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A Dynamic Face Mask Detection using Deep Learning

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Abstract: *The spread of COVID-19 pandemic has created a crucial global health crisis of the world, that has had a deep impact on humanity and the way we perceive our world and our everyday lives. Masks are very effective when it comes to prevention of spreading of the virus, this is how this idea came into picture. And since masks are compulsory in public places, mask detection can be useful if implemented. The proposed work is implemented on live video, that is from webcam in this case. It detects the person from the video and then checks if the person is wearing a mask or not.*

Keywords: CNN (Convolutional Neural Networks), Region of Interest (RoI)

I. INTRODUCTION

Safe distancing, wearing masks are one of the safety measures to prevent being affected by corona virus. Wearing mask to protect from the virus been a safety measure to protect ourselves from the COVID-19 or corona virus. The rapid spread of COVID-19 has increased in many areas of the world, more than 5 crore people are infected by COVID-19 in less than 8 months, the spread of virus is through the close contact between people and in public or crowded areas.

The epidemic has given rise to different technologies being implemented for various used. Artificial Intelligence can be used in different ways, Machine Learning and Deep Learning can help fight this epidemic. Monitoring the people if they're wearing masks or not physically can be a strenuous task, so implementing a monitoring process which does not require human efforts but only AI is very efficient.

According to a survey conducted by WHO, masks should be used as part of a comprehensive strategy of measures to suppress transmission and save lives. For health workers, medical masks are essential personal protective equipment when engaging with patients with suspected, probable or confirmed COVID-19. So, this project can be very helpful in public places, hospitals, educational institutions, etc.

II. LITERATURE SURVEY

The research is done using a proposed feature extraction model (ResNet50)[1]having an end-to-end structure without traditional techniques but with three classifiers machine learning algorithms for mask face detection. The classical machine learning algorithms[2] being decision trees, SVM, and ensemble algorithm. During the classification, the last layer in ResNet-50 was replaced with the classifiers. They then concluded that ensemble algorithm is better than decision trees, and the SVM [3] classifier in terms of validation, testing accuracy performance when the training is done over the first dataset and the third dataset. A statistical procedure was selected to be applied in non-masked face recognition and is also applied in the masked face recognition technique. Face Recognition [4] in this case is the un-masking of a masked face for security purpose. Criminals and terrorists cover their faces with masks to prevent themselves from being recognised, this was the main aim of this research. a statistical difference of accuracy between masked face recognition and non-masked face recognition using the PCA(Principal Component Analysis) algorithm[5]. Face Recognition is implemented using Local Binary Pattern algorithm and Convolution Neural Networks. Neural network [6] methods can be used not only to detect the face, can also be used to identify the face. In this paper the authors proposed a system which uses LBP feature map as the input of CNN [7].

A. Problem Definition

Faces mask detection based on CNN in the era of the COVID-19 pandemic. It detects if the person is wearing a mask or not. Mask detection basically has two phases training and deployment. The classifier is trained in the first phase on the dataset, and then the data is serialized. In the second phase, the data is loaded, the faces are extracted and then the classifier is applied to detect if the person if wearing a mask or not.

III. SYSTEM ARCHITECTURE

Using face-masks in public is very useful in minimising community transmission and burden of COVID-19. A study was done which concluded that up to 45% of the deaths projected over the next two months could be prevented if 80% of the people started using some sort of mask. Since people are still unaware and are not wearing masks in public places they must be checked. People are checked if they are wearing a mask or not physically, developing an AI to do this task is easier and of low cost. The system is implemented based on a deep learning algorithm and computer vision to detect if the person is wearing a mask or not.

