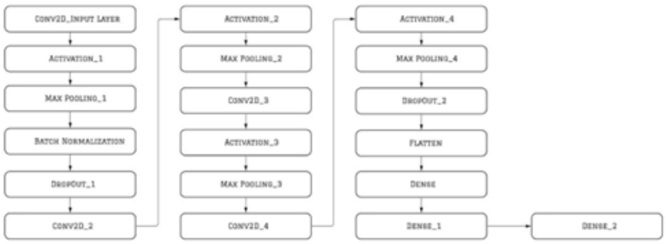

**Fig. 4. Layers in the model**

- Batch Normalization: It makes neural network stable and faster by performing normalization and standardization on the input from the previous layer.
- Dropout: Dropout layers help preventing over-fitting. They randomly sets input to zero. You can put dropout layer anywhere in the model.

### C. System Architecture

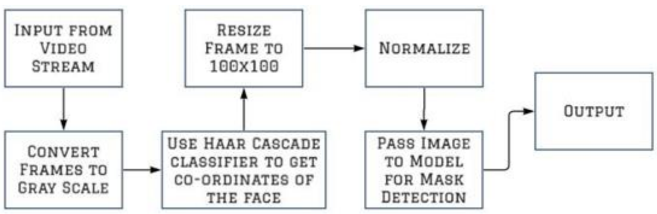


**Fig. 5. Mask Detector Architecture**

Proposed system takes real time frame by frames input from the camera, then it converts each frame into gray scale and pass it through the Haar cascade classifier to get co-ordinates of the faces that exist in the frame. We use those co-ordinates to crop faces from the frame. Then we resize the cropped image into 100*100 because we have trained our model with the 100*100 images. Then we pass that reshaped image to the mask detector model to detect whether person in the image is wearing the mask or not. After detection it gives red bounding box around the face if person is not wearing mask and green bounding box if person is wearing the mask. For drawing the bounding boxes we have used OpenCV library which is also used to take the real time input from the source. We can use OpenCV's cv2.rectangle() method to draw rectangles on the images.

We use OpenCV's cv2.putText method to write with mask or without mask on the frame.

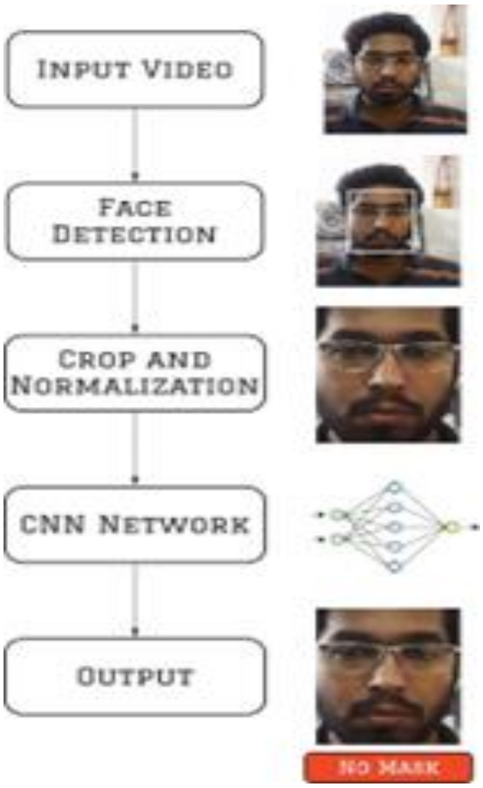


**Fig. 6. System Architecture**

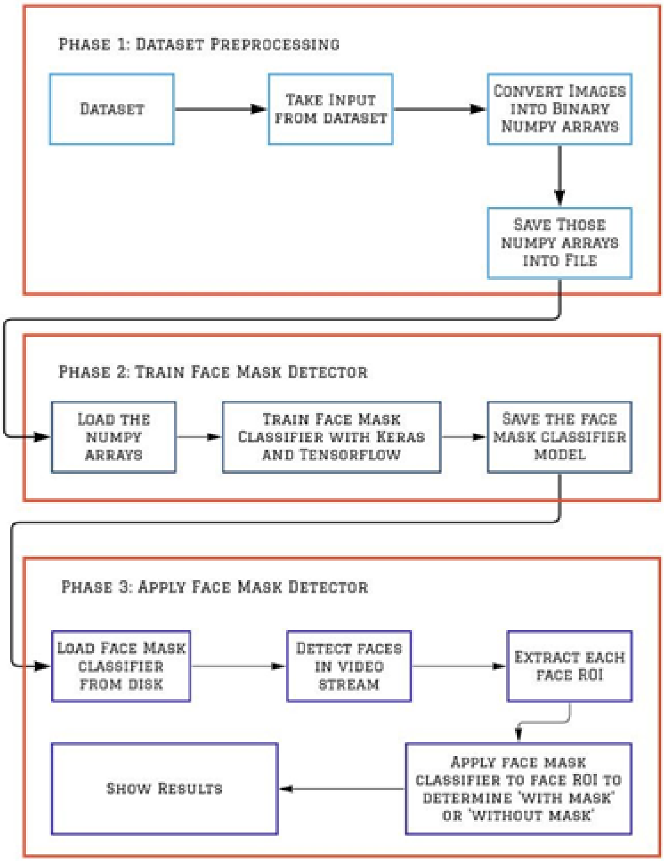


Fig. 7. System Pipeline

## III. RESULTS AND DISCUSSIONS

We have trained the model for two classes mask and no mask. We have used very varried dataset and made sure that dataset is not biased. That helped us obtain 99% training accuracy and 95% accuracy on the validation data.

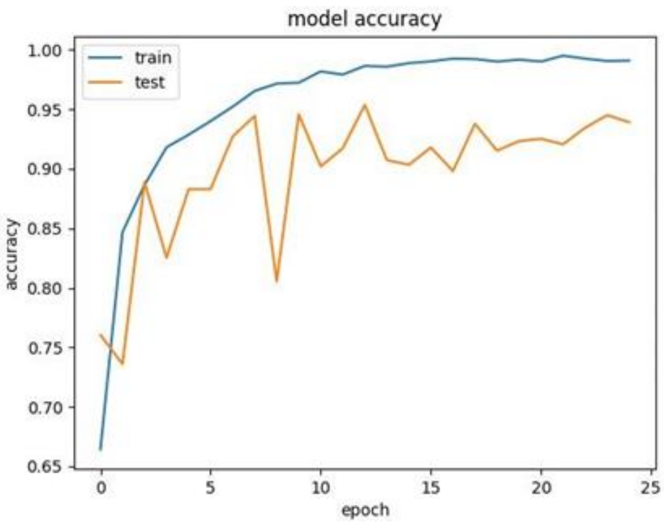


Fig. 8. Epoch vs Accuracy


Fig. 9. Real time mask detection

As you can see in the results, model also can count number of detected people in the image and can also detect if frame is empty.

## IV. CONCLUSION

With the help of CNN, we have made a more accurate and efficient and accurate face mask detection model that can be used in various scenarios. We have added features like counting people in the frame and alerting if the frame is empty. We have trained our face mask classifier model on a large and varied dataset. In the beginning, we had several problems but eventually, we got the desired accuracy on the validation data. While designing this model we focused on optimizing the model and tried to make it efficient.

## V. FUTURE SCOPE

In the future, we can focus on the YOLO-v3 architecture to design face mask classifiers, and for face detection, we can train the haar cascade with more training data. We can add a pose detection module to detect if someone is coughing and give an alert. Along with detecting masks, we can work on threat detection, which will help in security too.

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