Face Mask Detection Using Convolutional Neural Network

Ranjith R R[1], Praveen kumar D[2], Niveda S[3]
[1, 2] Dept of ECE
[3]Professor, Dept of ECE
[1, 2, 3] Sri Ramakrishna Engineering College, Coimbatore, Indi

Abstract- *The trend of porting face mask publically is rising because of the Covid-19 epidemic everywhere in the world. Because Covid-19 people wont to wear mask to shield their health from air pollution. Whereas other is self-conscious concerning their looks, they hide their emotions from the general public by activity their faces. Somebody treated the wearing face masks works on hindering Covid-19 transmission. Folks are forced by laws to wear face masks publically many countries. These rules and law we have a tendency yore developed as associate degree action to the exponential growth in cases an deaths in several areas. However, the method observation massive teams of individuals is changing into a lot of difficult. Recognition from faces is a popular and significant technology in recent years. Face alterations and the presence of different masks make it too much challenging. In the real-world, when a person is uncooperative with the systems. Here we introduce a mask face detection model that's supported machine learning and image process techniques. The planned model may be detect the mask with image and real time detection people wearing mask or not wearing a mask. The model is integration between deep learning and classical machine learning techniques with OpenCV, Tensor Flow and Keras. We have a tendency to introduced a comparison between them to seek out the foremost appropriate algorithm program that achieved the very best accuracy and consumed the smallest amount time within the method of coaching and detection.*

Keywords- Open CV, Machine learning, Image processing, Tensor flow,Keras, Convolutional neural network, Detection, Accuracy.

I. INTRODUCTION

In 2020, the fast spreading of Covid-19 has forced the who to declare Covid-19 as international pandemic. Quite 5 million cases were infected by Covid-19 in not up to half dozen month across 188 countries. The virus spreads through shut contact and in packed and overcrowded areas. The corona virus epidemic has given rise to a unprecedented degree of worldwide scientific cooperation. Computer science supported machine learning and deep learning will facilitate to fight Covid-19 in several ways. Machine learning a valuate huge quantities of knowledge to forecast the distribution of Covid-19, to function early warning mechanism for potential pandemics, and classify vulnerable population. Recognition from faces is a popular and significant technology in recent years. Face alterations and the presence of different masks make it too much challenging. In the real-world, when a person is uncooperative with the systems. An abundant number of researches work has been performed for recognizing faces under different conditions like changing pose or illumination, degraded images, etc.A feasible approach has been proposed that consists of first detecting the facial regions. and check persons wear mask or not and after checking human body temperature also measured.

II. LITERATURE SURVEY

A unique literature survey has been carried out for the detection of malicious websites. Various literature survey from different journals and conference paper has been studied for best results.

A personalized whitelist approach for phishing face detection(Authors: Toshanlal Meenpal, Ashutosh Balakrishnan)

Fully Convolutional Networks to semantically segment out the faces present in that image. Gradient Descent is used for training while Binomial Cross Entropy is used as a loss function. Further the output image from the FCN is processed to remove the unwanted noise and avoid the false predictions if any and make bounding box around the faces. Furthermore, proposed model has also shown great results in recognizing non-frontal faces. Along with this it is also able to detect multiple facial masks in a single frame. Experiments were performed on Multi Parsing Human Dataset obtaining mean pixel level accuracy of 93.884 % for the segmented face masks.

Face Verification with Disguise Variations via Deep Disguise Recognizer(Authors N. Kohli, D. Yadav, and A. Noore)Residual Inception network framework with center loss

for learning inherent face representations. The training for the Inception-ResNet model is performed using a large-scale face database which is followed by inductive transfer learning to mitigate the impact of facial disguises. To evaluate the performance of the proposed Deep Disguise Recognizer (DDR) framework, Disguised Faces in the Wild and IIITDelhi Disguise Version 1 face databases are used. Experimental evaluation reveals that for the two databases, the proposed DDR framework yields 90.36% and 66.9% face verification accuracy at the false accept rate of 10%.

