

FACE MASK DETECTION

Project Work Synopsis

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Abstract

The novel Coronavirus had brought a new normal life in which the social distance and wearing of face masks plays a vital role in controlling the spread of virus. But most of the people are not wearing face masks in public places which increases the spread of viruses. Hence to avoid such situations we have to scrutinise and make people aware of wearing face masks. Humans cannot be involved in this process, due to the chance of getting affected by corona. Hence here comes the need for artificial intelligence (AI), which is the main theme of our project. Our project involves the identification of persons wearing face masks and not wearing face masks in public places by means of using image processing or OpenCV and other AI techniques for giving alert through our UI to that person that they need to wear a mask. The object detection algorithms are used for identification of persons with and without wearing face masks which also gives the count of persons wearing mask and not wearing face mask. Based on the count of persons wearing and not wearing face masks the status is obtained. We can also keep the record of who is entering without a mask at which time so we can use that record for future purposes. We can also use Raspberry pi and Arduino for mechanical Work. We can use this model in offices where our model can keep the record of person who is not wearing mask and can send the mail or contact them that they need to wear the mask.

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Introduction

Problem Definition: The novel coronavirus covid-19 had brought a new normal life. India was struggling to get out of this virus attack and the government implemented a lockdown for the long way. Lockdown placed a pressure on the global economy. So, the government gave relaxations in lockdown. Declared by the WHO that a potential speech by maintaining distance and wearing a mask is necessary. The biggest support that the government needs after relaxation is social distancing and wearing of masks by the people. But many people are getting out without a face mask this may increase the spread of covid-19. According to Economic Times, India has stated that "90 percent Indians are aware, but only 44 percent are wearing a mask". This survey clearly points that people are aware but they are not wearing the mask due to some discomfort in wearing and carelessness. This may result in the easy spreading of covid-19 in public places. So, it is important to make people wear masks in public places. In densely populated regions it is difficult to find the persons not wearing the face mask and warn them. Hence, we are using image processing techniques for identification of persons wearing and not wearing face masks. The real time images from the camera are compared with the trained dataset and detection of wearing or not wearing a mask is done. The trained dataset is made by using machine learning technique which is the deciding factor of the result. The algorithm created by means of using a trained dataset will find the persons with and without wearing face masks.

Project Overview:

The System which we are proposing we are trying to eliminate cons of the existing system by making it more beneficial and reliable.

In the current system the accuracy of the system is very low and inefficient and even it doesn't guide or warn our user to wear the mask, in our project our UI will guide the user to wear the mask and even our program will send the mail to the authorised committee which will tell that this person is not wearing any mask by sending the picture as well.

The System which we are proposing needs very low maintenance and it is automated, we just need to run the program and then it will handle everything else on its own and by this, our work will be done with least efforts and effectively.

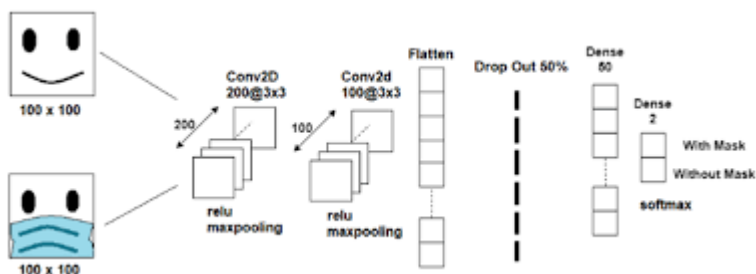


Figure 1: Network Architecture

We also added a feature that we can add a video or an image and our program can tell that which person is wearing mask and which person is not wearing mask with an accuracy percentage. We are also trying to add some other warning devices which will warn the person that he/she is not wearing mask

like a beeping device or a LED which will turn Red when a person is not wearing any mask.

