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FACE MASK DETECTION IN IMAGES USING HAAR CASCADE CLASSIFIER

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ABSTRACT

The only two things that can fight the present pandemics are face Mask and sanitizers. But there are people who aren't adhering to any rules or regulations. To restrict those people from coming to public places and keeping themselves as well as others in dangers, there needs to be as mechanism for quick, efficient and simple method of Face Mask Detection at public places. Present work focuses on developing a model for face Mask detection which can be easily installed at public places such as railway stations, bus stops, hospitals, shopping malls, offices, stadiums etc. The proposed model will receive image from the CCTV cameras which are already installed at most other public places now a days and will try to detect if anyone there without mask. The proposed model will use deep CNN model and HARR Algorithm for this purpose.

Keywords: Computer Vision, Image Processing, Haar Cascade Algorithm, Open Cv ,Keras.

I. INTRODUCTION

To prevent the spreading of various viruses, everyone must wear a face mask at least at public places. But many people are there who are not abiding by the COVID rules and they create problems not only for themselves but for others also. Thus there is a need for identifying those people and punishing them so that this kind of negligence can be stopped and those who are following the norms should be saved from this dangerous disease. Detection of mask among the crowds can solve this problem. To address this issue we have try to develop a model that can take CCTV feeds at public places and notify in case anyone without mask is detected. This solution will not only helps in checking the person wear face mask or not for protecting from viruses, It can also be used in various applications like ATM centers, Banks etc. For example if someone enter inside with wearing mask then it is automatically notify to the main authorization. Face Mask Detection is a method of detecting face mask. With the development of a facial detection we can see that a person is wearing a mask that agrees and allows their entry can be very helpful to the Community. In face mask detection model we have two phases those are as follows:

1.Train face mask detector

2.Applying face mask detector

which means it classifies into training phase and deployment phase.

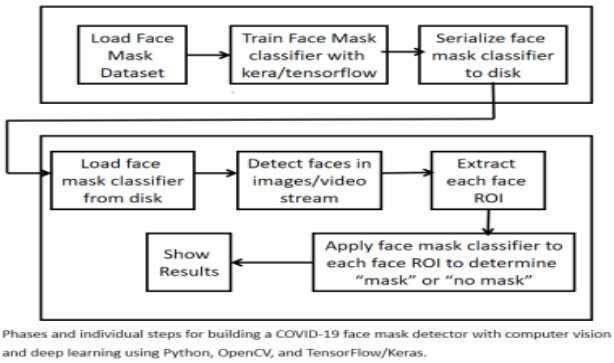

Figure:1. Two Phases of Face Mask Detection

II. METHODOLOGY

In the past decades, Face detection and face recognition are comprehensively studied. Like Vioal and jona invented face detetctor which is cascade Adaboost using HAAR Cascade Algorithm. Later that various of works

are worked on different features. Like various classifiers which means type of mask, identifying for moving object, live images and so on. And also in medical room detetcing face mask through facial attributes. In that process first detect the face and then mask to provide security. In that proposed methods authors proposed various algorithms like OHEM,HAAR cascade algorithm to improve the detection of object performance.

IMPORTED PACKAGES

1. Keras 2.Tensorfow 3.OpenCV

1. Keras

Keras is which provides a python interface for artifificial neural netwroks and it is a open source library. It provides high level APIs and also it reduces the number of user actions. which layers are used in the CNN model is by using the Keras.

2. Tensorflow

TensorFlow, an interface for demonstrating machine learning capabilities, is used to use ML systems in the construction of a wide range of computer science applications such as sensory analysis, recognising voice, extrcation of location, advanced image processing methods like computer vision, text coclusion, retrieval of data etc. In the proposed model, the entire structure of Sequential CNN (consisting of several layers) uses TensorFlow back. It is also used to resize data (image) in data processing. OpenCV OpenCV is useful for identifying the movements of objects, colors, recognizing the objects, eye gestures, camera track actions. It is a open source platform which open source computer vision and machine learning software library

III. MODELING AND ANALYSIS

In this proposed approach, we proposed how to detect face mask using HAAR cascade in open CV and Keras in detail:

Testing Model

In this process first we need to train a face mask detector, we can break this process into two sub-parts. Each sub-part will have its own steps as mentioned in the figure below:

First phase is training:

In training phase we will first load our face mask detection data set , will train the model using Keras and Tensor Flow in Google Colab.

