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Face Mask Detection

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ABSTRACT

Manual surveillance of whether people are wearing a mask or not is not only costly but also a risky process. In this present world, which is being hit by the Coronavirus pandemic, the risk of spread of virus is exponentially high when people are not wearing mask. Thus, the automation of the process of detection of people not wearing mask had become a necessity. Our project uses deep learning techniques to determine whether a person is wearing a mask or not. Our proposed system identifies the mask violators automatically which reduces the risk of transmission of virus and also makes it easier for the authority to monitor the mask violators and take action against them without being put at risk of transmitting the virus. We use MobileNetV2 architecture to efficiently achieve best accuracy which is the key to our system. We were able to achieve accuracy of 99.22% after training the model. Detecting and tracking the face mask is the main aim of the project.

Keywords: *Mask, Pandemic, Coronavirus, Surveillance, Automation, Authority, Virus and Deep Learning*

1. INTRODUCTION

In the current scenario the COVID-19 pandemic has become the biggest medical crisis of our time and greatest challenge we have ever seen and due to this we have now reached the tragic of milestone of over million deaths. Today in every country the authority has issued a mandate to wear masks covering both the nose as well as mouth to tackle SARS-CoV2 infection. This directive has been imposed to all the public places.

But we all can see that many people don't wear masks while they are in airports, malls, or any public place. These people who don't wear mask in public places increase the risk of spread of virus. Manual detection of these people is very uncertain and also quite risky. So, there is great need of software that can automatically detect people with no mask and can take a necessary step against them.

Our proposed system is a face mask detection system that scans the face of people to detect whether a person wearing or not wearing a mask and displays "Mask" or "No Mask" and also informs the authority. This system doesn't require any physical contact which is very important.

The goal of the project is to automate the face mask detection system and to make it easier for the authorities to monitor the mask violators and take action against the violators in a fast and efficient way. Detecting and tracking the face and the mask accurately is the main priority of the system.

With the help of our system people not wearing mask can automatically be identified and the manual labor which would've been otherwise involved is eliminated. The system determines whether someone is wearing a mask or not and if it finds someone who is not wearing a mask it automatically warns the authorities and then the concerned authority can take actions against those people. This will result in reduction of number of people who are not wearing mask and subsequently reducing the risk of spread of virus.

2. LITERATURE SURVEY

[1] Multi-Stage CNN Architecture for Face Mask Detection- A. Chavda et al

The proposed model by A. Chavda et al[1] uses a Deep Learning based system which is able to detect whether a person is wearing the mask properly or not. This system consists of a dual stage CNN architecture which can detect faces with mask and faces without mask. This system can be easily integrated with CCTVs and help in surveillance. The first stage of the model uses a pre-trained RetinaFace model for detection of faces powerfully. For training the model it uses a set of photos of person with mask and person without mask. The second stage of the model involves training the model with three different types of light weight Face Mask Classifier models on the created dataset and based on performance, the NASNetMobile based model was selected for

classifying the faces as masked or non-masked. Later, they also added Centroid Tracking to their algorithm, this helped in improving the performance of the model on video streams. This model achieved an accuracy of 93.884%

[2] Real-time face mask identification using Facemasknet deep learning network –Imandar M et al

In a proposal by Imandar M et al[2] their system uses Facemasknet, deep learning technique to accurately test whether a person is wearing face mask or not. It classifies into three types namely, person is wearing a mask, person is not wearing a mask and person is not wearing a mask properly. This proposed model got an accuracy of 98.6%. This model works with both still image and video stream. It gives quick results and hence can be used with CCTV cameras.

[3] RetinaFaceMask: A Face Mask Detector- M Jiang et al

The proposed system by M Jiang et al[3] RetinaFaceMask is a single-stage detector which is hightly efficient and accurate. It uses feature pyramid network to fuse high-level semantic information with multiple feature maps which focuses on detection of face masks. It achieves very good results on public face mask dataset with 2.3% and 1.5% higher than the baseline result. They are also exploring the possibility of implementing RetinaFaceMask with MobileNet for mobile device.

[4] Facial Mask Detection using Semantic Segmentation- T Meenpal et al

In a proposal by T Meenpal et al[4], they have designed a binary face classifier which is able to identify any face which is present in the frame disregard of the alignment of the face. They have proposed a method to generate accurate face segmentation masks from any arbitrary size input image. This system uses predefined training weights of VGG-16 architecture for extraction of the features. Fully Convolutional Network is used to train for semantically segmenting out the face which are present in the image. It is able to recognize non-frontal faces accurately and it is also able to detect multiple faces in a single frame. The proposed system has an accuracy of 93.884%.

