Smart Mask Detection And Counter With Email Alert System

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***Abstract*—In this project our main aim is to check whether everyone who come to our home, shop, any other places are wearing mask and following instructions given by government. To do this at first, we need to read image from a camera, check how many faces or people are there, segregate all of them and check whether they are wearing mask or not individually. i.e., total number of people present in front of door how many people are wearing mask and how many people are not wearing mask so that anyone can access it.Using MTCNN module in python we are detecting faces. For detecting mask, we made a neural network which has been trained with both faces having mask and faces not having mask.**

Keywords—segregate, detection, wearing mask, MTCNN module, Computer Vision (*key words****)***

I. INTRODUCTION

The pattern of wearing face covers openly is ascending because of the COVID-19 pestilence everywhere in the world. Before Covid-19, People used to wear covers to shield their wellbeing from air contamination. While others are reluctant about their looks, they conceal their feelings from general society by concealing their countenances. Researchers sealed that wearing face covers deals with blocking COVID-19 transmission. COVID19 (known as Covid) is the most recent pandemic infection that hit human wellbeing in the only remaining century. In 2020, the quick spreading of COVID-19 has constrained the World Health Organization to pronounce COVID-19 as a worldwide pandemic. Man-made brainpower (AI) in light of Machine learning and Deep Learning can assist with battling Covid19 from multiple points of view. Machine learning allows researchers and clinicians to evaluate vast quantities of data to forecast the distribution of COVID-19, to serve as an early warning mechanism for potential pandemics, and to classify vulnerable populations. The arrangement of medical services needs financing for arising innovation, for example, man-made reasoning, IoT, huge information, and AI to handle and anticipate new infections. To more readily comprehend contamination rates and to follow and rapidly distinguish diseases, the AI's force is being abused to address the Covid-19 pandemic. Individuals are constrained by laws to wear face veils out in the open in numerous nations. These standards and laws were created as an activity to the remarkable development in cases and passing in numerous zones. In any case, the way toward observing enormous gatherings of individuals is getting more troublesome. The checking cycle includes the location of any individual who isn't wearing a face cover. Here we present a veil face discovery model that depends on PC vision and profound learning.

II. LITERATURE SURVEY

Face Detection and Recognition using Open CV

In this paper[1] They had the Survey of Face Recognition approach of this has different facial recognition methods. Which combines neural networks, geometric features, graph matching methods, agenface and fisherface methods. and A survey on Multiple Face Detection and Tracking in Crowd different face Detection using crowd techniques are available such as Videos face Detection Automatic pedestrians tracking its use to Crowd, Using Images on detecting and segmenting out crowd of humans from still photos. Density-aware person Detection using “scanning-window”. some basic and important methods of face detection are Knowledge-based methods also include some rule-based method that encode our knowledge of Images, Template matching methods these algorithms compare the input images with stored images and Appearance- base methods A template matching method whose database is learnt from training images.

Joint Face Detection and Alignment using MultiTask Cascaded Convolutional Networks

In this paper [2] they had proposed a new framework to integrate these two tasks using unified cascaded CNNs by multi-task learning. The proposed CNNs consist of three stages. In the first stage, it produces candidate windows quickly through a shallow CNN. Then, it refines the windows to reject a large number of non-faces windows through a more complex CNN. Finally, it uses a more powerful CNN to refine the result and output facial landmarks positions. Thanks to this multi-task learning framework, the performance of the algorithm can be notably improved. The major contributions of this paper are summarized as follows: They proposed a new cascaded CNNs based framework for joint face detection and alignment, and carefully design lightweight CNN architecture for real time performance. They proposed an effective method to conduct online hard sample mining to improve the performance. Extensive experiments are

conducted on challenging benchmarks, to show the significant performance improvement of the proposed approach compared to the state-of-the-art techniques in both face detection and face alignment tasks.

Understanding of a Convolutional Neural Network

In this paper they explained and defineed all the elements and important issues related to CNN, and how these elements work. In addition, we will also state the parameters that effect CNN efficiency. This paper assumes that the readers have adequate knowledge about both machine learning and artificial neural network. They discussed about the important issues that related Convolutional Neural Network (CNN) and explain the effect each parameter on performance of network . The most important layer in CNN is convolution layer Which takes most of the time within the network. Network performance also depends on the number of levels within the network. But in the other hand as the number of levels increases the time required to train and test the network. CNN is considered as power full tool within machine learning for a lot of application such as face detection and image , video recognitions and voice recognition.

