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FACE MASK DETECTION SYSTEM USING PYTHON OPEN CV

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ABSTRACT

COVID-19 pandemic has tremendously affected our day-to-day life affecting the world trade and movements. Wearing a protective face mask has become mandatory. In the near future, many public service providers will ask the customers to wear masks to avail of their services. Therefore, face mask detection has become a essential task to help global society. This paper presents a simplified approach to achieve this purpose using some basic deep Learning packages like Tensor Flow, Keras, Open CV.The proposed methodology detects the face from the image/video stream correctly and then identifies if it has a mask on it or not. As a surveillance task performer, it can also detect a face along with a mask in motion. The method obtains accuracy up to 95.55% and 94.23% respectively on two different datasets. We explore optimized values of parameters using the Convolutional Neural Network model to detect the presence of masks correctly without causing over fitting.

Keywords: Convolutional Neural detection, Tensor Flow, Deep Learning, Keras.

I. INTRODUCTION

COVID-19 had a massive impact on human lives. The pandemic lead to the loss of millions and affected the lives of billions of people. Its negative impact was felt by almost all commercial establishments, education, economy, religion, transport, tourism, employment, entertainment, food security and other industries. According to WHO (World Health Organization), 55.6 million people were infected with Corona virus and 1.34 million people population in Europe in the 14th century [10].

COVID-19 mainly spreads through droplets produced as a result of coughing or sneezing by an infected person. This transfers the virus to any person who is in direct close contact (within onemeter distance) with the person suffering from corona virus. Because of this, the virus spreads rapidly among the masses [11]. With the nationwide lockdowns being lifted, it has become even harder to track and control the virus. Face masks are an effective method to control the spread of virus. It had been found that wearing face masks is 96% effective to stop the spread of virus [12]. The governments, all over the world, have imposed strict rules the everyone should wear masks while they go out. But still, some people may not wear masks and it is hard to check weather everyone is wearing mask or not. In such cases, computer vision will be of great help. There are no efficient face mask detection applications to detect weather the person is wearing face mask or not [13]. This increases the demand for an efficient system for detecting face masks on people for transportation means, densely populated areas, residential districts, large-scale manufacturers and other enterprises to ensure safety [14]. This project uses machine learning classification using OpenCV and Tensor flow to detect facemasks on people.

2. OBJECTIVE

The main objective of the face mask detection model is to detect the face of individuals and conclude whether they are wearing masks or not at that particular moment when they are captured in the image. In our proposed system we will use live video stream to identify whether the person on image/video stream is wearing a face mask or not with the help of computer vision.

3. LITERATURE SURVEY

In a Smart City Network, an Automated System to Limit COVID-19 Using Facial Mask Detection [1]: COVID-19, a pandemic caused by a novel corona virus, has been spreading over the world for a long time. COVID-19 has had an impact on practically every aspect of development. The healthcare system is in a state of emergency. Wearing a mask is one of the many preventative steps adopted to minimize the spread of this disease [15].

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In a smart city network where all public places are monitored by Closed-Circuit Television (CCTV) cameras, we propose a technique to limit COVID19 growth by identifying people who are not wearing any facial mask. When a person without a mask is spotted, the city network notifies the appropriate authority. A dataset of photos of people with and without masks acquired from diverse sources is used to train a deep learning architecture. For previously unreported test data, the trained architecture distinguished people with and without a facial mask with 98.7% accuracy. Our research is intended to be effective in reducing the spread of this infectious disease in many areas throughout the world. Face Recognition using a Masked Convolutional Neural Network [16]: In recent years, face recognition has become a popular and important technique. Face changes and the use of several masks make it far too difficult. Masking is another prevalent case in the real world when a person is uncooperative with equipment, such as in video surveillance. For these masks, current face recognition The quality of the work suffers. A large number of studies have been conducted on recognizing faces in a variety of situations, such as shifting stance or light, degraded photos, and so on.

Nonetheless, the challenges posed by masks are sometimes overlooked. The main focus of this research is on facial masks, specifically how to improve the recognition accuracy of various masked faces. A workable strategy has been developed, which involves detecting the facial regions first [17]. A Multi-Task Cascaded Convolutional Neural Network was used to solve the obstructed face identification problem (MTCNN). The Google Face Net embedding model is then used to extract facial traits.

The authors have developed a method to identify how a person is wearing the face mask. They were able to classify three categories of facemask wearing condition namely correct facemask wearing, incorrect facemask- wearing, and no facemask-wearing. This method achieved over 98% accuracy in detection.

