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Face Mask Detection System

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***Abstract*:** In recent years, Coronaviruses, a large family of viruses, have grown extremely prevalent, communicable, and harmful to the whole human race. It transmits from person to person by exhaling infected breath, which deposits virus droplets on various surfaces, which are subsequently breathed by another person, who contracts the illness. As a result, we must safeguard ourselves and others around us from this predicament. We may take safeguards like keeping social distance, washing hands every two hours, using sanitizer, and, most importantly, wearing a mask. Wearing a mask in public has grown quite widespread in recent years all around the world. Due to its high population in a short space, India is the most afflicted and terrible situation. This study presents a technique for detecting whether or not a face mask is used in offices or any other workplace with a large number of individuals. For this, we employed a convolutional neural network. The model was trained on a real-world dataset and successfully tested using live video streaming. The model's accuracy is further tested using several hyperparameters and many persons at various distances and locations inside the picture. Face Mask Detection, Convolutional Neural Network, MobileNetV2, Corona Virus Precaution are some of the terms used in this paper.

***Index Terms* –MobileNetv2, Facemask, CNN, Covid19.**

I. INTRODUCTION

Since the introduction of the new coronavirus epidemic, public use of face masks has become prevalent in China and other countries across the world. According to the Health Centre's advice, we now know that a considerable fraction of people with coronavirus has no symptoms ("asymptomatic") and that even those who later acquire symptoms ("pre-symptomatic") can transmit the virus to others before exhibiting symptoms. "This implies that the virus may transmit between individuals who are in close contact – for example, when speaking, coughing, or sneezing — even if none of them are sick." The latest research also points to a new coronavirus strain, the mutant coronavirus, in which the virus's structure has altered. The novel strain is undetectable by the RT-PCR technique we now employ. As a result, it is unavoidable for the citizens of an overcrowded country like India to put on masks and continue working. Nobody can keep track of whether or not everyone entering the workplace is wearing a mask. As a result, the requirement for the acquisition of a face mask increased. Convolutional Neural Network is used in this model. It is a model of deep neural network that can analyze any type of visual image. Receives image data as input, collects everything, and sends it to neurons. It contains a fully integrated layer that processes the final output, which is an image prediction. MobileNetV2 Architecture is a Convolutional neural network model used here. The MobileNet model is a network model in which the basic unit is a highly intelligent severance modification. It has two layers of deep intellectual flexibility: deep intellectual flexibility and spatial flexibility. It is built on a rectangular residual structure, with a residual connection between bottle levels. As a source of non-linearity, the medium expansion layer uses clever convolutions with depth and depth to easily filter out features. In total, the architecture of MobileNetV2 incorporates a fully flexible layer with 32 filters, followed by the remaining 19 layers of the bottle. The framework of MobileNetV2, which is employed in the model.

II) RELATED WORK:

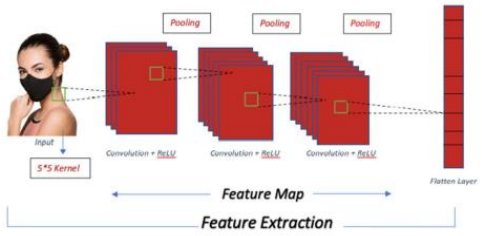
In the meanwhile, various solutions for COVID-19 in smart city networks have been created. In the BlueDot and HealthMap programs were implemented. The BlueDot approach was originally used to identify a cluster of atypical pneumonia in Wuhan, which led to the disease being identified as a pandemic. The infection was also expected to spread from Wuhan to Bangkok, Taipei, Singapore, Tokyo, and Hong Kong, according to the report. The cough sufferers were identified by the HealthMap program, which is situated in San Francisco Using Artificial Intelligence (AI) and large data, which is the first indicator of COVID-19. Describes research that used a facemask to stop COVID-19 from growing. According to the study, masks that are properly fitted successfully stop droplets from spreading while coughing or sneezing. Airborne particles and viruses can be retained by masks that aren't perfectly fitted. Allam and Jones suggested a smart city network paradigm that focuses on how data sharing should be done during the COVID-19 epidemic. The suggested system examined the potential of Urban Health Data in terms of economic and national security concerns. Data is collected from numerous spots across the city utilizing sensors and trackers in the system

III) LITERATURE SURVEY:

Deep learning techniques have applications in computer vision, design, and speech recognition, and are excellent for huge data analysis. The authors devised a method for detecting conditions while wearing a face mask. They were ready to categorize three types of people who used face masks. To recognize the person, I used principal component analysis on masked and unmasked facial recognition. The authors demonstrated a technique for identifying whether or not a mandatory medical mask is present in the operating room. The goal is to reduce false-positive face detection as much as possible without missing mask detection, such that alarms are only triggered for medical personnel who do not use a surgical mask. The relevance of Convolutional Neural Networks in image identification, object detection, and picture segmentation is highlighted in a variety of situations. There are a lot of Convolutional Neural Networks out there, but it all depends on what you want to do with them. There are several publications based on neural networks that have been published in the field of Mask detection systems. However, the majority of studies exclude a comparison of the efficiency of various CNN designs and instead focus on the performance of the Convolutional Neural Network. Effective mask detection and data analysis on diverse architectures are done in this research to get insight into hidden performance characteristics (training accuracy, training loss, execution time, etc.) VGG-16 and MobileNetV2 architectures are among the sequential architectures. Various handmade and deep learning feature-based techniques have been presented up to this point. Deep learning algorithms for Face-Mask identification have recently gained favor due to the more accurate findings of pre-trained models. The pictures from the camera feed are first extracted and segmented using bounding boxes to indicate confidence levels surrounding people wearing or not wearing masks. For mask detection, there are a variety of feature engineering approaches that are comparable to face detection systems. The training dataset includes photos with and without masks, and mask detection is analogous to face detection. This is a straightforward classification issue that is solved using deep learning techniques...

A) Convolutional Neural network:

Convolutional Neural Network (CNN) was the major technology used in this study to learn facial characteristics. Deep neural networks must be used to learn facial characteristics from photos.



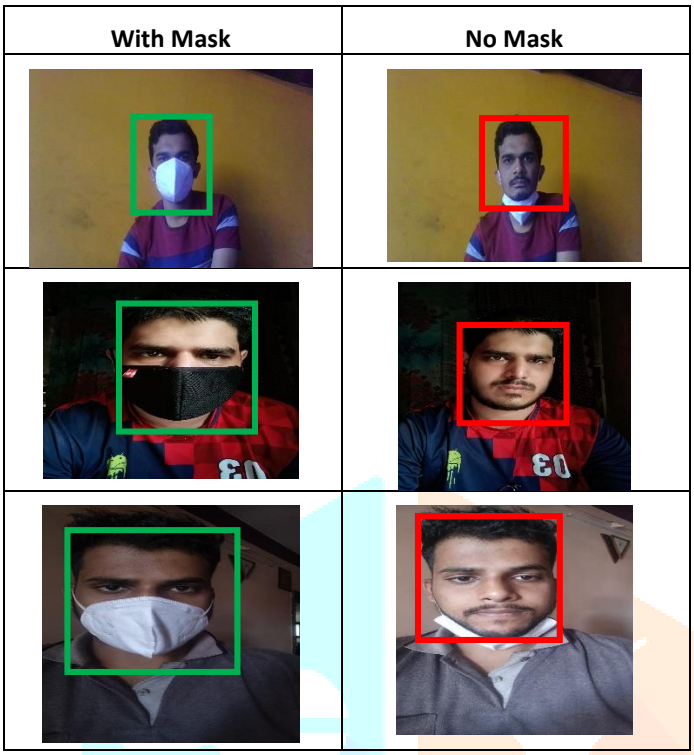
As a result, the Convolutional Neural Network is a Deep Learning Algorithm that focuses on data processing, especially image processing. Because images are represented as image data, each image has a series of pixels, each with a value that can be used to determine the color level and brightness of each pixel. Multiple layers of artificial neurons, which are mathematical functions that can compute the weighted sum of many inputs and outputs, are also integrated with CNN. To put it another way, CNN is used to extract visual attributes and shrink them without losing their qualities. CNN designs presume that the inputs are pictures, allowing the model to encode certain attributes... As a result, the forward functions are more efficient to construct, and the network's parameter count is reduced. A convolutional neural network is made up of several phases that must be completed for the model to function effectively. The figure illustrates each phase of the CNN process. Compared to other classification methods, CNN requires less pre-processing.

B) Training:

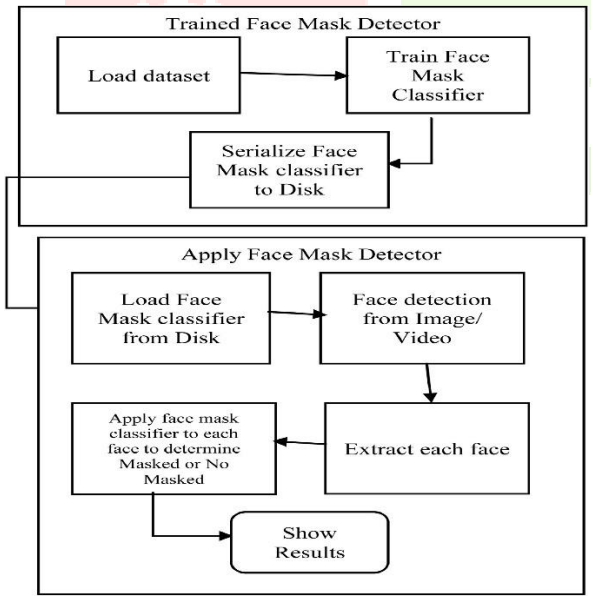
Backpropagation is another term for the training process. For the model to determine the weights that most precisely describe the input data and match its corresponding output class, the training stage is critical. As a result, their weights are updated regularly and shifted closer to their ideal output class. A Face Mask Detection Dataset was utilized to train the CNN model in this work. During the training procedure, the training data was divided into 100-piece batches. Splitting the whole dataset into a chain of decreasing quantities of data put into the model one at a time is referred to as a batch size. a learning rate of 0.001 was used to determine the size of a step in the direction of the loss function minimization. To train the model using the labeled data, the optimization method, forward pass, loss function, backward pass, and weights updates are used.