Fast Human detection using a cascade of histograms of oriented gradients

In this paper, They first gave some background on human detection. then described the method proposed , followed by the details of our framework and experimental results .In this paper, the detection performance greatly relies on the available motion information. However, for the Dalal-Triggs's INRIA database which contains extremely complicated backgrounds and dramatic illumination changes, the Harr-wavelet feature achieves a much lower detection accuracy than that of the HoG feature. We will demonstrate this point in the Experiments section.

Robust Real Time Face Detection

This paper brings together new algorithms and insights to construct a framework for robust and extremely rapid visual detection. Toward this end we have constructed a frontal face detection system which achieves detection and false positive rates which are equivalent to the best published results (Sung and Poggio, 1998; Rowley et al., 1998; Osuna et al., 1997a; Schneiderman and Kanade, 2000; Roth et al., 2000). This face detection system is most clearly distinguished from previous approaches in its ability to detect faces extremely rapidly. Operating on 384 by 288 pixel images, faces are detected at 15 frames per second on a conventional 700 MHz Intel Pentium III. In other face detection systems, auxiliary information, such as image differences in video sequences, or pixel color in color images, have been used to achieve high frame rates. Our system achieves high frame rates working only with the information present in a single grey scale image. These alternative sources of information can also be integrated with our system to achieve even higher frame rates. There are three main contributions of our face detection framework. We will introduce each of these ideas briefly below and then describe them in detail in subsequent sections. The first contribution of this paper is a new image representation called an integral image that allows for very fast feature evaluation. Motivated in part by the work of al. (1998) our detection system does not work directly with image intensities.

III. METHODOLOGY

The components are used in the project include

A.OpenCV*:*

Open CV (OpenSource Computer Vision Library) is an opensource 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.

B. MTCNN:

MTCCN or Multi Task Cascaded Convolutional Neural Networks is a neural network which detects faces and facial landmarks on images. It is used to detect human face in an image and used to localize the face in that image. It is python (pip) library.

C. CNN:

CNN or Convolution Neural Network is a neural network which is detect if a person is wearing a mask or not.

D. Python:

Python is an interpreted, object – oriented, high- level programming language with dynamic semantics. Python supports modules and packages, which encourages program modularity and code reuse.

E. Spyder:

Spyder is an open-source cross-platform integrated development environment for scientific programming in the Python language

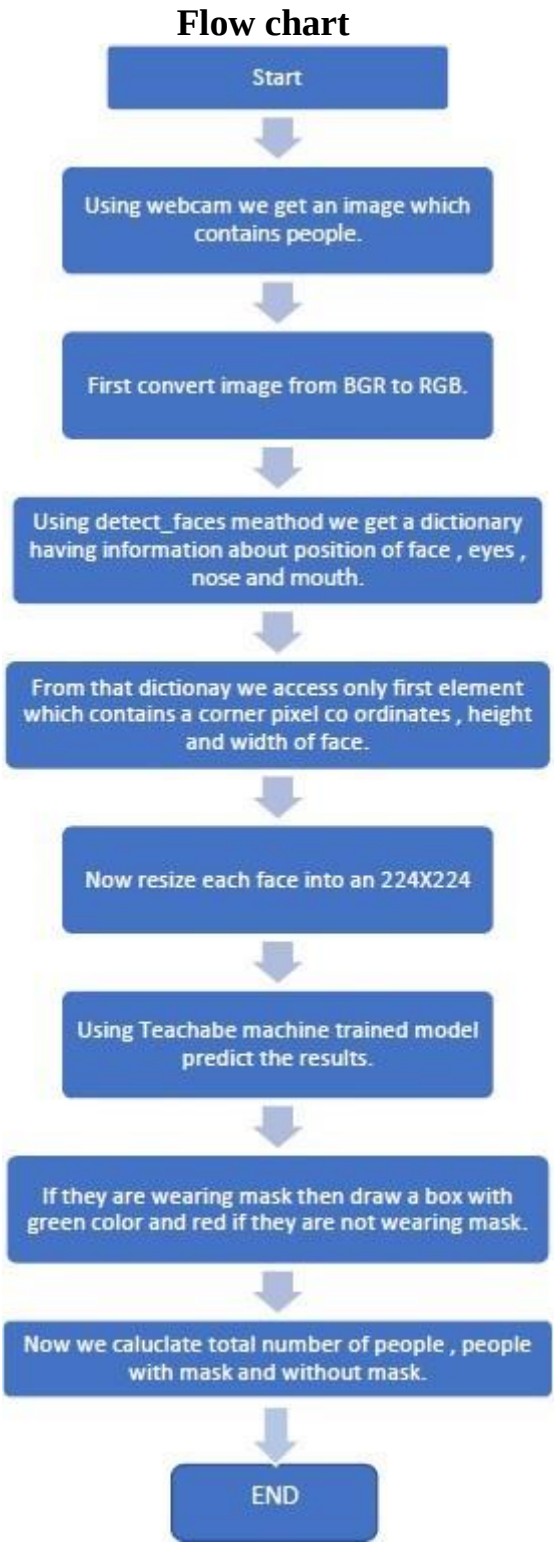
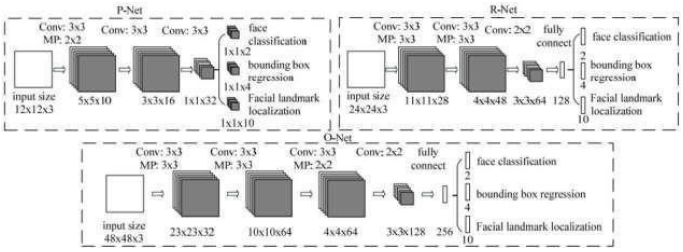


