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DETECTION OF FACE MASK USING MACHINE LEARNING

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Abstract: In today's age, COVID-19 has made the lives of people unsafe, unsecure. As Corona virus is very dangerous, each person needs to take care of self, family and society too. Scientific studies and various governments are announcing different measures to stop the spread of Corona virus. Some of the measures to keep ourselves safe from COVID-19 include maintain social distance, wash hands at frequent intervals, wear face mask, take vaccination, etc. As for the prevention, wearing a face mask is becoming now new essential while going outside or meeting to others. But still, some irresponsible people refuse to wear a face mask even at social places. Hence, to aware such people and maintain safety among the people, developing a face mask detector becomes necessary. With the help of technology, it becomes easy and possible to promote the use of face mask. This paper aims to develop a face mask detector using various 'Machine Learning' algorithms. Proposed system will be able to detect whether a person is wearing a face mask or not.

Keywords: Convolutional neural network (CNN), COVID-19, Deep learning, face mask, face mask detection, image processing, OpenCV, etc.

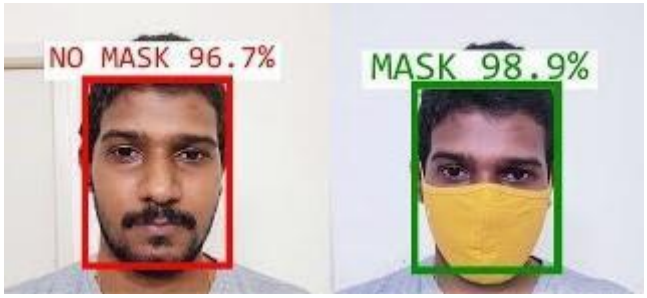
I. INTRODUCTION

Due to COVID-19 pandemic, people are using different measures to control the spread of Corona virus for their safety. Studies and research have proved that wearing a face mask significantly reduces the risk or fear of viral transmission. However, it is not possible to manually track the implementation with each and every one of this policy. Technology holds the key here.

"Face mask recognition" is an effective system to detect a wearing mask or not. Due to COVID-19, there is need of face mask recognition application on many places like airports, railway stations, malls, offices, hospitals, etc. for safety.

By the development of face mask recognition system, we can detect if the person is wearing a face mask or not and only allowing entry to those, who are wearing a face mask, would be of great help to the society and our nation. This project will be of great contribution towards the fight against COVID-19 or help our nation.

Since social distancing and wearing a mask are the only monitored ways to avoid the infection till vaccinations become accessible to all. In this paper, we propose face mask detection using image processing which is one of the high-accuracy and efficient face mask recognition system. This proposed system mainly consists of three stages i.e. 1. Image data pre-processing 2. Face detection, crop and resizing 3. Face mask classifier. Our system is capable of detecting masked and unmasked person faces and can be integrated with webcam cameras or other cctv cameras.



II. TODAY'S NEED OF THE SYSTEM

As the virus outbreak continues, business leaders and owners of company are coming up with innovative digital solutions. One of them is a face mask recognition system to identify people wearing mask or not.Analyzing the current scenario, government and private organizations want that everyone especially their employees working or visiting a public or private place is wearing masks throughout the day. The face mask recognition platform can quickly identify the person with a mask or without mask, using cameras. Depending upon the requirements and situation, the system is also adaptable to the latest technologies and different tools

i.e. you can add contact numbers or email addresses in the system to send an alert to that person who has not worn the mask. You can also send an alert message or email to the person whose face is not recognizable in the system.

This system can therefore be used in real-time applications which require face-mask recognition for safety majors due to the outbreak of Covid-19. This project can be enhanced or integrated with embedded systems for application in airports, railway stations, offices, schools, and public places to ensure that public safety guidelines are followed or not.

If we took example of a company where employees working from office so for their safety purpose this application will be very useful if we kept it on entry. Only those employees will enter who wear mask. .

III. OBJECTIVES

Every proposed system has some objectives based on which the whole system is developed. In the similar way, 'Face mask detection' system has some objectives based on which proposed system is designed. Main objective of face mask detection system is to provide some effective solution to prevent the spread of COVID-19 with the help of technology. Primary objectives are as follows,

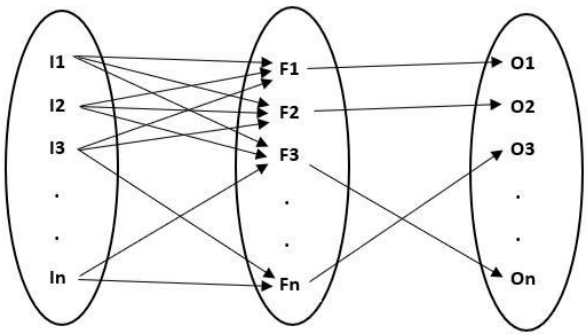
- Stop or minimize the spread of COVID-19 by promoting the use of face mask.
- Detect whether a person is wearing a face mask or not so that allowing entry of those who are wearing a face mask would be of great help to society.
- Help authorities by predicting the future outbreaks of COVID-19.
- Save the lives of people.

IV. MATHEMATICAL MODEL

- System Description :
  - Input: Image showing masked/unmasked face
  - Output: Detected face showing 'Mask' or 'No Mask' message. ○ Functions: Extract(), Detect(), Classify(),Display().
- Mathematical Formulation:

  S={I,F,O}
  where, I=Set of inputs to system = {I1, I2, I3,...,In} F=Set of functions = {F1, F2, F3,...,Fn}
  O=Set of outputs from system = {O1, O2, O3,…,On}
- Success Conditions:

  Masked and unmasked faces are successfully detected and expected output is displayed on screen.
- Failure Conditions:
  1. Camera is not capturing the input frame.
  2. Face is not available for detection purpose.

