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Face Mask Detection System Using Artificial Intelligence

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Abstract - *In current situation , Covid-19 has not totally go out same cause is arrving is day by day made us realize the importance of Face Masks and we need to understand the lots of effects of not wearing the face mask, now more than at that time. Right now, there are no mask detectors installed at the crowded places. But we have confidence in that it is of extreme significance that at transportation link, crowded populated domestic place, markets, educational institutions and healthcare areas, it is now very neccessary to take place face mask detectors model to make sure the protect to the public. We have take effortes to develop a two phased for face mask detector in this pepar which will be simple to implement at the discribe outlets. According to the Computer Vision, so now it is happend to detect and observe this on large scale. We have used CNN for the implementation of our model. The development process is completed in Python, and the python code implementation will help to train our face mask detector on our training dataset with the help of Keras and Tensorflow. We have added more robust features and trained our model on various variations, we made sure to have large various and make large dataset so this system is capable to clearly determine and detection in real time videos to identify the face mask. The trained model was tested on both real-time videos and stable image and in that both the cases system was more accurate as compared to other models.*

Key Words: **Traning Model, Object Detection, Face Detection, Mask Detection, Email Alert System.**

1. INTRODUCTION

In the last few years, we have seen Science and Technology advancing so much that now we are at a stage where, we know that with the right knowledge of the technology, the humans can achieve things that seemed nearly impossible just a few decades ago. Now, we have the advancing technologies and knowledge of Machine Learning and Artificial Intelligence, which has been proven to ease our lives from the micro levels to big impossible tasks. In the last few years, there has been a rise in the onset of algorithms that have been proven to be the solution to our complex, life threatening problems. One such field is the image and object detection, which has helped us find and spot people and things with just one click. Computer Vision plays a crucial role in our lives now. Who would have thought that while sitting in one city you can easily spot the people in the other cities? It's almost unimaginative how Computer vision is now a very innovative aspect of the technology. In 2019, the whole world witnessed the onset of the deadly Corona Virus, which now, still after almost a year has not left us and is still making the human race fight for its.

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2. LITERATURE SURVEY

The existing models have used deep learning but they lack the variation in the dataset which means that their model is not that efficient when it comes to real time images and videos. Deep learning technique has been useful for big data analysis work focuses on some commonly implemented deep learning architectures and their applications. Deep learning can be used in unsupervised learning algorithms to process the unlabeled data.. Our model is a trained custom deep learning and computer vision model which can detect this model if a person is using a mask or not. Our model has not used morphed or unreal masked pictures in the dataset. Our model is very accurate as we have used MobileNetV2 architecture, it has made the model computationally efficient too. This made it easier to deploy the model to embedded system. We can use this face mask detection system in places that require face mask detection in view of the current pandemic. The model can be deployed at Airports, Railway Stations, Offices, Schools and other public places.

3. PROPOSED WORK

Firstly there are one camera use for capturing person image or video then preprocessing on that image then using some algorithm like CNN, SVM and Keras and use to some data set like kaggle & to check person wearing mask or not and check also person put hands on face. After check person wearing mask then application is terminate, if person is not wearing the mask then system to check details in organization and pop-up notification on that person cellphone and due. If person put hands on face then siren goes on.

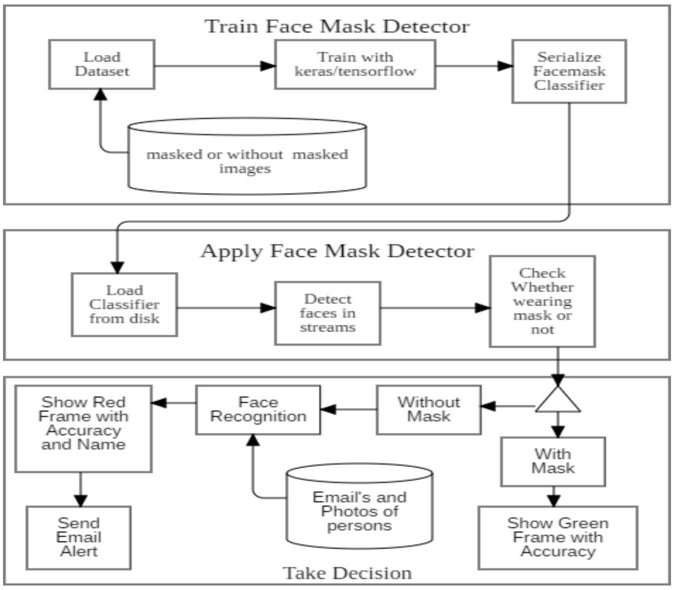

Fig.1 System Architecture.

