Face Mask Detection

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Abstract

After the new Coronavirus disease (COVID-19) case spread rapidly in Wuhan-China in December 2019, World Health Organization (WHO) confirmed that this is a dangerous virus thatcan be spread from humans to humans through droplets and airborne. As for the prevention,

wearing a face mask is essential while going outside or meeting others. However, some irresponsible people refuse to wear a face mask with so many excuses. Moreover, developing theface mask detector is very crucial in this case. This paper aims to develop a face mask detector that is able to detect any kind of face mask. Using TensorFlow, Keras, and OpenCV,

MobileNetV2.

Keywords – Detection, Covid 19, mask, no mask, pandemic, safety.

I. Introduction

Face Mask Recognition is a technique in which we match and store models of each human face in a group of people to identify/recognize a person based on certain features of that person's face. Face mask identification/recognition is a natural method of identifying/recognizing and authenticating people. Face mask recognition is an integral part of people's everyday contact and lives. The security and authentication of an individual are critical in every industry or institution. As a result, there is a great deal of interest in automated face mask recognition using computers or devices for identity/recognizing verification around the clock and even remotely in today's world. Face recognition has emerged as one of the most difficult and intriguing problems in pattern recognition and image processing. With the aid of such a technology, one can easily detect a person's face by using a dataset of identical matching appearances.

Recently many researchers tried to solve the masked face recognition problem but their method is not robust enough as result they got low recognition accuracy. Research papers on masked face recognition can be divided into two categories based on their approach. Which are reconstructive approaches and discard approaches.

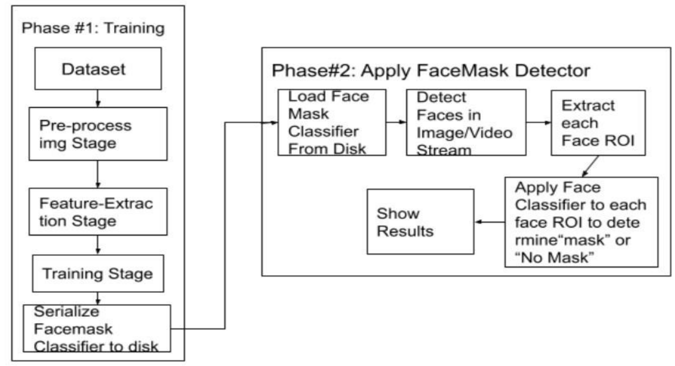
Quite some effort has been put into public-space to compute the applications of vision to help and combat the ongoing COVID-19 pandemic. One such application, Real-time face mask detection, involves first the detection of faces in a given frame of a video feed, and then the classification of each face to detect if the person is wearing a mask or not in the crowd. If implemented nationwide, such Computer Vision solutions can have a profound impact on the spread of the virus that has created a pandemic.

Support Vector Machines (SVMs) have been proven to be great at a variety of classification and regression problems. We aim to create an application using a machine learning model that utilizes TensorFlow, and Keras to reduce the dimensionality of image data, and then classify the image of a face as with a mask, without a mask, or as mask weared incorrect with the help of a neural network.

II. METHODOLOGY

We use MobileNetV2 on masked and unmasked face recognition for Real Time Detection and Recognition of Human Faces, which is simple face detection and recognition system is proposed in this paper which has the capability to recognize/detect the human faces in single as well as multiple face images or live stream video in a database in real time with masks on or off the face. Pre-processing of the proposed framework includes noise removal and hole filling in colour images. After pre-processing, face detection is performed by using SVM architecture. Architecture layers of SVM are created using Python Library. Detected faces

are augmented to make computation fast. By using MobileNetV2 features are extracted from the augmented image.