The above mentioned papers reveal various concepts of finding the Face recognition .. Several approaches based on machine learning are implemented, such as, Haar cascade,CNN algorithm. Compared to those papers the proposed model achieves better performance with more accuracy.

III. METHODOLOGY

In this section, we will introduce the framework of our system and corresponding implementation details of Face detection. We adopt Machine Learning to assist the identification of face detection.

Machine Learning is a subset of Artificial Intelligence and is based on the idea that machine should be given access to the data and should be left to learn and explore for themselves. It deals with the extraction of patterns from large data sets. Machine Learning enables a machine to automatically learn from the data, improve performance from experiences and predict things without being explicitly programmed. The process of learning begins with observations or data, such as examples, direct experience, or instruction, in order to look for patterns in data and make better decisions in the future based on the examples that we provide. The primary aim is to allow the computers learn automatically without human intervention or assistance and adjust actions accordingly. The reason behind the need for machine learning is that it is capable of doing tasks that are too complex for a person to implement directly. Supervised learning is a type of machine learning method is used. which provides sample labeled data to the machine learning system in order to train it, and on that basis, it predicts the output. The goal of supervised learning is to map input data with the output data. The supervised learning is based on supervision, and it is the same as when a student learns things in the supervision of the teacher. Supervised learning can be grouped further in two categories of algorithms:

1. Regression
2. Classification

The software used for our project is Python Version 3. It is an open source programming language. Python was made to be easy-to-read and powerful. Python is an interpreted language. Interpreted languages do not need to be compiled to run. A program called an interpreter runs Python code on almost any kind of computer. This means that a programmer can change the code and quickly see the results. This also means Python is slower than a compiled language like C, because it is not running machine code directly. Python is a good programming language for beginners. It is a high-level language, which means a programmer can focus on what to do instead of how to do it. Writing programs in Python takes less time than in some other languages. Its standard library is made up of many functions that come with Python when it is installed. On the Internet there are many other libraries available that make it possible for the Python language to do more things. These libraries make it a powerful language, it can do many different things. Python 3.0 (also called "Python 3000" or "Py3K") was released on December 3, 2008. It was designed to rectify fundamental design flaws in the language, the changes required could not be implemented while retaining full backwards compatibility with the 2.x series, which necessitated a new major version number. The guiding principle of Python 3 was to reduce feature duplication by removing old ways of doing things. Some of the library modules in Python includes:

1. NUMPY
2. PANDAS
3. MATPLOTLIB
4. SKLEARN

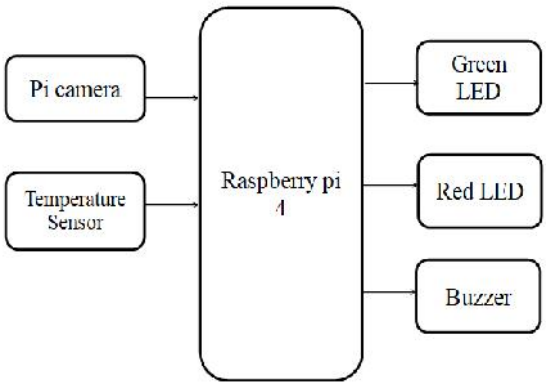

Fig. 1. Block Diagram

The figure 1 shows the block diagram of the proposed model. Each module description is given as follows:

A. Raspberry pi 4

Raspberry Pi board is a miniature marvel, packing considerable computing power into a footprint no larger than a creditcard. It's capable of some amazing things, but there are a few things you're going to need to know before you plunge head-firstinto the bramble patch. A camera records and stores photographic image in digital form. Many current models are also able to capture sound or video, in addition to still images. Capture is usually accomplished by use of a photo sensor, using a charged coupled.

B. Temperature sensor

A temperature sensor is an electronic device that measures the temperature of its environment and converts the input data into electronic data to record, monitor, or signal temperature changes. There are many different types of temperature sensors. Some temperature sensors require direct contact with the physical object that is being monitored (contact temperature sensors), while others indirectly measure the temperature of an object (non-contact temperature sensors).

