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Covid-19 - Detection of Unconstrained Face-Mask Framework

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Abstract. The main objective of this project is to identify if a person is wearing a mask or not, properly wearing a mask or face hand interaction. The present scenario of COVID-19 demands an efficient face mask detection application. Reports indicate that wearing face masks clearly reduces the risk of transmission [1]. Thus we are introducing a system based on Deep learning and Machine learning such that it can identify if a person is either wearing a mask properly or not. To implement the process, we consider the dataset that contains images of masked and unmasked faces that will undergo pre-processing such as data cleansing and data augmentation. The data will be trained using ML techniques like transfer learning that will accelerate the training speed and calculate the probabilities as well. The project is built using Convolution Neural Network (CNN) with OpenCv libraries along with computer vision. The implementation will be in Python. This system can be implemented in various areas such as grocery stores, movie theatres, hospitals, malls, and other places where there is more crowd.

Keywords: Covid-19, Deep Learning, Machine Learning, CNN, OpenCV

1. Introduction

1.1 About Project

The novel coronavirus covid-19 had brought a new normal life. Declared by the WHO that a potential speech by maintaining distance and wearing a mask is necessary. But many people are getting out without a face mask this may increase the spread of covid-19. Economic Times India has stated that " Survey [2] Shows that 90 percent Indians are aware, but only 44 percent wearing a mask ". This may result in the easy spreading of covid-19 in public places. To reduce the possibility of infection, it is advised that people should wear masks and maintain a distance of at least 1 meter from each other [3]. Deep learning has gained more attention in

object detection and was used for human detection purposes and to develop a face mask detection tool that can detect whether the individual is wearing a mask or not.

1.2 Objective of the project

The main objective of the face detection model is to detect the face of individuals and conclude whether they are wearing masks or not, wearing mask properly, or if there is face-hand interaction at that particular moment when they are captured in the image.

1.3 Scope of the project

This method is developed in an efficient way for the people who are not wearing face masks. This system can be implemented in various areas such as

- Grocery stores
- Movie theatres
- Hospitals
- Malls
- Convention centres
- Educational Institutions

and other places where there is a chance of high traffic.

2. Literature Survey

2.1 Existing System

When someone is entering into a public space and if the person is not wearing a mask then it is compulsory that someone like security or a volunteer to guide the person. The existing system is purely manual that if someone is found without face mask then he will be instructed wear it. There is no alternative for it. Sometimes someone may enter in a public place without noticing it and it will cause the spreading of Covid-19. There will be two problems,

- No one will be there for controlling the passing of people without mask every moment and thus spreading of covid 19 will be easy.
- Manual method is purely expensive.

An Automated System to Limit COVID-19 Using Facial Mask Detection in Smart City Network [4]. In this paper, we propose a system that restrict the growth of COVID-19 by finding out people who are not

wearing any facial mask in a smart city network where all the public places are monitored with Closed-Circuit Television (CCTV) cameras.

Face Recognition Using Deep Neural Network [5]. In this proposed approach, only the extracted facial features are provided instead of providing raw pixel values as input. Facial features are being extracted with the help of Haar-Cascade and feeding these facial features rather than raw pixel values.

2.2 Proposed System

An automated system where a camera is capturing video and recognizing a person without wearing a mask.

- It is possible by training the images and techniques used in CNN.

