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COVID MASK DETECION

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ABSTRACT

The covid-19 pandemic has affected our day-to-day life, disrupting our daily life activities because of the situation wearing the protective mask has become a new normal. Many public and private offices would be asking their employees to wear masks correctly to get people available for their services. This is the reason that detecting the face mask is a very important task nowadays. There is a need for a human to check whether all the employees in the office have worn the mask properly but it takes time, effort, and labor. In this paper, we are going to solve this problem of COVID MASK DETECTION using the Deep Learning packages like Tensorflow, Keras, and OpenCV to detect whether the person in the office CCTV video feed has worn the mask perfectly. Our method in this paper detects the face of the person in the frame using the OpenCV haar cascade file, which can be able to detect face coordinates in the image.

Keywords: New Normal, Deep Learning, OpenCV, CCTV, Face Coordinates.

I. INTRODUCTION

According to the World Health Organization (WHO) official Situation Report – 205, COVID-19 has globally infected over 20 million people causing over a 0.7million deaths. Individuals with COVID-19 have had an honest scope of symptoms reported – going from mellow manifestations to serious illness. Respiratory problems like shortness of breath or difficulty in breathing are one of them. Elder people having lung disease can possess serious complications from COVID-19 illness as they appear to be at higher risk. Some common human coronaviruses that infect the public around the world are 229E, HKU1, OC43, and NL63. Before debilitating individuals, viruses like 2019-nCoV, SARS-COV, and MERS-COV infect animals and evolve into human coronaviruses. Persons having respiratory problems can expose anyone (who is in close contact with them) to infective beads. Surroundings of a tainted individual can cause contact transmission as droplets carrying the virus may withal arrive on adjacent surfaces.

To curb certain respiratory viral ailments, including COVID-19, wearing a clinical mask is very necessary. The public should be aware of whether to put on the mask for source control or aversion of COVID-19. Potential points of interest of the utilization of masks lie in reducing the vulnerability of risk from a noxious individual during the "pre-symptomatic" period and stigmatization of discrete persons putting on masks to restraint the spread of the virus. WHO stresses prioritizing medical masks and respirators for health care assistants [4]. Therefore, face mask detection has become a crucial task in a present global society.

Face mask detection includes detecting the region of the face after figuring out whether the person has a mask on or not. Face identification categorically offers to distinguish a particular organization of entities. It has several applications, inclusive of self-sufficient driving, education, surveillance, and so on [5]. This paper provides a simplified method to serve the above reason the usage of the primary Machine Learning (ML) packages including TensorFlow, Keras, OpenCV, and Scikit-Learn. The relaxation of the paper is prepared as follows: Section II explores associated paintings related to face mask detection. Section III discusses the character of the used dataset. Section IV affords the information of the programs included to construct the proposed model. Section V offers a top-level view of our method. Experimental outcomes and evaluation are said in phase VI. Section VII concludes and attracts the road closer to destiny works.

II. METHODOLOGY

Our proposed method contains the haar cascade file which can able to find the coordinates for the faces in the image. and we have a classifier that takes the image as the input and classifies whether the image contains the mask or no mask or improper mask in the image. we trained our model based on the CNN (convolution neural network) which contains the 2d convolution layers connected to a layer of dense neurons.

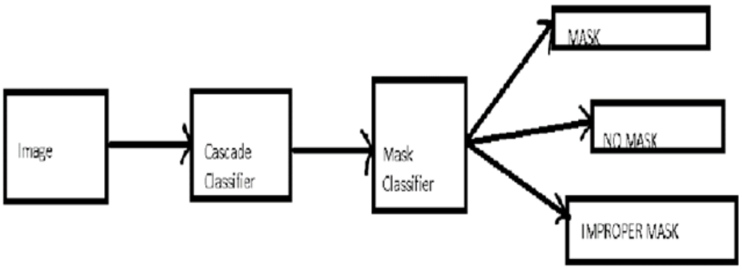

Fig1: Image classifier based on weared mask

A) Data preprocessing:

Initially, we take the frame from the video or CCTV footage and we convert this gray image. Because we get the image input in the form of the RGB but we need the gray image because cascade classifiers take the gray image as in the input.so Initially we convert the RGB image to a gray image and give it to the cascade classifier to find the coordinates of the faces in the image. After this conversion of RGB to the gray image. Now we need to reshape the image to give it to the algorithm. As we know that the input during relegation of an image may be a three-dimensional tensor, where each channel features a prominent unique pixel. All the pictures must have identically tantamount sizes like 3D feature tensor. However, neither images are customarily coextensive nor their corresponding feature tensors. Most CNNs can only accept fine-tuned images. This engenders several problems throughout data collection and implementation of the model. However, reconfiguring the input images before augmenting them into the network can help to surmount this constraint. The images are normalized to converge the pixel range between 0 and 1. Then they're converted to 4 dimensional arrays using data=np. Reshape (data,(data.shape,image size,image size,1)) where 1 indicates the Grayscale image. As, the ultimate layer of the neural network has 3 outputs – with mask and without a mask and improper mask i.e., its categorical representation.