C. LED

LED lights are ideal for numerous applications including night lighting, art lighting, and outdoor lighting. These lights are also commonly used in electronics and automotive industries, and for signage, along with many other uses.

D. Buzzer

A buzzer or beeper is an audio signalling device, which may be mechanical, electromechanical, or piezoelectric (piezo for short). Typical uses of buzzers and beepers include alarm devices, timers, and confirmation of user input such as a mouse click or keystroke.

E. Haar Cascade Algorithm

Object Detection using Haar feature-based cascade classifiers is an effective object detection method proposed by Paul Viola and Michael Jones in their paper, "Rapid Object Detection using a Boosted Cascade of Simple Features" . It is a machine learning based approach where a cascade function is trained from a lot of positive and negative images. It is then used to detect objects in other images.

Here we will work with face detection. Initially, the algorithm needs a lot of positive images (images of faces) and negative images (images without faces) to train the classifier. Then we need to extract features from it. For this, Haar features shown in the below image are used. They are just like our convolutional kernel. Each feature is a single value obtained by subtracting sum of pixels under the white rectangle from sum of pixels under the black rectangle.

all possible sizes and locations of each kernel are used to calculate lots of features. (Just imagine how much computation it needs? Even a 24x24 window results over 160000 features). For each feature calculation, we need to find the sum of the pixels under white and black rectangles. To solve this, they introduced the integral image. However large your image, it reduces the calculations for a given pixel to an operation involving just four pixels.

F. CNN Algorithm

With the development of convolutional neural networks, the achievements made in various competitions are getting better and better, making it the focus of research. In order to improve the training performance of the forward BP algorithm, an effective method is to reduce the number of learning parameters. This can be done by convolution of the spatial relationship of the neural network. Convolutional neural network, the network structure is proposed, it minimizes the input data pretreatment. In the structure of convolution neural network, the input data is input from the initial input layer, through each layer processing, and then into the other hierarchy, each layer has a convolution kernel to obtain the most significant data characteristics. The previously mentioned obvious features such as translation, rotation and the like can be obtained by this method.

Image processing based on convolutional neural networks needs to collect a large number of pictures for the computer to learn. This topic will take a lot of people a lot of images, after collecting a lot of images cropped irrelevant parts of the face. This article uses the face detection and cut saved in the created folder. At this time, the collected images have been trimmed and resized. Then all the images are stitched and stitched in the olivettifaces face dataset, each line represents the category of two people, after all the face images stitching together, and then get the small face database gray degree treatment.

In terms of algorithms, there are sharing parameters between the convolution layer and the convolution layer of CNN. The advantage of this is that the memory requirements are reduced, and the number of parameters to be trained is correspondingly reduced. The performance of the algorithm is therefore improved. At the same time, in other machine learning algorithms, the pictures need us to perform preprocessing or feature extraction. However, we rarely need

to do these operations when using CNN for image processing. This is something other machine learning algorithms cannot do. There are also some shortcomings in depth learning. One of them is that it requires a lot of samples to construct a depth model, which limits the application of this algorithm. Today, very good results have been achieved in the field of face recognition and license plate character recognition, so this topic will do some simple research on CNN-based face recognition technology.