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

3. Proposed Architecture

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3.1 System Architecture

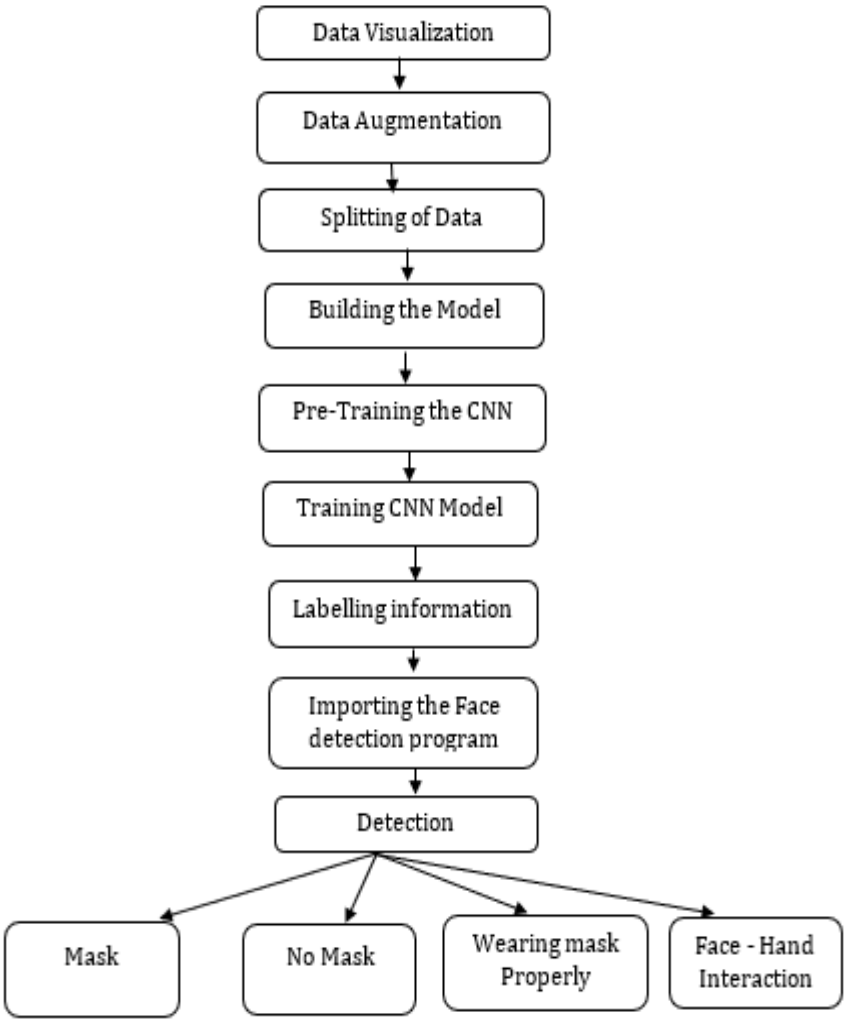

Fig. 1. Architecture

3.2 Block Diagram

A block diagram is a graphical representation of a system – it provides a functional view of a system. Block diagrams give us a better understanding of a system's functions and help create interconnections within it. They are used to describe hardware and software systems as well as to represent processes.

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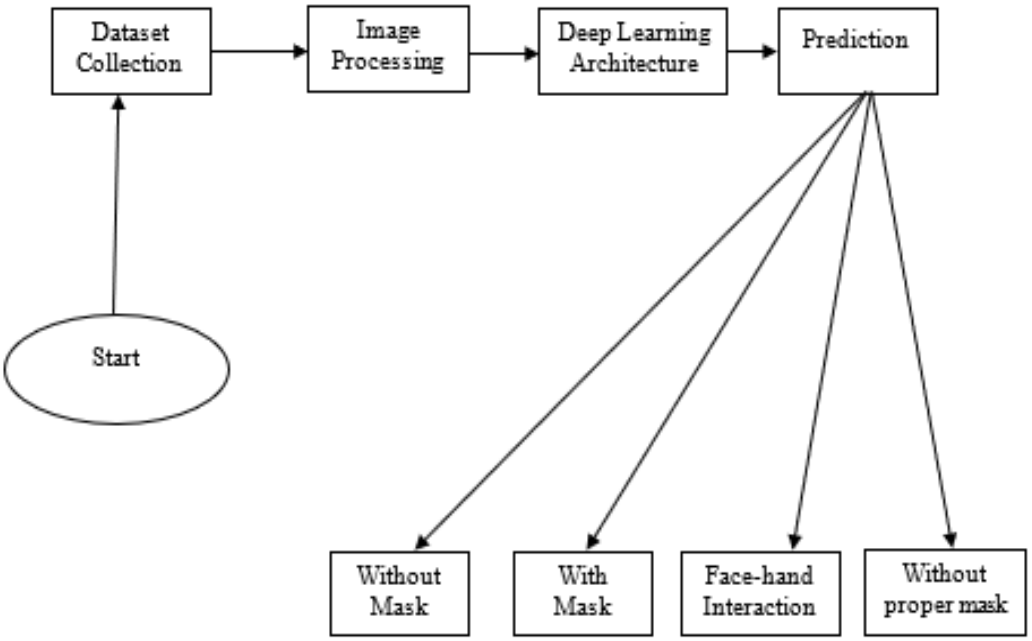

Fig. 2. Block Diagram

3.3 Sequence Diagram

A sequence diagram is a type of interaction diagram because it describes how and in what order a group of objects works together. Sequence diagrams can be useful references for businesses and other organizations. Try drawing a sequence diagram to:

- Represent the details of a UML use case.
- Model the logic of a sophisticated procedure, function, or operation.
- See how objects and components interact with each other to complete a process.
- Plan and understand the detailed functionality of an existing or future scenario.