4. METHODOLOGY

Dataset Collection: The dataset was collected from Kaggle Repository and was split into training and testing data after its analysis.

Training a model to detect face masks: A default OpenCV module was used to obtain faces followed by training a Keras model to identify face mask.

Detecting the person not wearing a mask: A open CV model was trained to detect the names of the people who are not wearing masks by referring the database.

4.1Proposed system

This system is capable to train the dataset of both persons wearing masks and without wearing masks. After training the model the system can predicting whether the person is wearing the mask or not. It also can access the webcam and predict the result.

5. BLOCK DIAGRAM

Block diagram consists of two phases as follows:

PHASE 1:

a) Training face mask detector.
b) Load face mask dataset.
c) Train face mask classifier with keras and tensor flow.
d) Serialize face mask detector to disk.

PHASE 2:

a) Apply face mask detector.
b) Load face mask classifier from disk.
c) Detect faces in the video streams.
d) Extract each face ROI.
e) Apply face mask classifier to each face ROI to determine “mask” or “no mask”.

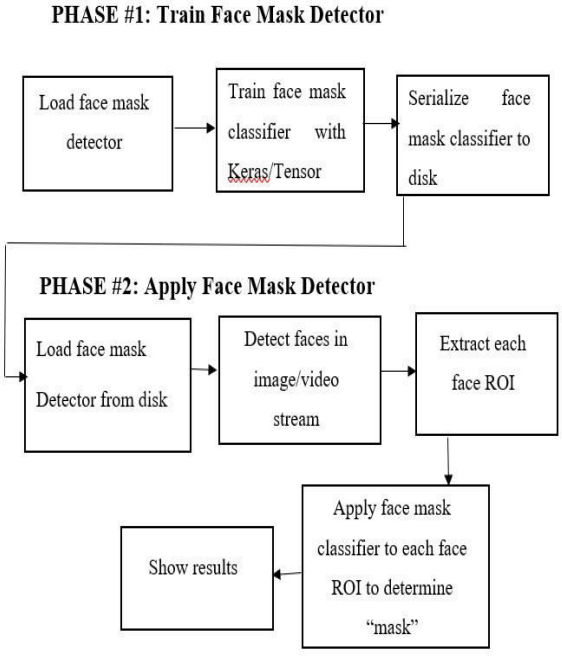

Fig:(a). Block diagram of Mask detector

In order to train a custom face mask detector, we need to break our project into two distinct phases, each with its own respective sub-steps:

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Training: Here we'll focus on loading our face mask detection dataset from disk, training a model (using Keras/Tensor Flow) on this dataset, and then serializing the face mask detector to disk

Deployment: Once the face mask detector is trained, we can then move on to loading the mask detector, performing face detection, and then classifying each face as with_maskor without mask.

The major requirement for implementing this project using python programming language along with Deep learning ,Machine learning , Computer vision and also with python libraries [9]. The architecture consists of Mobile Net as the backbone, it can be used for high and low computation scenarios. We are using CNN Algorithm in our proposed system.

Our set of tensorflow.keras imports allow for:

a. Data augmentation.
b. Loading the MobilNetV2 classifier (we will fine-tune this model with pre-trained IMAGE NET weights).
c. Building a new fully-connected (FC) head.
d. Pre-processing.
e. Loading image data.

5.1 IMPLEMENTATION OF JPROJECT

Imports:

- Import all the libraries and modules required.
- Build the neural network:
- This convolution network consists of two pairs of Conv and MaxvPool layers to extract features from the dataset.
- This is then followed by a Flatten and Dropout layer to convert the data in 1D and ensure over fitting.
- Two dense layers for classification.
- Image Data Generation/Augmentation:
- Initialize a callback checkpoint to keep saving best model after each epoch while training
- Training the model and detected output is shown.

Data Pre-processing

- Preprocessing steps as mentioned below was applied to all the raw input images to convert them into clean versions, which could be fed to a neural network machine learning model.
- Resizing the input image (256 x 256)
- Applying the color filtering (RGB) over the channels (Our model MobileNetV2 supports 2D 3 channel image)
- Center cropping the image with the pixel value of 224x224x3.
- Finally converting them into tensors (Similar to NumPy array)

6. WORKING OF PROPOSED SYSTEMOPENCV

Opencv (Open Source Computer Vision

Library) is an open source computer vision and open source computer vision and machine learning software library. OpenCV was worked to give a typical foundation to PC vision applications and to quicken the utilization of machine discernment in business items. The library has in excess of 2500 streamlined calculations, which incorporates an extensive arrangement of both works of art and cutting edge PC vision and AI calculations. These calculations can be utilized to distinguish and perceive faces, recognize objects, group human activities in recordings, track camera developments, track moving articles, separate 3D models of items, produce 3D point mists from sound system cameras, line pictures together to create a high-goal picture of a whole scene, find comparable pictures from a picture data set, eliminate red eyes from pictures taken utilizing streak, follow eye developments, perceive view and build up markers to overlay it with enlarged reality, and so on.