Second Phase Deployment:

After the data set trained in deployment phase, we will move to loading face mask detection model, will perform detection, and will then next classify each face as it is with mask or without mask. let first have a short description about the data set we will be using to train our model. In easy descriptive primarily we get the image with face and run it through a cascade classifying algorithm. The classifier is give region of interest of the face with height and width. Next we will resize the region of the interest into a 100x100 dimensions and pass it to the pre trained CNN, it will give us a probability as an output. we take the images as a data set which classified into without mask and with mask.

Now we will use these images to construct deep CNN (convolutional neural network) model by using HAAR algorithm to identify whether person wear the mask or not wear the mask. Training and Deployment phases are classified in to following phases.

1.Collecting the Data

2.Preprocessing the Data

3.Splitting the data

4.Building the CNN model

5.Pre-Training the CNN model

6.Trainig the CNN model

7.Labeling the information

8.Importing the face detection process

9.Identifying Faces with mask and without mask

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1. Data collecting

In Face mask detection first and foremost step is collecting the data. This we called as dataset, this one useful for detetect who wear and who didn't wear the mask. This Process is also called as data visualization. In data visualization we partioned the data set into two classes that is with mask and without mask. Data recognition is an very important step in any data science analysis work, once the required data has been collected, processed as per required and modeled, it must be visualized in order to draw conclusions. Data detection is also a feature of broad data delivery discipline, which aims to identify, detect, manipulate, formatting and deliver data in a highly efficient process. we decide the day into two groups and are labeled In this process the first and foremost step is to have the knowledge of the total number of images in our data set in both masked and non-masked categories.

Figure 2: Without mask

Figure 3: With mask

3. Data Preprocessing

Data preprocessing is also called as data augmentation. It is a step before training data and testing data. In this we have four steps. They are:

1.Resize the image size

2.convert the image into array

3.Using the mobilenetv2 augment the data.

4.Now performing labels to encode.

In most of the practical cases, we have limited dataset because cost of data collection is high and also time consuming, but most of the CNN models require huge datasets. In order to use our dataset efficiently and to its fully potential Data Augmentation techniques are used. Data addition or Data augmentation refers to a process which can help in increasing the amount of data we have by adding modified copies of our existing data or by creating new data by various basic methods like rotation, inversion, expansion etc. from existing data. It works as normal and helps to reduce equilibrium when training a machine learning model. This process is almost the same as sampling in data analysis .. In this process, we will prepare a two-stage data set to add some images to our training model. In this data processing process we will rotate and scan each image in our data set. After the data augmentation process, we see this, for example we have a total number of 2698 images blurred and rotated images also included when the images will increase because here we take several photos by inserting them separately.

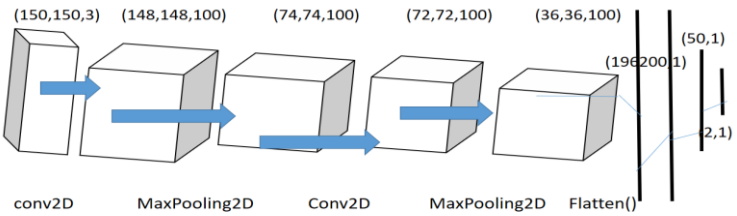

Figure 4: Data process from one step to other

4. Splitting the Data

After augmentation or preprocessing phase we split the date into train set and test set. Here we are splitting eighty percent to training set and remaining into test set. We will use the train set data for training our Deep CNN model. Since training requires large amount of data, we have kept 80% of our dataset for training only. After training the model we need to test the model on unseen data. For that we will use test dataset. So, we will split our dataset in two parts with split ratio 0.8, which is equivalent to 80 percent of the dataset, which we will use for the training purpose and the rest 20% images will be used to test our CNN model. For example, the total of a training set with a label that says yes means a mask is 1024 As smart as it is, in a test set with a mask it means you have a label yes 252. and with the exception of the mask labeled for data setup training and testing of set data is 1096 and 265

5. Building the Model

After splitting the dataset, the next step is building the model. we will build a Sequential Convolutional Network Model with different layers. The sequence of processes at each layer is Conv2D layer, then MaxPooling2D layer, then Flattening layer, a layer for Dropout and then a Dense layer at the end. In this phase we have six steps those are:

1.Preprocessing of training images.