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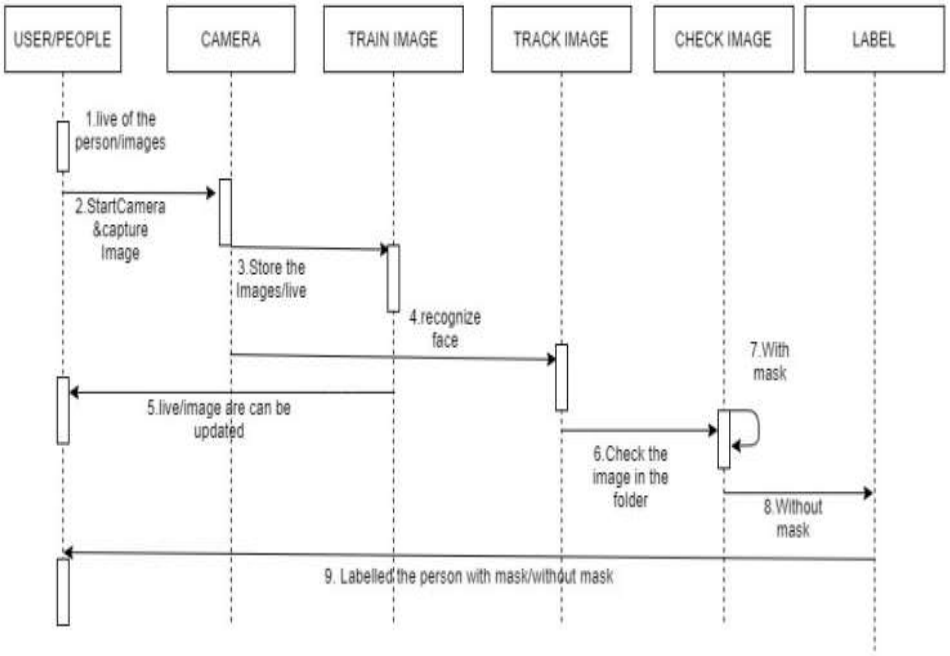

Fig. 3. Sequence Diagram

3.4 Class Diagram

Class diagram is a static diagram. It represents the static view of an application. Class diagrams are the only diagrams which can be directly mapped with object-oriented languages and thus widely used at the time of construction.

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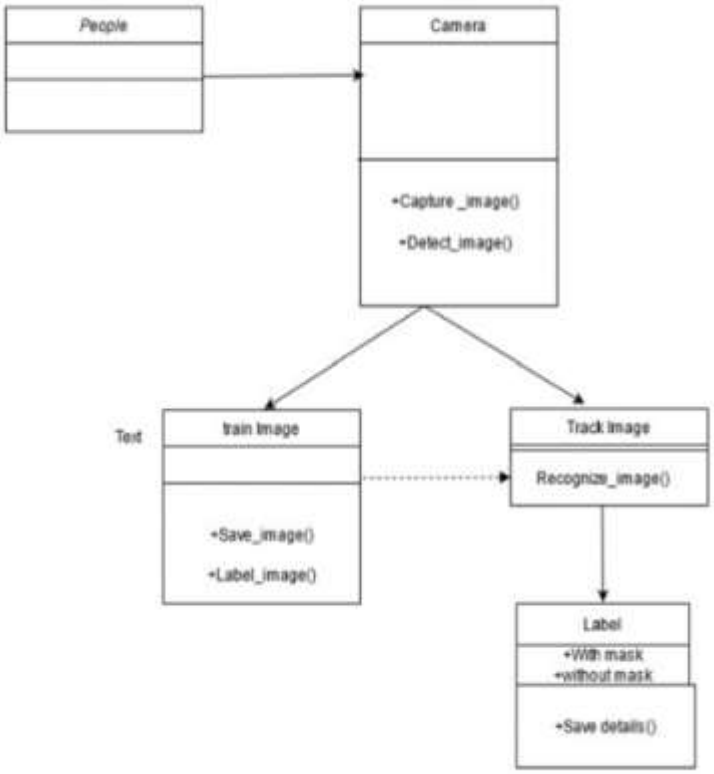

Fig. 4. Class Diagram

3.5 Activity Diagram

An activity diagram is a behavioral diagram i.e., it depicts the behavior of a system. An activity diagram portrays the control flow from a start point to a finish point showing the various decision paths that exist while the activity is being executed.

