Face Mask detection with fine rate

R Suganya1, S Arthi2, S Kowshika2, V Dhivya Lakshmi2

1Associate Professor, Department of Information Technology, Sri Krishna College of Technology, Coimbatore, India
2U.G students, Department of Information Technology, Sri Krishna College of Technology, Coimbatore, India
17tuit006@skct.edu.in, 17tuit039@skct.edu.in, 17tuit015@skct.edu.in

Abstract. The COVID-19 pandemic is causing a worldwide wellbeing emergency so the powerful assurance strategies are wearing a face cover in open territories as per the World Health Organization (WHO). The COVID-19 pandemic constrained governments across the world to force lockdowns to forestall infection transmissions. Reports show that wearing face covers while at work unmistakably decreases the danger of transmission. An effective and financial methodology of utilizing AI to establish a protected climate in an assembling arrangement. A half and half model utilizing profound and old style AI for face cover location will be introduced. A face veil location dataset comprises of with cover and without cover pictures. We will construct a continuous framework to recognize whether the individual on the webcam is wearing a veil or not. After the breakout of the overall pandemic COVID-19, there emerges an extreme need of assurance components, face veil being the essential one. The essential point of the venture is to distinguish the presence of a face veil on human appearances on live web based video just as on pictures. We have utilized profound figuring out how to build up our face identifier model.

1. Introduction
To screen that individuals are following this fundamental wellbeing standard, a procedure ought to be created. A face cover identifier framework can be executed to check this. Face cover discovery intends to recognize if an individual is wearing a veil. The initial step to perceive the presence of a veil on the face is to identify the face, which makes the technique separated into two sections: to recognize faces and to distinguish covers on those appearances [1]. Face recognition is one of the uses of article location and can be utilized in numerous territories like security, biometrics, law implementation and that's just the beginning. There are numerous identifier frameworks created around the planet and being executed. Be that as it may, all this science requires enhancement; a superior, more exact identifier, in light of the fact that the world can't bear the cost of any more expansion in crown cases.

Face Detection has advanced as an extremely mainstream issue in Image handling and Computer Vision. Numerous new calculations are being concocted utilizing Convolutional structures to make the calculation as precise as unrealistic [2]. A model for face identification utilizing semantic division in a picture by ordering every pixel as face and non-face.

2. Related works
We have designed our project into two phases: training face mask detector and implementing face mask detector. Figure 2 depicts the training and detection phase of our face mask detector model [3]. The dataset is loaded for the model to be trained and the model is serialized in the training phase. Further, the trained model is loaded, the faces are detected in images and video streams and then the region of interest (ROI) is extracted. Finally, the face mask detector is applied and the images or faces in the video streams are classified as with a mask, improperly worn mask, without a mask. The green and yellow rectangular frame individually interpret the detected face and mask. The dataset consisted of 15 images of improperly worn masks, 10 masked images, and 10 images without a mask [4]. We have used Matlab programming to build our facemask detector model. To train the model, we have used Face mask net architecture. The initial learning rate is 1e-4 and the number of training epochs is 20. The data is then pre-processed. The images are resized to 227 x 227 x 3 pixels intensities in the input image.

After this, the model was compiled to be trained and then the model was evaluated on the test set. The accuracy and iteration curves were plotted. After the model was trained, an image was loaded as an input to distinguish whether a person is wearing a mask or not or wearing it improperly. The input image is then loaded and preprocessed [5]. To localize wherein the image all faces are, face detection takes place and also the region of interest (ROI). The green and yellow rectangular frame respectively represent the detected face and mask. After that detection of face mask takes place. The results are displayed on the screen after post-processing.

3. Project Description
Deep learning technique has been useful for big data analysis and has its applications in computer vision, pattern and speech recognition, etc. [6]. Work focuses on some commonly implemented deep learning architectures and their applications. The auto encoder, the convolutional neural network, Boltzmann machine, the deep belief networks are the networks that are presented in detail. Deep learning can be used in unsupervised learning algorithms to process the unlabeled data.

A CNN model for speedy face detection has been introduced by [6] that evaluates low resolution an input image and discards non-face sections and accurately processes the regions that are at a greater resolution for precise detection. Calibration nets are used to stimulate detection. The advantage of this model is that it is fast and achieves 14 FPS in case of standard VGA images on the CPU and can be quickened to 100 FPS on GPU. A face detection system called Deep Dense Face Detector (DDFD) was proposed by Farfade et al. which we considered the problem of multi-view face detection.