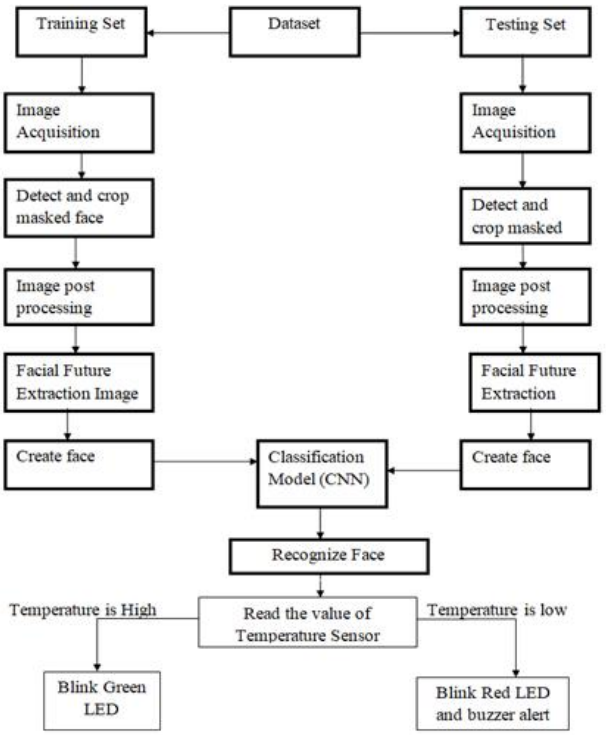

Fig. 2. Flow Diagram

The figure 2 shows the flow diagram of the project. Various steps are given as follows:

1. Dataset: Collection of masked and without masked images.
2. Training set/Testing set:Training set is a subset to a train model.Test set is a subset to the trained model.
3. Image Acquisition:It is achieved by suitable camera.It include the processing,compression,storage,printing and display.
4. Detect and Masked crop face:To detect the image whether it has a mask and crop the masked face.
5. Image Post processing:It is the process of editing the data captured by the camera.
6. Facial Future attraction:Detection of features of human face like eyes,nose,mouth,etc.
7. CNN & Recognise Face:It is used to detect the types of image whether the person wears his mask or not.It recognize the face and declare the output.
8. Temperature sensor:It measures the temperature of the human.If the human has high temperature buzzer will sound and red LED will blink.If the human has normal temperature green LED will blink.

IV. EXPERIMENTAL RESULTS

There are four types of results:

- With mask & Normal temperature
- Without mask & High temperature
- With mask & High temperature
- Without mask & Normal temperature

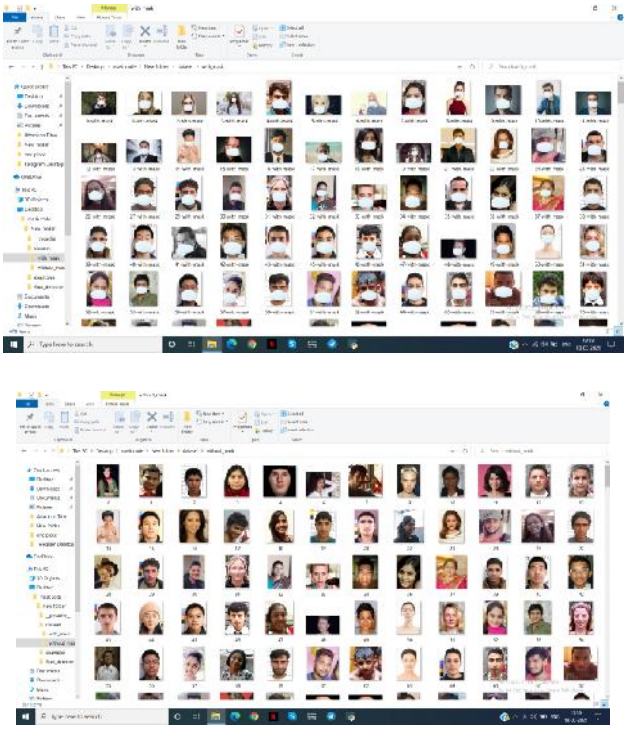

Fig. 3. Datasets Collected

Figure 3 represents the collection of images. A number of images which contain both mask and without masked images.

These set of images used for training the image.