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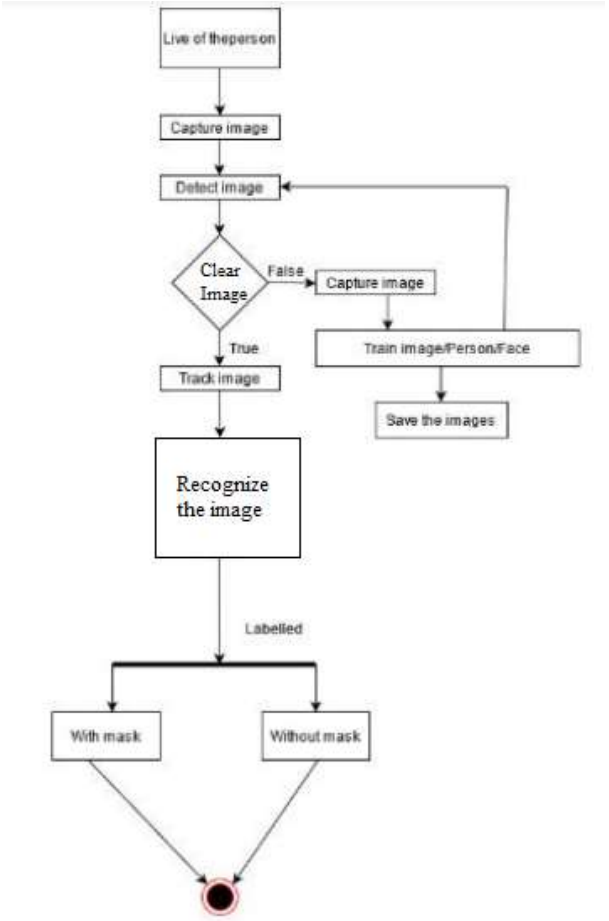

Fig. 5. Activity Diagram

3.6 User Interface Layouts

User interface design (UI) or user interface engineering is the design of user interfaces for machines and software, such as computers, home appliances, mobile devices, and other electronic devices, with the focus on maximizing usability and the user experience. The goal of user interface design is to make the user's interaction as simple and efficient as possible, in terms of accomplishing user goals (user-centred design).

4. Implementation

4.1 Algorithm

The implementation of the project is carried out in Pycharm. Deep learning Technique is used in our system with CNN. Convolutional Neural networks is used for image extraction [6]. Even though current machine recognition systems have reached a certain level of maturity, their success is limited by the conditions imposed by many real applications [7]. Face verification involves determining whether a pair of facial images belongs to the same or different subjects. This problem [8] can prove to be quite challenging in many important applications where labelled training data is scarce.

To train the face mask detector, we have to divide our project into two stages:

Training. We will collect our facial mask detection record of a hard drive to form a model (with keras / tensorflow) and finally serialize the facial mask detector on the disk.

Deployment. After the face mask detector has been trained, we perform face recognition, and then decide whether each face is equipped with or without a mask. Also, it will require a webcam.

Step 1: Dataset is collected that consists of Masked face images, Unmasked face images, Face hand interaction images.

Step 2: Data pre-processing is a process of preparing the raw data and making it suitable for a machine learning model. It is the first and crucial step.

Step 3: Split the data

- Training Data
- Testing Data

Step 4: Building the Model

Step 5: Testing the Model

Step 6: Implement the Model

4.2 Code Implementation

Tensorflow. TensorFlow is an amazing information stream in machine learning library made by the Brain Team of Google and made open source in 2015.It is intended to ease the use and broadly relevant to both numeric and neural system issues just as different spaces. Fundamentally, TensorFlow is a low-level tool for doing entangled math and it targets specialists who recognize what they're doing to construct exploratory learning structures, to play around with them and to transform them into running programs.