C) Dataset Collection:

The model is trained and tested using data from two independent sources. A total of 1000 photographs of people wearing masks and 1000 images of people without masks were obtained. Eighty percent of each class's photographs are used for instruction, while the remaining images are used for testing. Figure 2 depicts photos from two separate courses



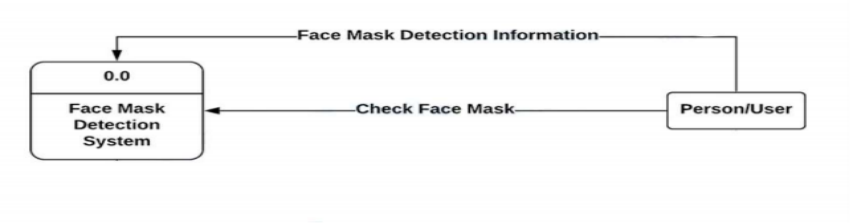
D) Block/ working Diagram:



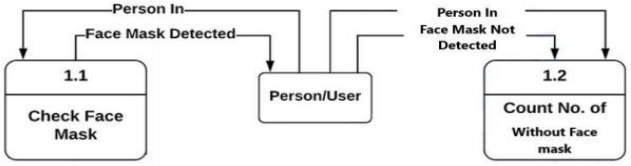
We will load a dataset of various images for training purposes in a trained face mask Detector. Mask for training Serialize the classifier To the Disk, add a face mask classifier. Face Detection system detects image/video from web camera when the dataset is loaded. After taking an image with the camera, the program extracts all of the photos from the classifier and saves each image to the dataset. It will verify whether the data is masked or non-masked after extraction and display the result in the output window. If the mask is identified in the face, a green square with a text mask will appear on the output screen; if the mask is not recognized in the face, a red square will appear on the output screen.

The data flow diagrams are shown below.

With Mask



Without Mask



Let us first have a deeper understanding of the situation. We aim to create a system that can recognize faces in real-world videos and determine whether or not those people are wearing masks. So, what exactly do we mean when we say "real-world videos"?

When you look at people in webcam footage, you'll notice that their faces are tiny, grainy, and low resolution. People don't always stare straight at the camera, and their facial angles change. These real-world movies differ significantly from those obtained by webcams or selfie cameras, making the face mask recognition challenge in practice considerably more challenging.

In this paper, we'll look at mask/no mask classification in webcam videos first, then move on to the mask/no mask classification problem in real-world videos. In webcam videos as well as real-world footage where the faces are tiny and indistinct and people are wearing masks of various forms and colors, our described model can recognize faces and categorize masked faces from uncovered ones. In the following section, we'll go over the face detector in further depth

E) RESULT AND ANALYSIS

The mask detector can operate in real-time and is also accurate in its predictions. Because technology is advancing and new trends are forming, a revolutionary mask detector has been developed that may help to improve public healthcare. Because the backbone is frequently utilized for both high and low computation situations, the design includes Mobile Net. To determine whether persons were wearing face masks or not, OpenCV, tensor flow, Keras, and CNN were used. Images and real-time video feeds were used to evaluate the models. The model's correctness is reached, and model optimization may be a continual process. By modifying the hyperparameters, a very accurate solution is built. If a person wearing a mask is spotted and allowed admission, it will be of immense benefit to society Max pooling has a training accuracy of 99 percent and a validation accuracy of 99 percent. Furthermore, the average pooling obtained 99 percent training accuracy and 99 percent validation accuracy. The accuracy of the MobileNetV2 architecture was 99 percent for training and 99 percent for validation. The table now includes a brief explanation.MobilenetV2 can successfully identify the mask from video streams with proper accuracy.

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Table1: COMPARISON WITHIN THE CNN TECHNIQUES

	Epoch	Training Loss	Training Accuracy	Validating Loss	Validating Accuracy
Max Pooling	13	1.00%	99.00%	1.00%	99.00%
Average Pooling	13	1.00%	99.00%	1.00%	99.00%
MobileNetv2	13	1.00%	99.00%	1.00%	99.00%

F) Limitation and Future Scope

This is presents a deep learning study on facial recognition and face mask detection utilizing transfer learning and fine-tuning approaches to develop a CNN model. Even though half of the faces are hidden behind masks, this technique provided accurate and speedy results for facial recognition security systems.. The model was able to reach a performance accuracy of 97.1 percent, which is a great achievement... Furthermore, by enabling all persons to wear a face mask while conducting biometric verification, the study provided a valuable tool in combating the spread of the COVID-19 illness. Due to the emergence of the COVID-19 virus, facial recognition using a face mask has become more important in the last year. Our next projects involve detecting social separation and alerting if someone is not wearing a face mask properly

G) Conclusion

This study describes a method for reducing the transmission of coronavirus by telling authorities about people who are not wearing a face mask, which is a COVID-19 preventive action

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