TENSORFLOW

It is a free and open-source programming library for dataflow and differentiable programming across a degree of assignments. It is a representative mathematical library and is likewise utilized for AI applications, for example, neural organizations. It is utilized for both examination and creation at Google, Tensor Flow is Google Brain's second-age framework. Keras is an API intended for people, not machines. Keras follows best practices for decreasing intellectual burden: it offers steady and straightforward APIs, it limits the number of client activities needed for basic use cases, and it gives clear and significant Messages.

CNN

The Convolutional Neural Networks (CNNs) are category of Neural Networks that have proven effective in areas such as image recognition and classification. CNN have been successful in identifying animals, face masks, objects and track signs apart from powering vision in self driving cats.

CONFIGURATION OF THE SYSTEM

- Input image (100,100,3) for coloured image.

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- Input image (100,100,1) for greyscale image.
- Convolutional layer (filter size)
- ReLU layer (to get featured map output)
- Pooling and flattening to reduce the dimension of featured map output
- Fully connected layer
- To predict the accuracy how perfectly if the person is wearing mask or not in percentage.

Training the CNN model

It is an important step where the images fit in the training set and to the test set for sequential model by using keraslibrary.This model is trained for 30 epochs(iterations).For high accuracy we have to use more number of epochs in its training there it occurs over-fitting [4].

Training loss and Accuracy

Face mask detector training accuracy/loss curves demonstrate high accuracy and little signs of over fitting on the data. The imutils paths implementation helped us to find and list images in our dataset. And we have used mat plot lib to plot our training curves [8].

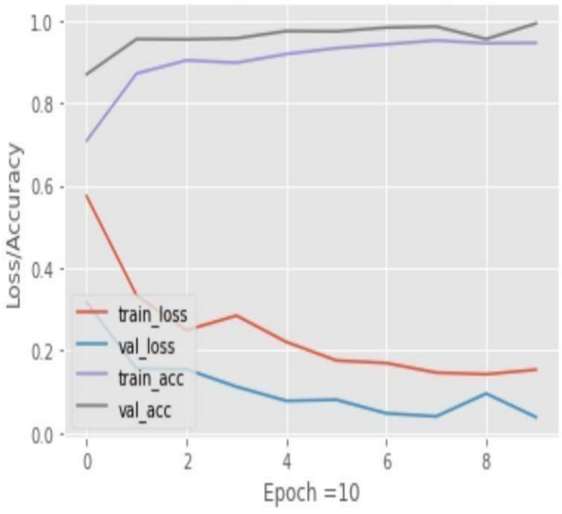

Fig :(b): Training loss and curve wave form

The data set has been divided into two sets, likely a training and validation set. The accuracy of image classifier over the training set vs validation.

7. RESULT

The mask recognition is implemented using the camera as a medium and shows accurate results. When the persons face is in the camera frame, model will detect the face and a green or a red frame will appear over the face. A person who is not wearing mask will get a red frame over his face in camera while the person who is wearing mask will get a red frame. The result is also visible written on top left of the result frame. A percentage match can also be seen on the top of the result frame. The model works even if the side view of the face is visible to the camera. It can also detect more than one face in single camera frame.

Open up the command prompts and execute the command pythondetect_mask_video.py using your webcam, this script applies face mask detection to every frame in the live stream.

Fig: (c): Mask Recognition

8. CONCLUSION

This Paper Face Mask Detection System Using Python Open CV has been implemented in order to provide safety to the people. The current study used OpenCV and CNN to detect whether people were wearing face masks or not. The models were tested with images and real-time video streams. The accuracy of the model is around 99%, the optimization of the model is a continuous process and we are building a highly accurate solution by tuning the parameters. We have successfully trained the module with the help of keras and tensor flow. . Overall, the model shows the accurate results. Our model gave 98%accuracy for Face Mask Detection after training.

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Conflict of interest

The authors declare that there is no conflict of interest in this paper.

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