Python 3.7. Python is broadly utilized universally and is a high-level programming language. It was primarily introduced for prominence on code, and its language structure enables software engineers to express ideas in

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fewer lines of code. Python is a programming language that gives you a chance to work rapidly and coordinate frameworks more effectively.

5. Result

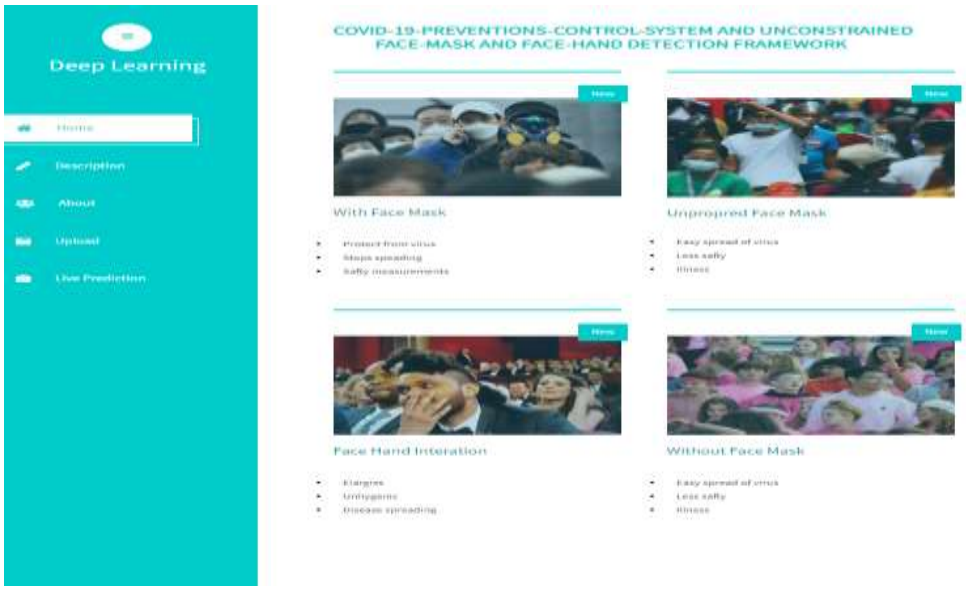

Fig. 6. Front - End Home Page

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Fig.7. Description Bar

On uploading an image from dataset, it identifies if the person is wearing a mask or not, wearing the mask properly, or if there is face-hand interaction.