Fig 4: With mask & Normal temperature

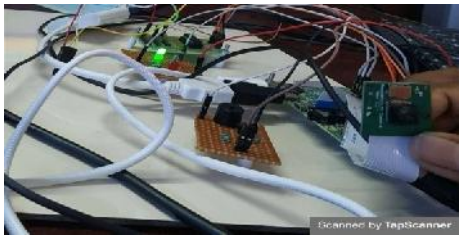

Fig 5 : Green LED

In this method fig(4) shows that to identify the person wearing mask are not by scanning and if mask is ok he is allowed and then the buzzer sounds and Green LED glows which shows in the fig(5)

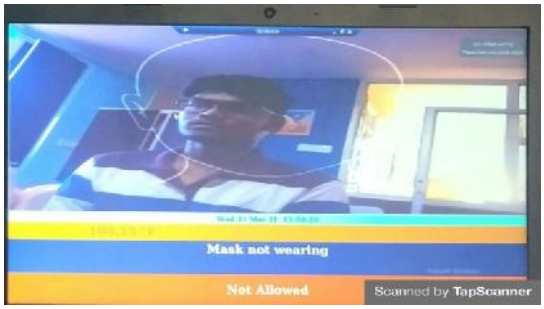

Fig 6: High Temperature & Not wearing mask

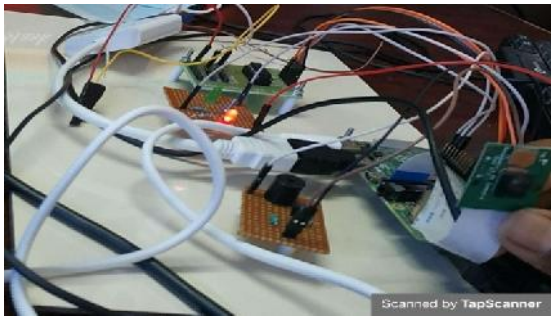

Fig 7 : Red LED

In this method fig(6) shows that to identify the person wearing mask or not by scanning and if Mask is not wearing he is not allowed and then the buzzer sounds and Red LED glows shown
in the fig(7).

Fig 8: Wearing mask & High Temperature

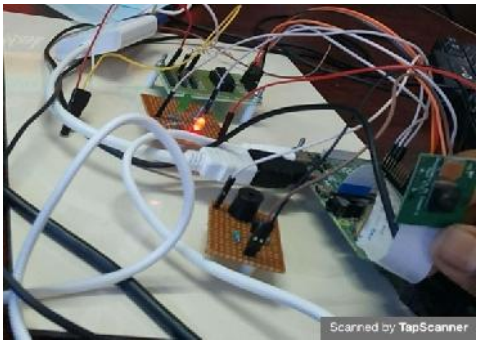

Fig 9: Red LED

In this method fig(8) shows that to identify the person wearing mask and he has high temperature so he is not allowed and then the buzzer sounds and Red LED glows shown in the fig(9).

Fig 10: Not wearing mask & Normal temperature

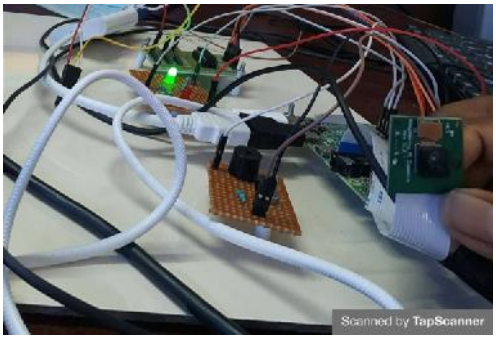

Fig 11: Green LED

In this method fig(10) shows that to identify the person not his wearing mask and he has normal temperature so he is not allowed and then the buzzer sounds and Green LED glows shown in the fig(11).

V. CONCLUSION

As the technology are blooming with emerging trends the availability so we have novel face mask detector which can possibly contribute to public health care department. The architecture consist of cascade classifier as the back bone and low computation scenarios. The our face mask detection is trained on CNN model and we are used OpenCV, Tensor Flow, Keras and python to detect whether person is wearing a mask or not. The model were tested with image and real is achieved and, the optimization of the model is continuous process. This specific model could be used as use case of edge analytics

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