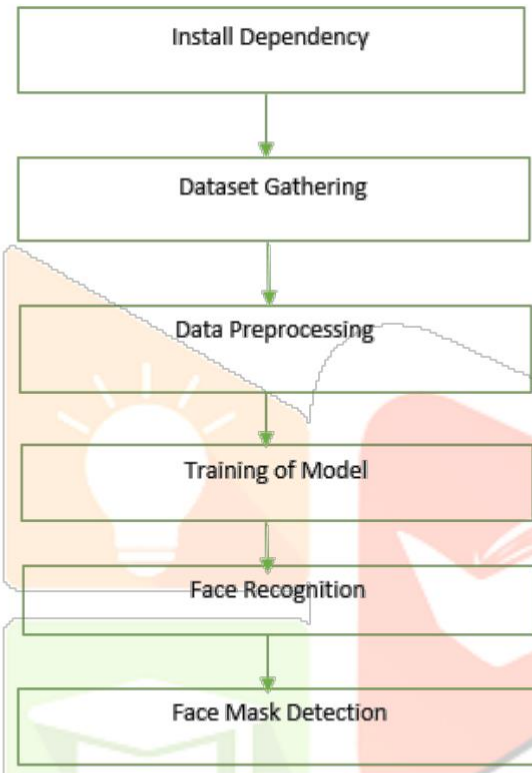


V. SYSTEM ARCHITECTURE

The system architecture of 'Face Mask recognition' project consists of different stages which are as follows;

- We have to install all the dependency which are required.
- After that we need Dataset for processing.
- Then we have to pre-process that data from dataset as well as the corresponding images.
- Once it done, then we have to train that data model.
- And then to check accuracy of system we have to run it and view it.
- And finally, we have to apply a model on camera.

Detailed system algorithm identification and working: -



1. Install Dependency: -

As this system is based on Machine Learning Technology, so here we required some library's to carry out successfully this system. Required libraries and their required versions are as follow;

- ✓ Tensor flow>=1.15.2
- ✓ Keras==2.3.1
- ✓ Imutils==0.5.3
- ✓ Numpy==1.18.2
- ✓ Opencv_python==4.2.0.*
- ✓ Matplotlib==3.2.1
- ✓ Argparse==1.1
- ✓ Scipy==1.4.1

To install this libraries we just need to go to command prompt and give a command;

Pip install-r Required_libraryNamewith_version

2. Dataset Gathering: -

As this system is fully based on image processing we required Dataset of masked and unmasked images of people. We have taken dataset of with mask and without mask images. Each dataset approximately consist of 1000-1900 images each which are collected from open source like images libraries, Google images and kaggle.

3. Data Preprocessing: -

In this Stage of system we are converting all images from folder which we have in dataset in arrays and those arrays create an deploying model. Conversion of image into array will be done by using image_to_array () function mainly.

4. Training of Model: -

In this, we are going to use MobileNet instead of Convolutional in CNN as it is faster and requires less parameters than CNN. Once the input image is processed into an array the moblieNet processing is carried on it. Then Max-polling is done and then full-connected frame we get. And finally as output the frames we get which looks like a video streaming.

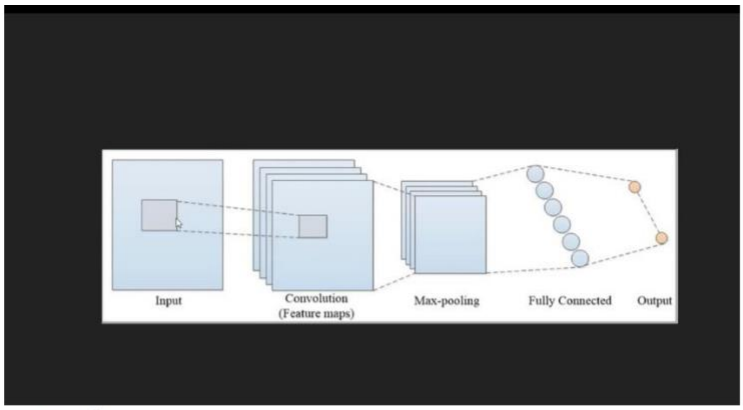


Fig. Model Training

5. Run and View the Accuracy of the Model: -

From this stage we will come to know the accuracy and loss rate of the system in graphical mode.

Fig. Loss Rate and Accuracy of model.

6. Face Recognition : -

For detection of face into an image we have taken couples of files which are used for face detection. We include them into system by using 'FaceNet' which is a part of DNN i.e. Deep neural network. By giving path of this filed into implementation our syst em is detecting the face.

7. Face Mask Detection: -

To detect the face mask we have implemented a method called detect_and_predict_mask () which includes three parameters viz; Frame, FaceNet, MaskNet with two local variables naming, 'locs' and 'preds' which contain the specific region of face and marks it with rectangle and predicts is that person has wear mask or no. And accordingly the massage will be displayed.

VI. CONCLUSION

- In times of the COVID-19 pandemic, with the world looking to return to normalcy this system can be easily deployed for automated monitoring of the use of face masks at workplaces.
- By the development of this detector we can detect if the person is wearing a face mask and allow his entry in the workplace.
- This detector can possibly contribute to public healthcare.

VII. REFERENCE

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