2.MobileNetV2 basic CNN model

3.Initialising various Parameters of CNN model

4.Compiling and tuning the CNN model

5.Training the CNN model

6.For further prediction process save the model.

In the dropout and dense layer, we have used the softmax function to extract a set of vector that provides an opportunity for each of the two categories.

Figure 5: Artificial mask to train the data

6. Pre-Training the CNN model

After building our model, the next step is pre training the cnn model which means let we build a 'train generator' and a confirmation generator means validation generator to suit our model in the next step for training the Convolutional Neural network(CNN).

7. Training the model

The next step that will follow pre-model training is, to train our proposed model, this is the most crucial process. We will train our model on our training dataset with both kinds of data i.e. with mask and without mask using keras package in Google Colab. We can train our model as much as possible but we found out 30 Epochs are sufficient. Where Epoch and repetition help to increase accuracy, the number of repetitions leads to increased accuracy, but its taking lots of time. We can train our model some additional number of epochs to achieve higher accuracy but that doesn't result in much significant change in results, besides that it can also lead to overfitting of our model because of which we can have high accuracy in training time but while testing time our accuracy will be low. We observed that after 30 repetitions our model is 98.86 percent accurate with the training set and 96.19 percent with the test dataset. The above result shows that our model is very well trained without any chance of being overly balanced.

8. Labeling the Information

Next to the training and creating the model, we have two possibilities for our output. those are 'zero' corresponds

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to without mask and 'one' corresponds to with mask .To show effectively that with green and red boundary for both categories we also set a boundary rectangular color using RGB (Red Green Blue) values. labels dict = 0 means 'without mask', 1 means 'with mask' dictate or command colour = 0: (red)(0,0,255), 1: (green)(0,255,0)

9. Cascading face Detection Model

We try to test our model on practical basis, to find out if we were wearing a face mask or not from the feeds from our PC webcam. For this, first of all, we need to use face detection. To achieve this task we have written separate code for taking inputs from PC webcam, then we will apply a face detector model to detect face in the image from PC webcame. For this, we used famous Haar based Feature Cascade Classifiers to find facial features. This cascade classified algorithm is designed for OpenCV to get front faces by training thousands of images. And will then apply our model over it to identify if the person is wearing mask or not.

10. identifying the person with or without Masks

We will use the webcam or CCTV or any other camera for live video feeds, and can detect in real time if everyone is wearing mask or not. The video will be read in frames, a HAAR based face detection algorithm will be used on those frames. Once the face is detected, we will proceed with the following procedure. From the found frames that contain faces, pre-processing will be done including adjusting image size, transforming it to suitable form, installing pre-processing packages using MobileNetV2. After that, we will predict that the input image consist of person with mask or not.

IV. RESULTS AND DISCUSSION

In this paper we classified dataset into two classes: With mask and without mask. Here model is trained then validated and tested upon dataset(various images). we plot the graph between ephocs and loss/accuracy.

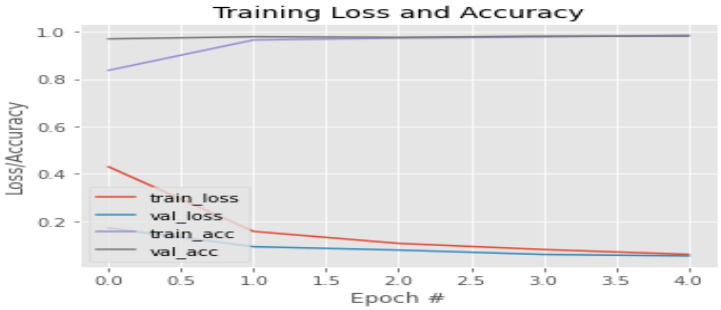

Figure 6: Graph between Accuracy and Epochs

If the data is with image then it will give green colour rectangular box with accuracy as shown below figure. If the input is without mask then it gives red colour rectangular box around image and here we can identify whether the person wear mask properly or not. Here properly means covering the land marks or not(mouth and nose) And also we can identify malpractices, if some people are covering their land marks with hand it can identify easily by HAAR Cascade algorithm. In this paper, we classified the images into three categories with mask and without mask as well as halfly covered the landmarks(mouth and nose).