B) Training the model:

Building the CNN model: when it comes to image classification Convolution neural networks are the best model or networks in Deep learning. CNN architecture works better in image-related problems and they give the best accuracy. The current we are using Sequential CNN. The first layer is followed by the RELU and Max pooling layers. The convolution layers learn to form the 200 filters. Kernal size we are set to the 3*3 which specifies the height and width of the convolution window which is 2d in the shape. we need to specify to the model the image input shape. then the following layers can perform instinctive shape reckoning. We need to put the default padding as valid where the spatial dimensions are sanctioned to truncate and the input volume is non-zero padded. we need to set the activation parameter to the conv2d class is set as 'relax it represents the approximation of the linear function that possesses all the inputs of the linear models that can easily be optimized with the method called the Gradient-descent. if we consider a generalization of the deep learning models, it is best to compare with the other types of activation functions. Max pooling is used to reduce the spatial dimensions of the output volume. After all this building the CNN layers and max-pooling layers. finally, we start the insertion of the data into the CNN, the long vector of input is passed through a flatten layer which transforms the matrix of features into a vector that can be feed into the fully connected neural network classifier. we use the Dropout to reduce the overfitting of the model using Dropout layer to zero is added to the model. Then a Dense layer of 64 neurons with a ReLu activation function is added. The final layer (Dense) with two outputs for two categories uses the Softmax activation function. The learning process needs to be configured first with the compile method [13]. Here "adam" optimizer is used. Categorical cross-entropy which is also known as multiclass log loss is used as a loss function (the objective that the model tries to minimize). As the problem is a classification the problem, metrics are set to "accuracy".

C) Spliting the data and Training the CNN model:

After setting the blueprint of the model to analyze the data. The model needs to be trained using a specific dataset and then tested against the different datasets. proper model and optimized train test split help to

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produce accurate results while making a prediction. The test size is set to 0.1 i.e., 90% data of the dataset undergoes training and the rest 10% goes for testing purposes. The validation loss is monitored using Model Checkpoint. Next, the images in the training set and the test set are fitted to the Sequential model. Here, 20% of the training data is used as validation data. The model is trained for 20 epochs (iterations) which maintains a trade-off between accuracy and chances of overfitting. Fig. 2 depicts a visual representation of the proposed model.

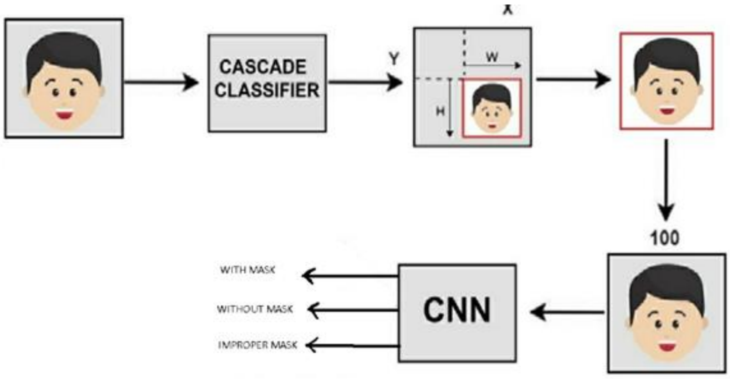

Fig 2: visual representation of our model

III. MODELING AND ANALYSIS

Related work:

In the face detection method, a face is detected from the associate image that has many attributes in it. Consistent with analysis into face detection needs expression recognition, face tracking, and creation of estimation. Given a solitary image, the challenge is to spot the face from the picture. Face detection may be a troublesome trip as a result of the faces modification in size, shape, color, etc, and that they don't seem to be immutable. It becomes a gruelling job for opaque image obstructed by another issue not braving camera, then forth. Authors suppose occlusive face detection comes with 2 major challenges: 1) inconvenience of sizably voluminous datasets containing each cloaked associated unmasked faces, and 2) exclusion of facial features within the lined area. Utilizing the regionally linear embedding (RLE) algorithmic rule and therefore the dictionaries trained on a vastly large pool of masked faces, synthesized mundane faces, many misplaced expressions will be recuperated and therefore the control of facial cues will be lessened to a nice extent. in keeping with the work according to, Convolutional neural network (CNN) in computer vision comes with a strict constraint concerning the scale of the input image. The rife follow reconfigures the pictures before fitting them into the network to surmount the inhibition. Synthesized mundane faces, many misplaced expressions will be recuperated and therefore the ascendency of facial cues is often satisfied to a nice extent. per the work according in], convolutional neural network (CNN) in computer vision comes with a strict constraint concerning the dimensions of the input image. The rife apply reconfigures the image before fitting them into the network to surmount the inhibition. Here the most challenging task is to notice the face from the image properly then determine if it's a mask or not to perform police investigation tasks, the planned technique ought to conjointly detect a face beside a mask in motion.