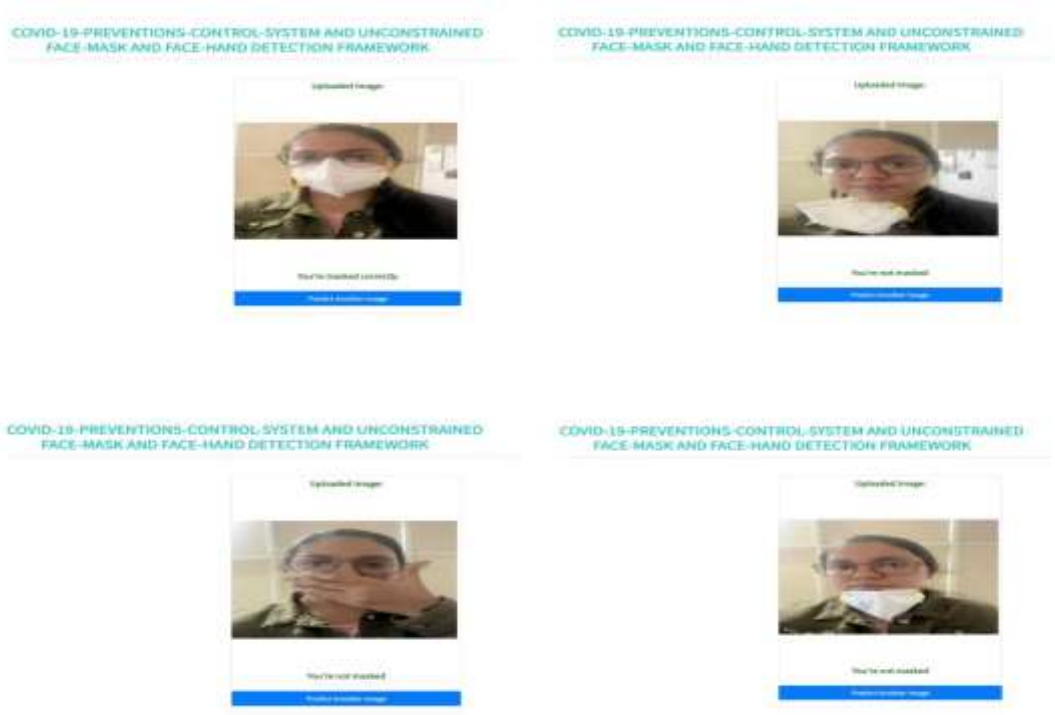

Fig. 8. Uploading images from Dataset

The results are more of what was expected of the model. The mask recognition is implemented using the camera as a medium and shows accurate results. When the person's face is in the camera frame, model will detect the face and a green or blue or red frame will appear over the face. A person who is not wearing mask will get a green frame over his face in camera while the person who is wearing mask will get a blue frame and person hiding his/her face using his/her hand will get a red frame. A percentage match can also be seen on the top of the result frame.

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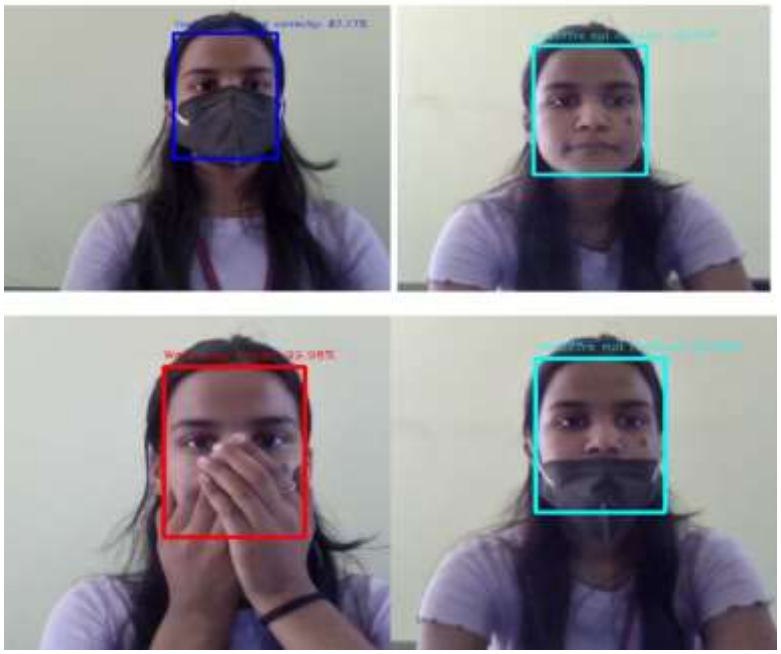

Fig. 9. Live Prediction

6. Conclusion

We used tensorflow, and CNN as deep learning architecture to develop an efficient network for recognising facemasks. This project can instantly recognise the faces of the mask from any angle. It generates output from an RGB input image of any orientation [9]. The primary responsibility of this function is to extract characteristics from photographs and predict which class they belong to. The dimensionality of photographs is reduced to an efficient representation in this section. In our recommended concept, the camera might be utilised to recognise the mask face. We are provided some model data with their accuracy level when the training phase is done. The models were tested with stored images and live images. By the development of face mask-detection we can detect if the person is wearing a face mask and allow their entry would be of great help to the society by reducing the spread of corona virus. Along with the advantages, there are disadvantages to every model. The disadvantages that are caused by this model are:

1. Massive data storage burden.

2. Detection is vulnerable.

3. Live detection varies in nanoseconds.

7. Future Scope

Across the globe more than 70 countries have made it mandatory to wear masks at all public places. Computer vision learning pay a high attention due to global pandemic COVID-19 to enhance public health service [10]. If you want to go out you have to cover your face in schools, supermarkets, transports, offices, stores and at all public places. This web application can be used with any current USB, IP, or CCTV cameras for identifying people who do not wear a mask. The live video mask detection function can be introduced in web and desktop applications so that the operator may know whether users are not wearing masks and warning messages can be lost. If anyone isn't wearing a mask, images should be submitted to software operators. Furthermore, we can mount an alarm device that will emit a beep sound if anyone enters the area without wearing a mask. Only people wearing face masks can enter using this application software, which can be linked to the entrance gates. This system could be connected in hospital gates, schools, malls and at many more public places, and also proper lighting and usage of efficient cameras, the accuracy of the system can be improved.

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