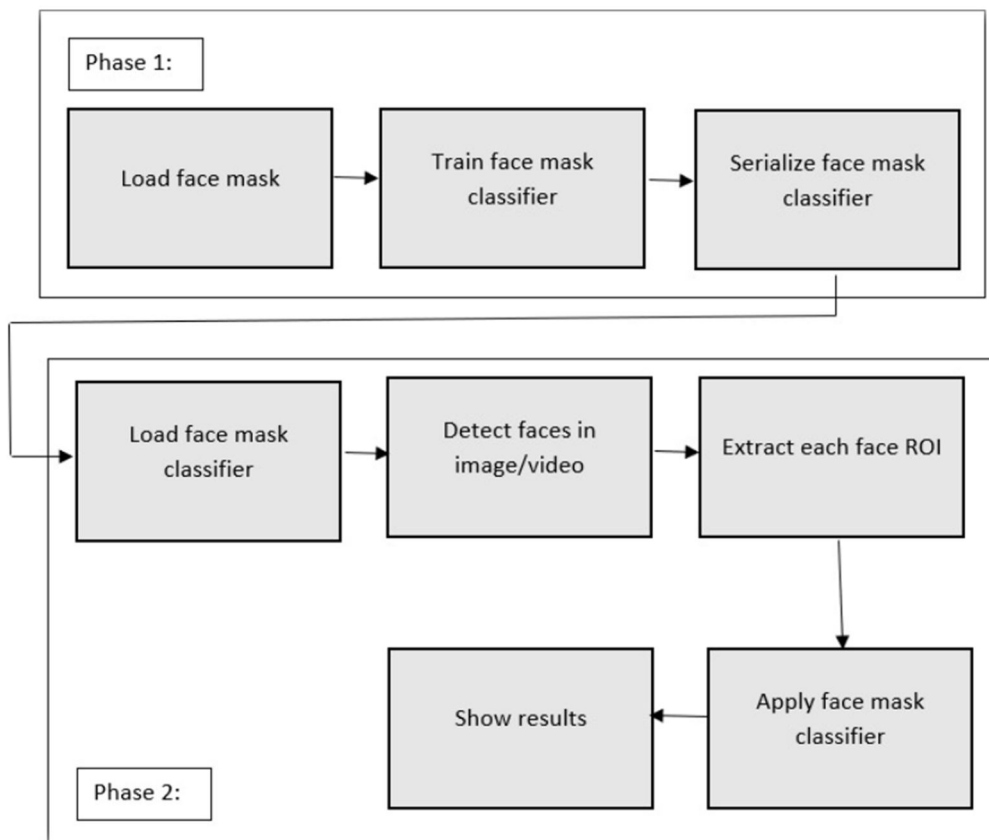


Fig.1 System Model

The project detects whether the person is wearing a mask or not and there is two phase COVID-19 face mask detector

IV. METHODOLOGY

A. Phase 1 or Training

In this phase (train mask face detector) the mask dataset is loaded and then the facemask classifier is trained with the keras or tensor flow, the trained dataset to loaded and then the data is serialized in an order in the disk or given folder.

B. Phase 2 or Deployment

In the second phase (application of face mask detector), from the disk serialized in the phase-1 the dataset is loaded, then the faces in the given images or the video stream are detected and each face is to be extracted. Face mask classifier is applied to each ROI to detect or determine whether the face has the mask or not from the given dataset. The results are showed at the end after detecting the face has the mask or not.

For the project, two datasets are needed one is images of faces and the other dataset is the images covered with masks. Facial landmarks or facial features allow to automatically infer the location of the facial structures which include- eyes, eyebrows, nose, mouth, jawline.

C. Face Detection and Features Extraction



Fig. 2: Faces Detected

For the usage of facial features or landmarks to build datasets wearing masks, first an image of the face without mask is to be considered.

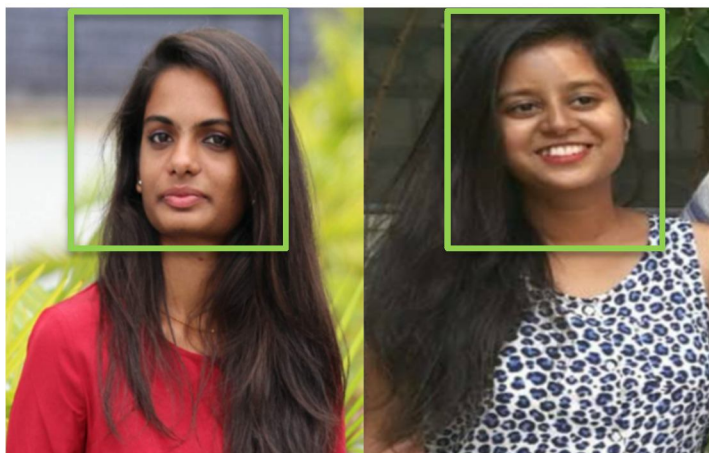


Fig.3: Face Detection with Box

Then the apply the face detection classifier to compute the bounding box of the face location that means the classifier has detected the face from the given image.



Fig.4: Face Closure

When the face images are detected from the given image, need to extract the face region of interest (ROI).



Fig.5: Detecting Facial Features

The facial features or facial landmarks are detected from the closure face cropped image from the dataset.



Fig.6: Face Dataset With and Without Masks

The second dataset is considered apply the face mask classifier/detector to each face then combining the object detectors-with and without mask. First, the object detector will be able to naturally detect people wearing masks that otherwise would have been impossible for the face detector to detect due to too much of the face being obscured. Secondly, this approach reduces our computer vision pipeline to a single step — rather than applying face detection and then our face mask detector model, all we need to do is apply the object detector to give us bounding boxes for people both with_mask and without_mask in a single forward pass of the network.

V. CONCLUSION

In this project, a deep learning based method is used to detect if the person is wearing the mask or not. To detect the person is wearing a mask or not in the project two class models of people wearing the masks and the people who are not wearing the masks are considered. The face mask detection is applied to the given data set of images and is trained so that it could be applied in real time data set like live video streaming or web-cam to detect who are wearing masks or not. It mainly has 3 steps:

- 1) Detecting face in video,
- 2) Extracting each individual face,
- 3) Applying the face mask classifier to give output.

This work can be implemented in real-time for restricting people who are not wearing masks from entering offices, malls, public places, etc., Face detection maintain the main role in the project and featuring extracting, also applying face mask classifier. Further, the future scope of the project is to detect the people who are wearing masks in the crowded areas like markets, malls, offices, educational institutions etc., and also not the person is not allowed if the person is not wearing the mask into the zone or area.



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