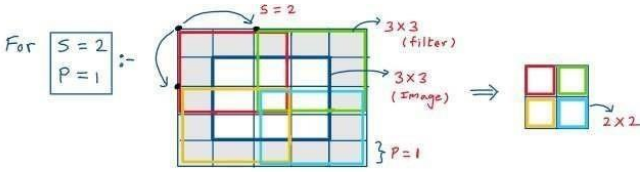
Fig 1: Flow of the process

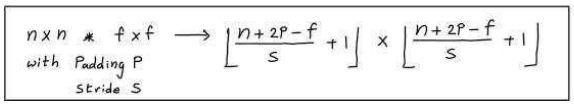
IV. WORKING

For reading images, resizing images, accessing web camera in real time we use OpenCV. By seeing Face Detection and Recognition Using OpenCV we got to know about the usage of functions like cv.imread , cv.capture , cv.resize. Authors [1] used OpenCV for face detecting and recognizing faces. But when we wear mask OpenCV is not able to detect faces. Therefore, we need more powerful algorithm for detecting faces. [4][5] authors used different types of face detecting algorithms one is cascade of histograms which can be used to detect faces and objects which are given in a photo. But in this algorithm all objects including faces are getting detected. But we don't need all of them to be detected. So, we got to know about the famous algorithm called cascade face detector. Here viola – jones used many filters named Haar filters and detected faces. This algorithm gave good accuracy of 90 percent. But again, when we tried for faces with mask it gave good results which are better than OpenCV but all faces were not detected when we use this algorithm. Since cascade face detector cannot detect faces when they are occluded, are in various poses. Later we got to know about MT-CNN algorithm which first resizes the given image into different scaled version of given image which is normally called as "Image Pyramid" and apply three powerful networks namely P-net, R-net, O-net. P-net means Proposal network, R-net means Refine network, O-net means Output network.

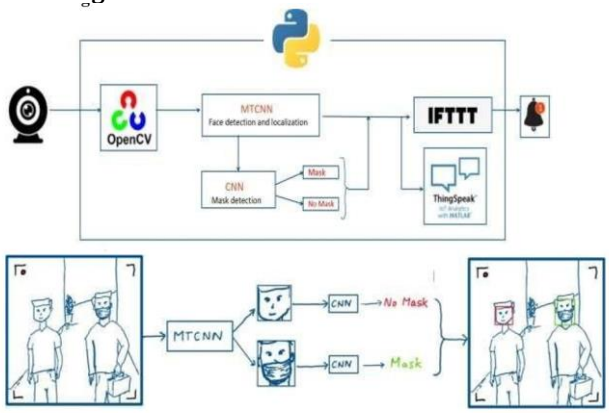


Generally, P-net and R-net are responsible for detecting faces and O-net gives us the locations of facial landmarks like eyes, nose, and mouth. This model has an accuracy of 96 percent. So here we are done with multiple face detection. Now we need mask detection algorithm which has to be trained by our own. By studying [1] we got to know about working of CNN. Basically, what is CNN and what all classification can be done using CNN. (CNN – Convolutional Neural Network) Generally, a CNN is used for image classification, object detection (detection = classification + localization) and other tasks related to images like segmentation, image up-sampling etc. First when an image is given as an input, it is convoluted with a filter or kernel of size f x f with stride of "S" and padding "P".