Dataset:

Dataset plays an important role in developing any deep learning and machine learning project in general. It is very important to make the dataset very general and diverse in nature when it comes to the classes and their behavior. In Our project, we created a dataset of our own and we used it for our project. There are many datasets are available for mask detection online but we think that some important features were lacking in those datasets. This is the reason that we created our dataset. It is an image data set containing the three labels of the mask, no mask, and the improper mask. We make sure that each of the label images contains more than 2000+ images for training the image classifier.

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Fig 3: Sample Images from Dataset

INCORPORATED PACKAGES

Tensorflow:

TensorFlow, an interface for expressing machine learning algorithms, is employed for implementing ML systems into fabrication over a bunch of areas of computing, including sentiment analysis, voice recognition, geographic information extraction, computer vision, text summarization, information retrieval, computational drug discovery, and flaw detection to pursue research. Within the proposed model, the whole Sequential CNN architecture (consists of several layers) uses TensorFlow at the backend. it's also wont to reshape the info (image) within the processing.

Keras:

Keras gives fundamental reflections and building units for the creation and transportation of ML arrangements with high iteration velocity. It takes full advantage of the scalability and cross-platform capabilities of TensorFlow. The core data structures of Keras are layers and models [19]. All the layers used in the CNN model are implemented using Keras. Along with the conversion of the category vector to the binary class matrix in processing, it helps to compile the general model.

OPENCV:

OpenCV (Open Source Computer Vision Library), an opensource computer vision and ML software library, is employed to differentiate and recognize faces, recognize objects, group movements in recordings, trace progressive modules, follow eye gesture, track camera actions, expel red eyes from pictures taken utilizing flash, find comparative pictures from a picture database, perceive the landscape and found out markers to overlay it with increased reality then forth. The proposed method makes use of those features of OpenCV in resizing and color conversion of knowledge images.

IV. RESULTS AND DISCUSSION

The model is trained, validated, and tested upon two datasets. Corresponding to dataset 1, the method attains accuracy up to 95.77% (shown in fig. 7). Fig. 6 depicts how this optimized accuracy mitigates the cost of error. Dataset2 is more versatile than dataset 1 as it has multiple faces in the frame and different types of masks having different colors as well. Therefore, the model attains an accuracy of 94.58% on dataset 2 as shown in Fig. 9. Fig. 8 depicts the contrast between training and validation loss corresponding to dataset 2. One of the main reasons behind achieving this accuracy lies in MaxPooling. It provides rudimentary translation invariance to the internal representation along with the reduction in the number of parameters the model has to learn. This sample-based discretization process down-samples the input representation consisting of an image, by reducing its dimensionality. The number of neurons has the optimized value of 64 which is not too high. A much higher number of neurons and filters can lead to worse performance. The optimized filter values and pool size help to filter out the main portion (face) of the image to detect the existence of the mask correctly without causing over-fitting. The system can efficiently detect partially occluded faces either with a mask or hair or hand. It considers the occlusion degree of four regions – nose, mouth, chin, and eye to differentiate between annotated mask or face covered by hand. Therefore, a mask covering the face fully including the nose and chin will only be treated as "with mask" by the model. The main challenges faced by the method mainly comprise varying angles and lack of clarity. Indistinct moving faces in the video stream make it more difficult. However, following the trajectories of several frames of the video helps to create a better decision – "with mask" or "without a mask" and "Improper mask".

V. CONCLUSION

In this paper, we briefly explained the motivation of the work at first. Then, we illustrated the learning and performance tasks of the model. Using basic ML tools and simplified techniques the method has achieved reasonably high accuracy. It can be used for a variety of applications. Wearing a mask may be obligatory shortly, considering the Covid-19 crisis. Many public service providers will ask the customers to wear masks correctly to avail of their services. The deployed model will contribute immensely to the public health care system. In the future, it can be extended to detect if a person is wearing the mask properly or not. The model can be further improved to detect if the mask is virus prone or not i.e. the type of the mask is surgical, N95, or not.

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