Data Flow chart Diagram

III. Literature Review

Name Of Publisher	Approach	Result	Disadvantage
Emir Kremic, Abdulhamit Subasi, Kemal Hajdarevic (2012)	PCA Client server model and GPG infrastructure	Detection accuracy was improved 72%	Computer vision problem
Richard Aliradi, Naima Bouzera, Dr.Abdelkarim Meziane (2013)	Support Vector Machine (SVM) has been adapted	Succeeds in locating facial features in the facial region exactly 80%	Non-convex problem
Arjya Das, Mohammad Wasif Ansari, Rohini Basak (2020)	CNN Facemask detect on face on human on live stream	85% Accuracy	Adequate data And time are required
Samuel Ady Sanjaya, Suryo Adi Rakhmawan (2020)	MobileNetv2 Is a state of art for mobile visual recognition including classification	99% Accuracy	It takes more time for data processing and training

IV. Data processing

1. Dataset(Image)

The Real-time input images are used in this proposed system. The face of the person in the input images with and without masks must be fully or partially covered as they have masks on them. The system requires a reasonable number of pixels and an acceptable amount of brightness for processing. Based on the experimental evidence, it is supposed to perform well indoors as well as outdoors i.e. street public image.

2. The Pre-processing Stage

The input images dataset must be loaded as Python data structures for pre-processing to overturn the noise disturbances, enhance some relevant features, and for further analysis of the trained model. Input image needs to be pre-processed before face detection and matching techniques are applied.There are four steps in the preprocessing which are resizing image size, converting the image to the array, pre-processing input using MobileNetV2, and the last is performing hot encoding on labels.

The resizing image is a critical pre-processing step in computer vision due to the effectiveness of training models. The smaller size of the image, the better the model will run. In this study, the resizing of an image is making the image into 224 × 224 pixels.

The next step is to process all the images in the dataset into an array. The image is converted into the array for calling them by the loop function. After that, the image will be used to pre-process input using MobileNetV2.

3. The Feature-Extraction Stage

Feature Extraction improves model accuracy by extracting options from pre-processed face pictures and translating them to a lower dimension while not sacrificing image characteristics. This stage permits the extraction of features and the classification of human faces.

4. Training Stage

The method is based on the notion that it learns from pre-processed face images and utilizes a neural network model to construct a framework to classify images based on which group it belongs to. This qualified model is saved and used in the prediction section later. In neural network models, the stages of feature extraction are done by Tensorflow, Keras and feature selection done by Sobel Edge Detector and thus it improves classification efficiency and accuracy of the training model.

5. Building the Model

The next phase is building the model. There are six steps in building the model that are unit constructing the coaching image generator for augmentation, the base model with MobileNetV2, adding model parameters, collecting the model, coaching the model, and therefore the last is saving the model for the longer term prediction method.

6. Prediction Stage

In this stage, the saved model automatically detects the face mask image captured by the webcam or camera. The saved model and the pre-processed images are loaded for predicting the person behind the mask. TensorFlow and Keras offer high accuracy over face detection, classification, and recognition to produce precise and exact results. TensorFlow, Keras model follows a sequential model along with Keras Library in Python for the prediction of human faces.

V. Packages

A. TensorFlow

TensorFlow, an interface for expressing machine learning algorithms, is used for implementing ML systems into fabrication over a bunch of areas of engineering science, together with sentiment analysis, voice recognition, geographic info extraction, computer vision, text summarization, info retrieval, machine drug discovery and flaw detection to pursue analysis. In the proposed model, the whole Sequential MobileNetV2 architecture (which consists of many layers) uses TensorFlow at backend. It additionally wants to reshape the data(image) info in the data processing.

B. Keras

Keras offer fundamental reflections and building units for creation and transportation of ML arrangements with high iteration velocity. It takes full advantage of the measurability and cross-platform capabilities of TensorFlow. The core data or information structures of Keras square measure layers and models. All the layers utilized in the MobileNetV2 model are implemented using Keras. Along with the conversion of the class vector to the binary class matrix in data processing, it helps to compile the general model.