Block Diagram



Training of the Model

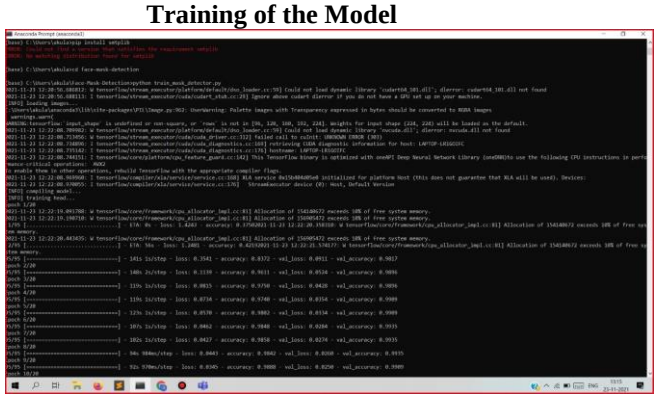


Fig 2 : code

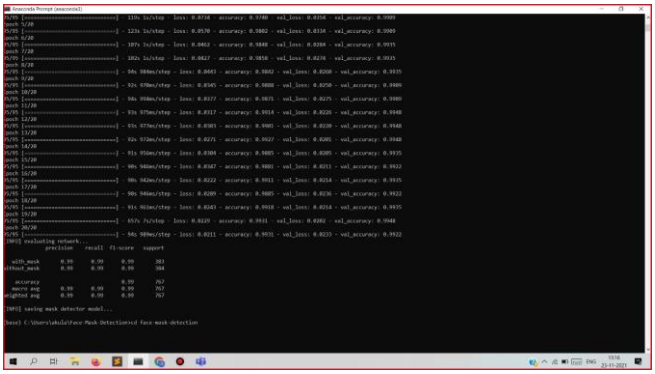


Fig 3 : code

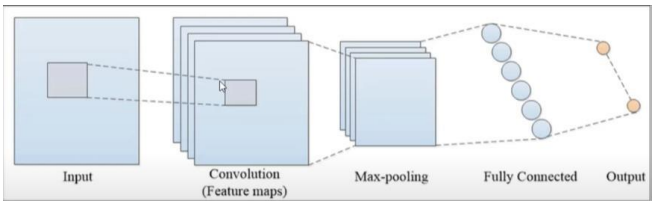


Fig 4: Training part

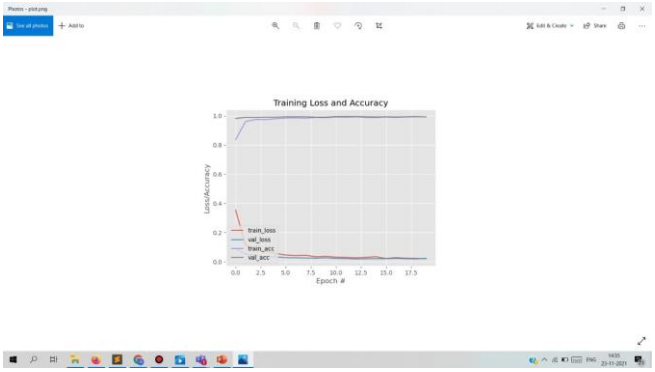


Fig 5 : Training loss and accuracy for the algorithm we trained

Results and Discussion

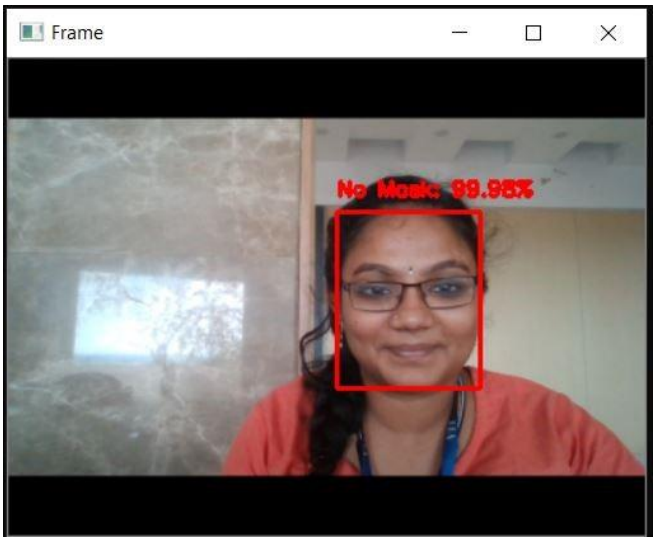


Fig 6 : Trained Algorthim Detects If mask is worn by people is worn or not

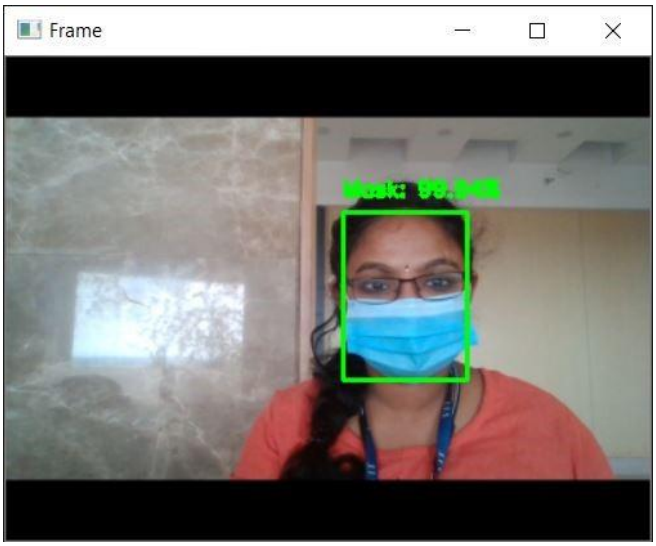


Fig 7: Detection of Mask with Perfection

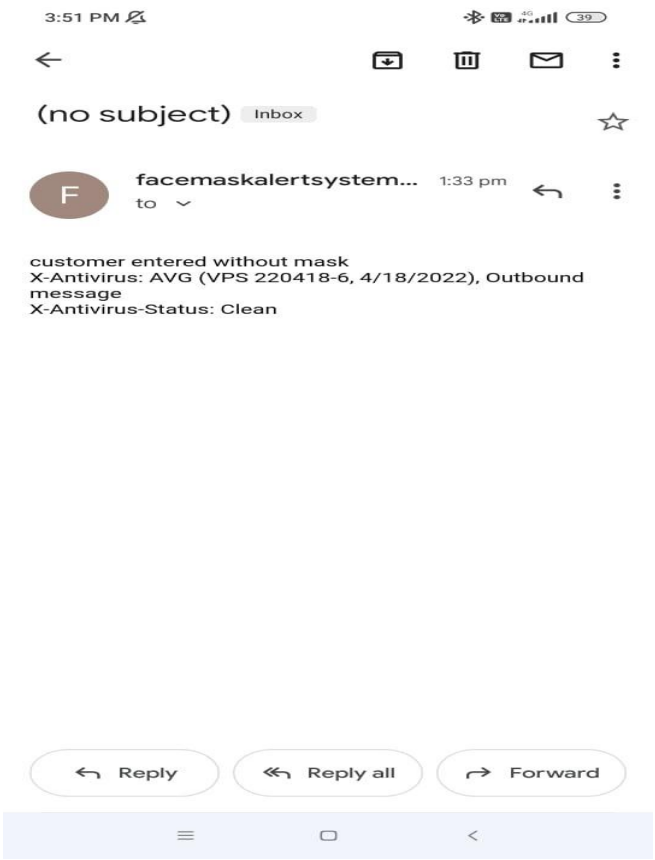


Fig 8 : Email alert if anyone not wearing mask

CONCLUSIONS:

To mitigate the spread of COVID-19 pandemic, measures must be taken. We have modeled a facemask detector using SSD architecture and transfer learning methods in neural networks. To Train , validate and test the model, we used the dataset that consisted of 1916 masked faces images and 1919 unmasked faces images. These images were taken from various resources like Kaggle and RMFD datasets. The model was inferred on images and live video streams. To select a base model, we evaluated the metrics like accuracy, precision and recall and selected MobileNetV2 architecture with the best performance having 100% precision and 99% recall. It is also computationally efficient using MobileNetV2 which makes it easier to install the model to embedded systems. This face mask detector can be deployed in many areas like shopping malls, airports and other heavy traffic places to monitor the public and to avoid the spread of the disease by checking who is following basic rules and who is not.

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