3. CNN ALGORITHM

CNN stands for Convolutional Neural Network, which is a type of deep learning algorithm commonly used for image and video recognition, analysis, and processing. The basic architecture of a CNN includes convolutional layers, pooling layers, and fully connected layers. Convolutional layers apply a set of filters to the input image to extract relevant features, while pooling layers downsample the feature maps to reduce their size and increase their computational efficiency. Fully connected layers then use the extracted features to classify the image into one or more categorize.CNNs are trained using large datasets of labeled images and use backpropagation to update the weights of the network to minimize the difference between the predicted an actual output Some popular applications of CNNs include image classification, object detection, facial recognition, and autonomous driving.

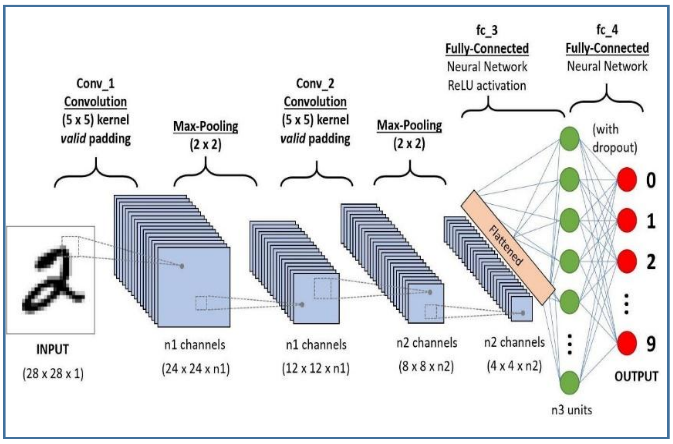

Fig.2 CNN Algorithm.

3.1 Convolutional Layer

The first layer of a CNN is typically a convolutional layer. In this layer, the network applies a set of filters to the input image, each of which captures different patterns or features. The filters are small matrices of weights that are convolved with the input image to produce a set of feature maps. The size of the filters and the number of filters can be adjusted depending on the specific task. After the convolutional layer, the output is typically passed through a non-linear activation function, such as ReLU (Rectified Linear Unit), which introduces non-linearity into the network and helps to improve its performance.

3.2 Pooling Layer

A pooling layer is a type of layer commonly used in convolutional neural networks (CNNs) to reduce the spatial dimensions (height and width) of the input tensor, while retaining the most important features. Pooling layers are often used after convolutional layers in CNNs, and they help to reduce the number of parameters in the network, which can prevent overfitting and reduce computational complexity. There are several types of pooling layers, including max pooling, average pooling, and global pooling. Max pooling is the most common type of pooling layer, which selects the maximum value from each subregion of the input tensor. Average pooling, on the other hand, computes the average value of each subregion of the input tensor. Global pooling computes a single value by taking the average or maximum of the entire feature map.Pooling layers typically have two hyperparameters: the pooling size (the size of the subregion used for pooling) and the stride (the step size used to move the pooling window across the input tensor). A larger pooling size will result in greater spatial reduction, but may also result in loss of information, while a smaller pooling size may preserve more detail but lead to greater computational complexity. The stride parameter determines the amount of overlap between adjacent subregions.

3.3 Flatten Layer

In convolutional neural networks (CNNs), a filtering layer, also known as a convolutional layer, is a type of layer that applies a set of filters to an input tensor. The filters are learned during the training process and are used to extract features from the input tensor. The filtering layer works by performing a convolution operation between the input tensor and the learned filters. This operation involves sliding the filters over the input tensor and computing the dot product between the filter and the portion of the input tensor it is currently covering. The result of the convolution operation is a feature map that represents the presence or absence of certain features in the input tensor. The filters used in a filtering layer can have different sizes and shapes, and the number of filters can also vary. The size and shape of the filters determine the spatial resolution of the output feature maps, while the number of filters determines the depth of the output feature maps. Filtering layers are often followed by activation layers, such as ReLU or sigmoid, to introduce nonlinearity into the network. They may also be followed by pooling layers to reduce the spatial dimensions of the output feature maps and control overfitting.