The proposed method is least complex and it does not demand segmentation, bounding-box regression, or SVM classifiers and can recognize faces at numerous angles. A novel data augmentation approach for mask detection from speech was proposed by [7]. That could be used for communication amongst surgeons, used in forensic fields or infectious diseases like coronavirus. They have used multiple ResNet models and have trained Generative Adversarial Networks (GANs) with cycle consistency to build their project that could do binary classification. In their future work, they would be focusing on multiclass problems. Wang et al. has made executing face mask related projects an obvious task by providing three samples of masked face datasets, which comprise of Masked Face Detection Dataset (MFDD), Real-world Masked Face Recognition Dataset (RMFRD) and Simulated Masked Face Recognition Dataset (SMFRD). Previously, [8] had stated in his work about a deep learning model that binarizes an image as a mask is used or not mask. 380 images had a mask and 460 images had no mask and these images were used in the training of the MobileNetV2 model.

The AUROC of the model was 97.6 %. A few limitations were observed in the model. Those remarks were: it could not correctly classify partially hidden faces and the model is not able to detect faces if the camera height is greater than 10 feet.
A face mask-wearing classification system with the incorporation of image super resolution using classification network (SRCNet), was made by [9] as shown in Figure 1. It quantified mask, no mask, and incorrectly worn masks, based on 2D facial pictures. Image pre-processing, face detection and crop, image super-resolution, and face mask-wearing conditions identification formed the backbone of the algorithm.

![Figure 1. Face mask-wearing classification system](image)

The training dataset comprised of 3835 images that included 671 images without a facemask, 134 images of incorrect face mask-wearing, and 3030 images of correct facemask-wearing. SRCNet gave an accuracy of 98.70% accuracy. A Retina face mask has been proposed by Jiang et al. Which is a high-accuracy and efficient face mask detector. The models used are ResNet and MobileNet.

Transfer learning was used to extract robust characteristics trained on a large dataset of 7959 images. [10] worked on developing a HGL method for head pose classification with masks, using color texture analysis of pictures and line portraits. Front accuracy of 93.64% was achieved along with a side accuracy of 87.17%. The aforementioned project recognizes between face mask and not wearing a face mask. Matthias et al. has done a face mask recognition project that focuses on capturing real-time images indicating whether a person has put on a face mask or not. The dataset was used for training purposes to the main facial features (eyes, mouth, and nose) and for applying the decision making algorithm. Putting on glasses showed no negative effect. Rigid masks gave better results whereas incorrect detections can occur due to illumination, and to objects that are noticeable out of the face.

### 4. Implementation Details

![Figure 2. Face Mask detection from webcam](image)
Two main approaches for Face Detection:

1. Feature Base Approach
2. Image Base Approach

4.1 Feature Base Approach

Articles are generally perceived by their interesting highlights. There are numerous highlights in a human face, which can be perceived between a face and numerous different items. It finds faces by removing primary highlights like eyes, nose, mouth and so on and afterward utilizes them to identify a face.

Regularly, some kind of factual classifier qualified then accommodating to isolate among facial and non-facial areas. Also, human countenances have specific surfaces which can be utilized to separate between a face and different articles. Also, the edge of highlights can assist with distinguishing the items from the face. In the coming segment, we will actualize a component based methodology by utilizing Open CV.

4.2 Image Base Approach

When all is said in done, Image-put together strategies depend with respect to procedures from factual examination and AI to locate the important qualities of face and non-face pictures. The learned qualities are as appropriation models or discriminant capacities that is thus utilized for face location.

In this technique, we utilize various calculations, for example, Neural-organizations, HMM, SVM, AdaBoost learning. In the coming area, we will perceive how we can distinguish faces with MTCNN or Multi-Task Cascaded Convolutional Neural Network, which is an Image-based methodology of face identification.

5. Result and Discussion

In all, 35 images were included in the dataset. Out of these cumulative images, 10 had photographs of individuals wearing a mask, 15 pictures of improperly worn masks, and 10 pictures involved a person’s face without any mask put upon their faces. This dataset was used to train our Facemask net model resulted in an accuracy of 98.6 % in identifying face-masked and without face-masked photographs. The results obtained when the face mask detector was tested on various images is seen in figure 3. The green and yellow red-colored rectangular frames in (a), (b), and (c) respectively represent the detected face and facemask. (d) Shows the sample dataset which was using to train model. Despite having limited training data, our face mask detector model works adequately. A comparison of researchers who have done similar work is executed. A comparison is also produced of the method used and the accuracy obtained. The maximum and minimum accuracy obtained was 98.7 % and 74.97 % respectively.
6. Conclusion and Future work

To improve our face veil identification model further, you should accumulate genuine pictures (as opposed to falsely created pictures) of individuals wearing covers. While our counterfeit dataset functioned admirably for this situation, there's not a viable alternative for the genuine article. Furthermore, you ought to likewise accumulate pictures of countenances that may "befuddle" our classifier into speculation the individual is wearing a veil when indeed they are not — potential models incorporate shirts folded over faces, handkerchief over the mouth, and so forth. These are instances of something that could be confounded as a face cover by our face veil identifier.

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