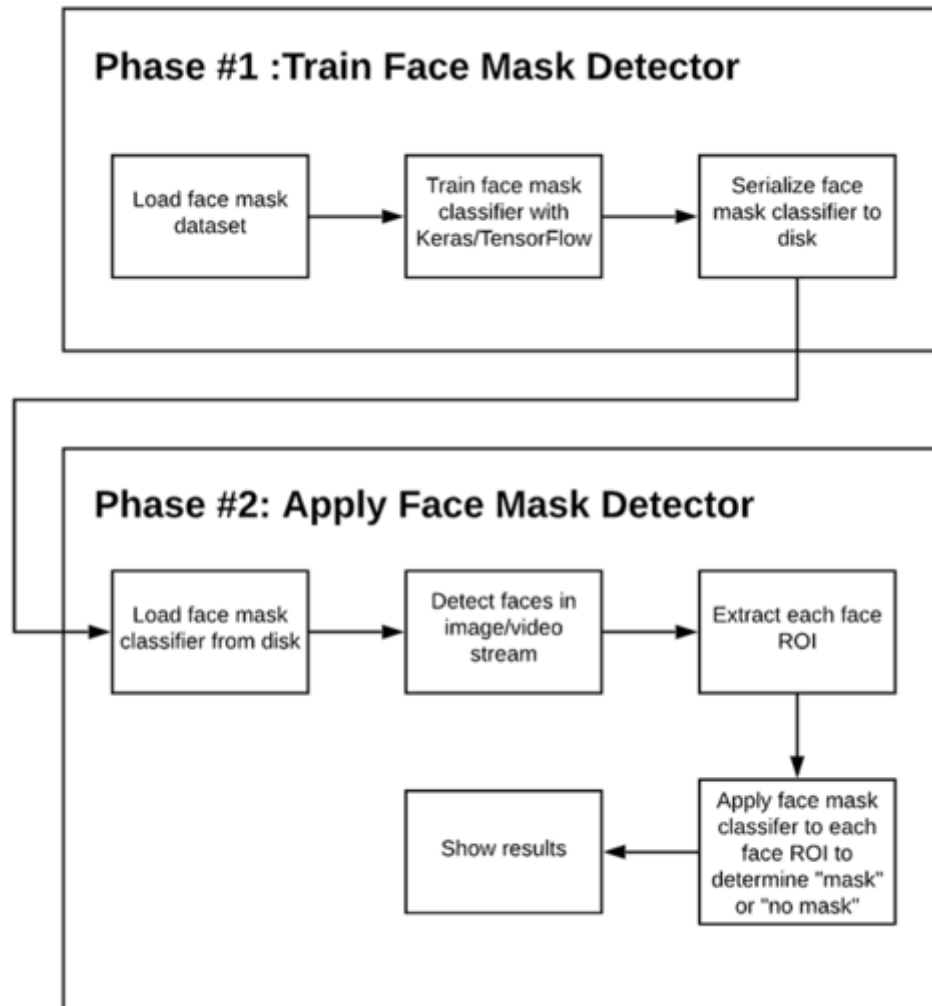


Figure 2: Facial Mask Detection System Structure

If someone tries to get inside without wearing any mask then the machine will take the picture of that person and send it to the authorised committee in real time and will start beeping and our UI will tell him/her that they need to wear the mask to control the spreading of Coronavirus.

As we previously stated that for now our project is only software based but for future purposes, our project will use a camera to identify and recognise faces and there face mask, and we are also using a UI guidance system, which will necessitate the use of a speaker. We'd also need a device to maintain all these things and where our software will be loaded; an ideal choice would be a Raspberry Pi or an Arduino Board, but as we're simply submitting software, we won't be utilising one. Also, our programme is OS independent as long as all dependencies are loaded. We developed it on our personal computers. We've also tested on a variety of operating systems, including Windows, Ubuntu, etc.