C. OpenCV

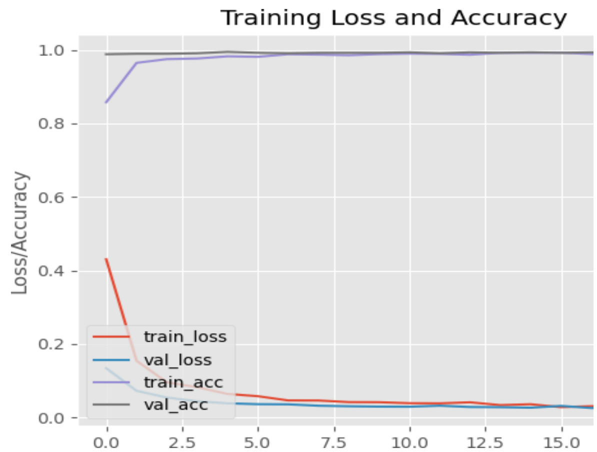
OpenCV (Open Source Computer Vision Library), an open-source computer vision and ML software package library, is utilized to differentiate and acknowledge faces, acknowledge objects, group movements in recordings, trace progressive modules, follow eye gesture, track camera actions, expel red eyes from photos taken utilizing flash, notice the comparative photos from a pictures database, perceive landscape and set up markers to overlay it with inflated reality and so forth. The proposed method makes use of these features of OpenCV in resizing and color conversion of data pictures.

D. MobileNetV2

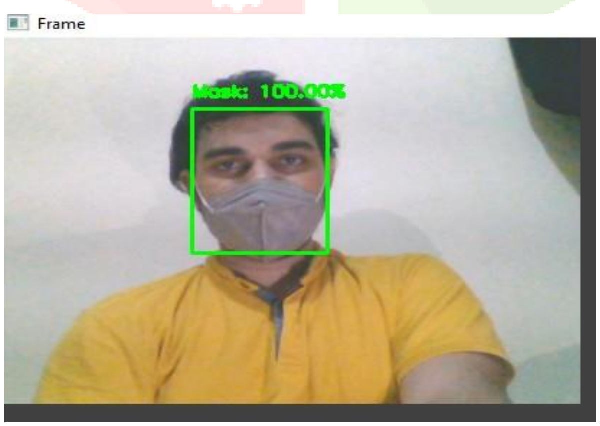
MobileNetV2 is a convolutional neural network architecture that seeks to perform well on mobile devices. It is based on an inverted residual structure where the residual connections are between the bottleneck layers. The intermediate expansion layer uses lightweight depthwise convolutions to filter features as a source of non-linearity. As a whole, the architecture of MobileNetV2 contains the initial fully convolution layer with 32 filters, followed by 19 residual bottleneck layers.

VI. RESULT & Analysis

The model is trained on mask and non-mask datasets. Using the above method attains accuracy up to 99.% depicts how this optimized accuracy mitigates the cost of error. Therefore, One of the main reasons behind achieving this accuracy is *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 image, by reducing its dimensionality. Number of neurons has the optimized value of 64 which is not too high. A much higher range of neurons and filters will result in worse performance. The optimized filter values and pool_size facilitate to separate the most portion (face) of the image to detect the existence of mask properly without causing over-fitting.



Above image is without mask.



Above image is with mask.

VII. Implementing the model

The model is enforced within the video. The video is read or scanned from frame to frame, then the face detection algorithm works. If a face is detected, it proceeds to the consequent method. From detected frames containing faces, reprocessing will be carried out including resizing the image size, converting to the array, and preprocessing input victimization MobileNetV2.

The next step is predicting the computer file(input data) from the saved model. Predict the input image that has been processed using a previously built or designed model. Besides, the video frame will be labelled whether or not the person is carrying or wearing a mask or not along with the predictive percentage.

VIII. Conclusion

Our proposed system will notice or detect and recognize human faces in a real-time world. Compared to the traditional we illustrated the learning and performance tasks of the model. Using the TensorFlow, Keras, and OpenCV tools and simplified techniques the strategy has achieved moderately high accuracy. Wearing or carrying a mask may be obligatory within the near to future, considering the Covid-19 crisis. For that crisis, we have a tendency to deploy a model that may contribute vastly to the general public health care system. Whitin the future, it is extended to detect or notice if someone 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 kind of the mask is surgical, N95, or not. The results show us that the current technology for face detection and recognition is compromised and might get replaced with this proposed work.

Therefore, the proposed technique works very well within the applications of biometrics and surveillance.

IX. Reference

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