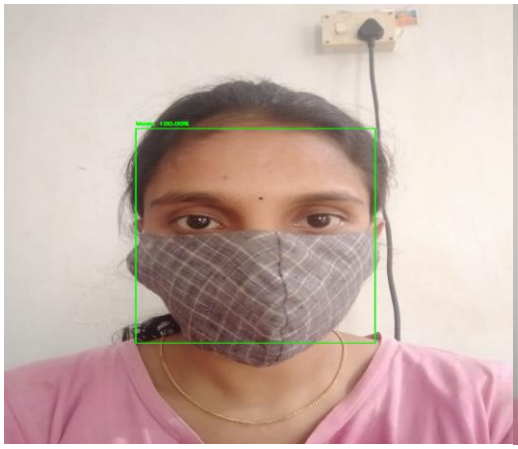

Figure 7: Result with mask

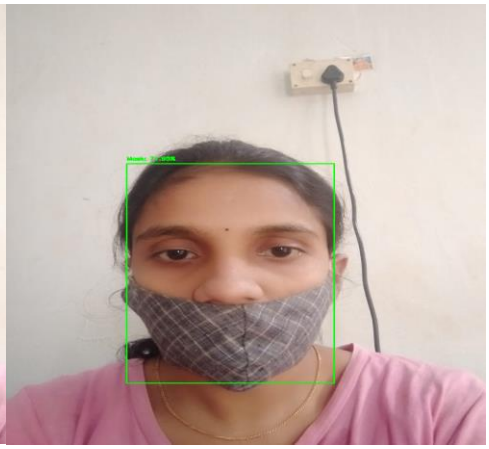

Figure 8: Result with halfly covered mask

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And also we can detect if the person is covering with his body parts other than mask .In below figure the image is showing that her landmarks covered with hand so its giving the result red colour boundary which means its goes under the without mask category.

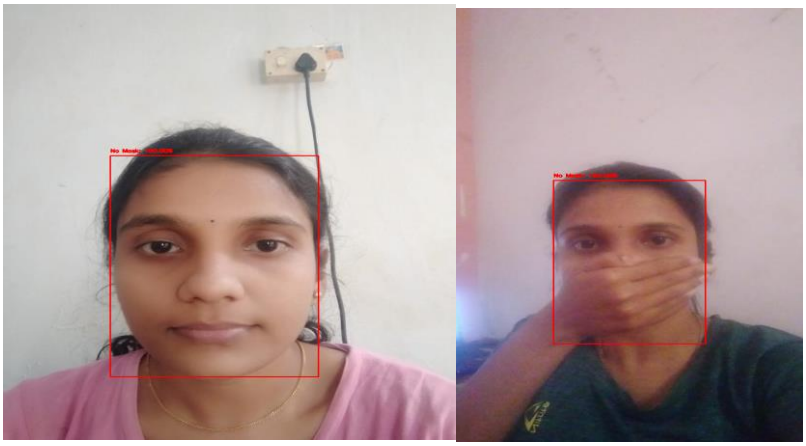

Figure 9: Result without mask and Result which covered landmarks but not with mask

And also we they covered half of regions which means not covering properly also its gives the results without mask category as no.

V. CONCLUSION

In this paper, we have improved face detection using Python, Cameras, OpenCV and tensor flow. We made a face detection model to see if anyone was wearing a mask. We trained the model using Cameras to build the network. We classify the dataset in to three categories. Those are with mask without mask and halfly covered mask which means not covered landmarks properly. Here we implemented by using HAAR cascade algorithm in open CV and Keras. At that point, we represented the learning and execution errand of the model. Utilizing essential ML instruments and improved on strategies the strategy has accomplished sensibly high exactness. It tends to be utilized for an assortment of uses. Wearing a cover might be mandatory soon, considering the Covid-19 emergency. Numerous public specialist organizations will request that the clients wear veils accurately to benefit of their administrations. The conveyed model will contribute monstrously to the general medical care framework. Furthermore, we extend a data set and try to classify the various classes like detect the type of mask means n95,cotton,surgical or not.

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