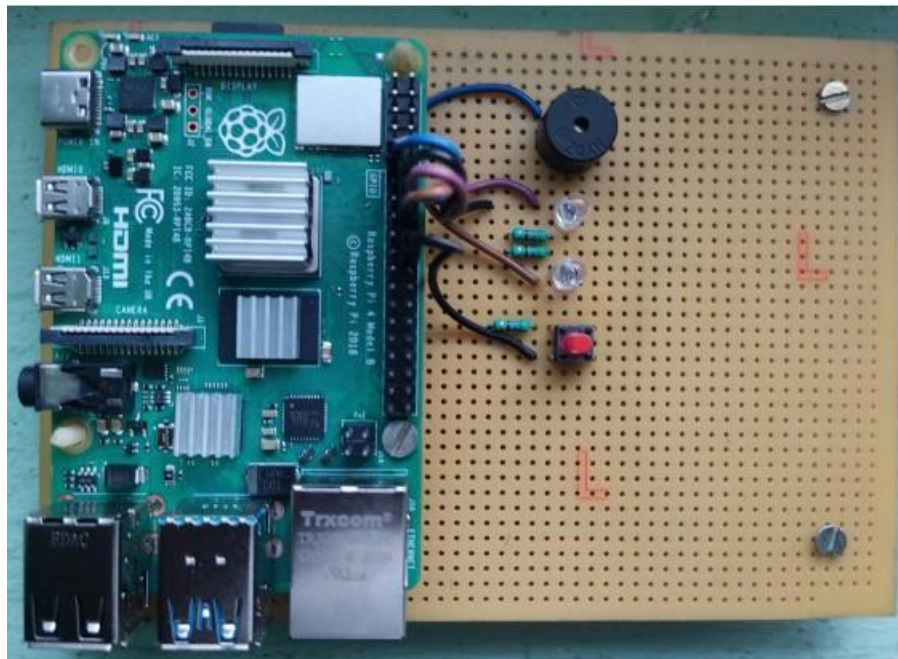


Figure 03: Prototype model of Face Mask Detection

Software Used

The most basic requirement is python, as the entire software is built on it. We would also require pip to install additional packages. A large number of Python modules would be required like TensorFlow and Keras Modules for face building module and making predictions. Google Text to Speech (gTTS), Computer Vision (cv2), and Smtplib Module for sending Email's to the authorised committee. The most fundamental need is Github. GitHub is a version management and collaboration tool for programming. For receiving the response from the owner, we will use the web framework Flask, which is developed in Python and we are also using .caffemodel and .prototxt file for face detection and we'll also need a dataset (.xml file) for training our data. We have used different text editors and IDE like some are spyder, emacs, vscode, jupyter-notebooks for writing code.

Literature Survey

Existing System:

In the current system for face mask detection the efficiency is very low like if a person is wearing a mask on mouth but not covering there nose then also it doesn't warn that person but, in our project if the efficiency is less than 75% our UI will start warning that person that they need to wear the mask properly and if he/she still doesn't wear mask properly then we will click the photo of that person and send the authorised committee for taking the further actions.

Furthermore, there really is no automation for doing all the things adjacently, kind of, there was always a need for a person to maintain all these features adjacently and there are many places where committee assigns a person for this work only to report them who is wearing the mask and who is not which will increase the hand work and that person need to do everything on his own like warning people that they need to wear the mask and all so our project is solving every problem we might face in the future as well. There is one more problem that the existing system is facing, i.e., the real time pictures and the reporting of that pictures on time, the existing program takes at least 10-15 minutes for reporting that picture and in the meantime that person might leave or wears a mask so that is also a concerned problem that we need to warn them in the real time.

The existing systems are controlled manually.

Also, existing systems are very complex and hard to maintain like we need to fetch details of every minute from existing project and then we can proceed, we also face these problems in our existing system–

- ❖ No Automated facial recognition.
- ❖ No real time information gathering and sending to the authorised committee.

Proposed System:

We particularly have updated fairly many for all intents and purposes superior functions in the proposed system of our project Face Mask Detection to generally make the system generally more definitely effective and profitable, pretty contrary to popular belief.

Such as, if any person tries to enter at a place where our program is established then he/she needs to wear a mask for the safety of everyone. Our program ensures the safety level and prevents the spread of coronavirus.



Figure 4: Output of Our Program

We are also trying to add a beeping machine and a LED which will display the status of a person whether he/she is wearing any mask or not and we are also adding a UI which will warn people to wear the mask by using the AI. This program can be used in many places because everybody is trying to stop the spreading of coronavirus.

Status	Green LED	Red LED	Buzzer
Safe	ON	OFF	OFF
Warning	OFF	ON(Blink)	ON(Blink)
Danger	OFF	ON	ON

Figure 5: What our LED and Beeping Machine is displaying



Figure 6: Email Alerts

Our program will send the image of the person who is not wearing any mask to the authorised authority in real time so our committee can take the required actions accordingly and for warning purposes our Beeping machine and LED's will work.

Problem Formulation

- ❖ While installing the cv2 module we encounter a problem, which for the most part is fairly significant.
- ❖ The face a lot of problem to collect the dataset. However, we did it well in few days. but then the difficulty was to convert it into an array and add a another dimension layer because our CNN Architecture needs fine tuning for it.
- ❖ We also face problems in speech recognition accuracy, so
- ❖ While installing the cv2 module we encountered a problem, which particularly is quite significant.
- ❖ We face problem while setting up smtp and mostly send mails to user, demonstrating that
- ❖ We also face problem to get the model trained easily because none of us have the GPU in our home. Also, google colab does not let us upload the dataset in an easy comfort. It actually took a lot of time to upload the dataset in the colab.
- ❖ Again, we face a problem in attaching the picture of a person without a mask in mail, which basically is quite significant.
- ❖ We also really try kind of hard to actually make the confusion matrix scores well accurate as defined by the model.
- ❖ The hardest part was is to train the model and add our labels layers in the last layers.
- ❖ We actually even lost the model and whole dataset and also needed to train it again but we actually saved the data and model in the Google Drive.
- ❖ While detecting if someone for all intents and purposes is there and starting the process of matching the face in a definitely big way.

Research Objectives

Our goal in creating this project is to learn about technological breakthroughs and create a product that will not only challenge but also benefit people because it is inexpensive and improves an existing system.