3.4 Dataset

The collection is made up of 3918 photos separated into two categories: faces with masks and faces without masks. Faces without masks is a Kaggle dataset that comprises faces with diverse skin colours, angles, occlusion, and other features. Faces with masks comprises masks with hands, masks, and other items that cover the face, giving us an advantage when it comes to improving dataset variants. The second collection contains photographs of persons associated with the organisation where our project is installed. This data is essential for facial recognition and sending emails to certain individuals.

4. MATHEMATICAL MODEL

We are take a small matrix of the numbers that means called kernel or filter, pass it over our image, and transform it based on the values from the filter.

$G[m,n]=(f\times h)[m,n]=\Sigma j \Sigma i\ h[j,k]\ f[m-j,n-k]$

So let our image shrinks every time, we perform convolution, only a limited number of times we can do it early our image removed completely.

$P=(f-1)/2$ hence of shifting the kernel by one pixel, so number of steps we can increase. than, step length is also treated the convolution layer hyper parameters. nout= floor(1 +(n+2p-f)/s) You want to apply filter and image to the must have the same number of channels.

$$[\boldsymbol{n}, \boldsymbol{n}, \boldsymbol{nc}] \times [\boldsymbol{f}, \boldsymbol{f}, \boldsymbol{nc}] = [\boldsymbol{floor}\ (\mathbf{1} + (\boldsymbol{n} + \mathbf{2}\boldsymbol{p} - \boldsymbol{f})/8\ ),\ \boldsymbol{floor}\ (\mathbf{1} + (\ \boldsymbol{n} + \mathbf{2}\boldsymbol{p} - \boldsymbol{f}\ )/\mathbf{8}\ ), \boldsymbol{nf}]$$

Fig.3 Dataset With mask without mask face mask.

5. MODEL TESTING

This system helps to identify the organizational person if he or she is wearing or not wearing mask.

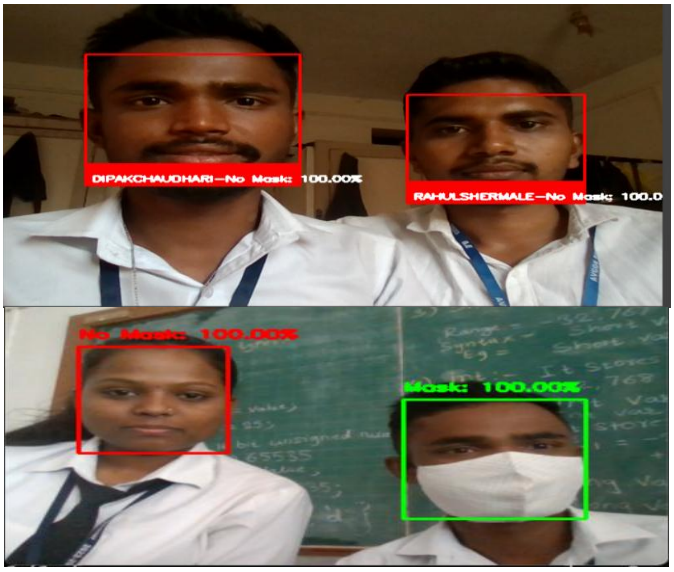

Fig.4 Face recognition of organizational person

In the above fig System identify the person is not wearing mask and show the output by using red frame, Name of person, accuracy of wearing mask or not.

Fig.5 Mask Detection

The figure above helps to identify whether the person is wearing a mask or not. And email alerts are sent to people who don't wear masks.

Fig.6 Email Alert System

The above figure shows an e-mail alert that has been sent to a person who is not wearing a mask.

6. CONCLUSION

The use of artificial intelligence for face mask detection has been a promising approach in the fight against COVID-19. The system uses computer vision techniques to analyze video feeds and identify individuals who are not wearing face masks in public places such as airports, hospitals, and schools. The technology has the potential to reduce the spread of the virus and help to keep communities safe.

There are various approaches to building a face mask detection system, including machine learning algorithms and deep learning models. These systems can be trained on large datasets of images and videos of people wearing and not wearing masks, allowing them to recognize patterns and make accurate predictions.

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