We've integrated facial recognition, but because it's a research area, there's always room for improvement, therefore we'll strive to do it with cutting-edge technologies like Deep Learning. We've also applied voice recognition, which is something that firms like Google and Amazon aren't quite perfect at.

Some security flaws that we are attempting to resolve include the ability to get access to a home by displaying a photograph of the owner, therefore our goal is to determine whether the person in front of the camera is a photograph or a real person.

The proposed aim will be achieved by dividing the work into following objectives:

1. Eye flickering detection and turning face right left can be used to cope with security flaws and there are many more techniques which can be found [here](#).

2. Cost can be minimised by installing the program on Raspberry Pi which is the cheapest desktop available in the market.
3. We Have Implemented face recognition using a python module named `face_recognition` , but that's not accurate so we can use Deep Learning and AI.

Methodology

This endeavour necessitates a great deal of new knowledge, such as Deep Learning and AI. We'll also need to learn Flask (a web framework), and we'll have to study a lot of documentation. This is the skill we will need the most in the future, as new technologies emerge on a daily basis, and not everything has well-formatted tutorials. As a result, we learnt a crucial skill: learning new skills through documentation. We've used opencv to recognise cameras and faces, therefore it's the library we've used the most. We will also use Speech Recognition for taking information like reason of coming from the visitor at the door. But the main concept here is all about Transfer Learning and Tensorflow implementation. It almost took a lot of time for us to learn and understand the idea and concept. However, Thanks to python for making it simpler for us to understand it in an easier way.

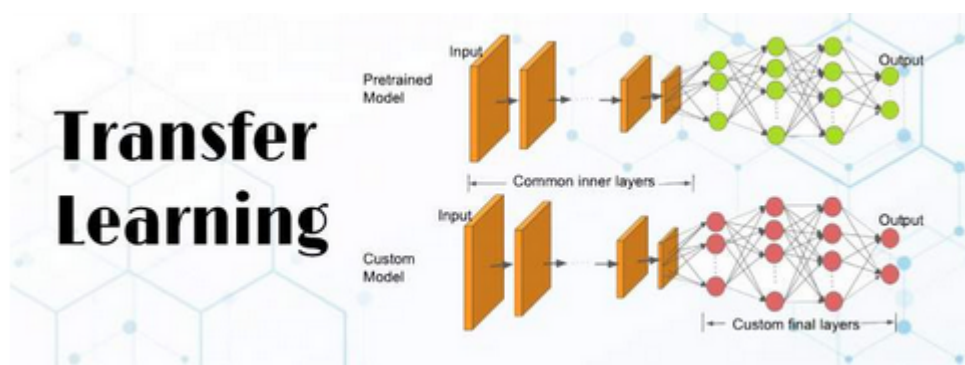


Figure 7: Transfer Learning Diagram

The next most important step here is to determine the accuracy of our model. We have used MobileNETv2 which is the best CNN Architecture.

The accuracy we got using This architecture is well amazing. See the following confusion matrix.

	precision	recall	f1-score	support
with_mask	0.99	0.99	0.99	433
without_mask	0.99	0.99	0.99	386
accuracy			0.99	819
macro avg	0.99	0.99	0.99	819
weighted avg	0.99	0.99	0.99	819

Figure 7:Confusion matrix

There is no hardware based functionality. It's similar to a camera in that it can see outside, but it requires a arduino/ raspberry pi, to do this functionality.

However, if one can insert this functionality it can become the best device for awareness of wearing mask in public restaurants/ shops/ universities and even hospitals.

To determine how well our proposed system worked, we must test it on several aspects, including facial mask detection accuracy, cost, time consumption, reliability, and security.

We have done significant advancements from the existing technology, as we make the system more reliable . pocket friendly and have implemented AI in the needed field, so as we know AI is the future so we are trying to solve people's problems using AI and deep learning.

Tentative Chapter Plan for the Proposed Work:

- ❖ We started this project on 18th Feb. 2022
- ❖ We will gather the required knowledge till 5th march 2022
- ❖ After that we will implement a face detection system till 10th march 2022.
- ❖ After that we gather datasets of masked and without masked.
- ❖ After that we will implement the burglar alarm system before 20th march 2022.
- ❖ Before 22nd march 2022 we will give some basic knowledge to our system like how to deep learning concept.
- ❖ Before 27th march we will implement speech recognition that will be used to gather the unknown visitor information.
- ❖ We will test our system for one month if we encounter any bug and we get some idea to enhance the efficiency of our system. We will try hard to do the same within this period only and also, we will prepare a good presentation within this time only.
- ❖ We will also prepare research papers before the deadline.
- ❖ Finally, we will submit our project before the deadline.

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