3. PROPOSED SYSTEM

The proposed system automatically monitors through cameras. Due to this automation there will be high accuracy and the risk involved with the manual detection will be countered. Our system takes the video stream input from the camera. It then processes this data and then predicts whether a person is wearing or not wearing a mask. If someone is found not wearing a mask an automated mail is sent to the responsible authorities to take further action.

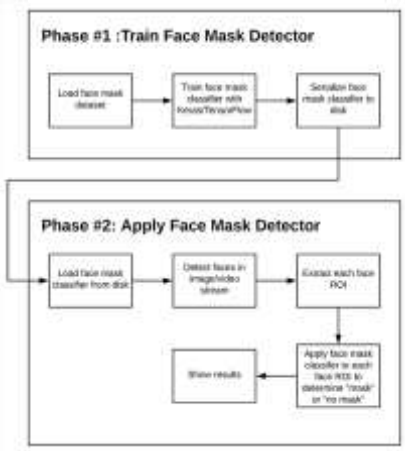

Fig. 1: Block Diagram of Proposed System

Advantages of our project:

- It increases accuracy and reduces the time required for identifying mask violators
- It helps in making sure that everybody is wearing mask
- It helps in making public places safer
- It avoids the risks and cost involved in manual detection

4. ALGORITHM USED

4.1 Convolutional Neural Network

Convolutional Neural Network is a Deep Learning algorithm which takes image dataset as input, assigns weights and biases to various objects in image and then it is able to differentiate one from the other. The preprocessing which is required in CNN is very less in comparison with other classification algorithms.

A ConvNet successfully captures the temporal and spatial dependencies in an image by applying relevant filters. It reduces the image into such form which is easier to process and it also makes sure that it has all the features which is important for better predictions. It extracts all the important features from the image which is important for prediction by using valid padding and same padding. Once the image is flattened it is then classified using Neural Network.

We have used MobileNetV2 by Google, one of the CNN architectures, in our project. MobileNetV2 is present in tesorflow library. It tends to perform well on devices with less computational power. It is best suited for our project as it performs better than NASNet and ShuffleNet and can perform well in any device without the requirement of high computational power.

Input: Mask-No Mask Dataset

Steps:

1. Data Preprocessing
2. Assigning the learning rate, epochs and batch size
3. Training the model using MobileNetV2 architecture
4. Using the mask_detector.model to predict whether the person is wearing a mask or not
5. If a person is not wearing mask then send email using SMTP

5. RESULT

After training we were able to achieve an accuracy of 99.22% for Epoch value of 20.

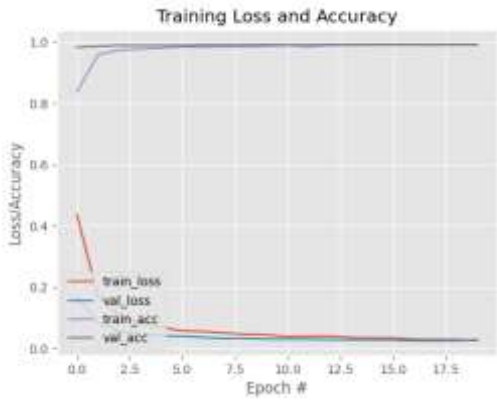

Fig. 2: Loss and Accuracy Plot

We got the desired results as our system was able to predict whether a person is wearing a mask or not accurately. An email was also sent to the assigned mail address when a person is not wearing a mask.

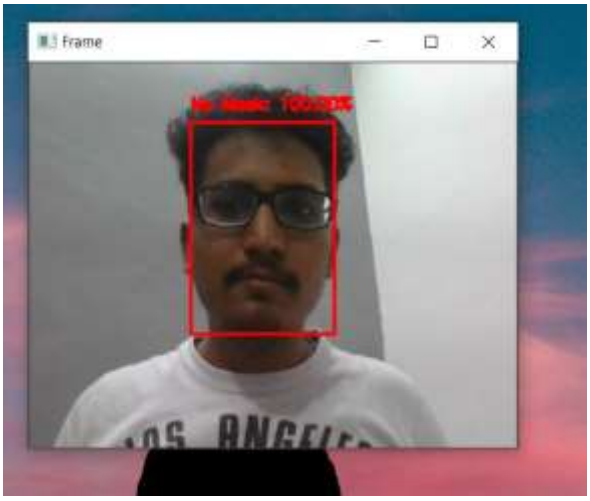

Fig. 3: Person not wearing a Mask

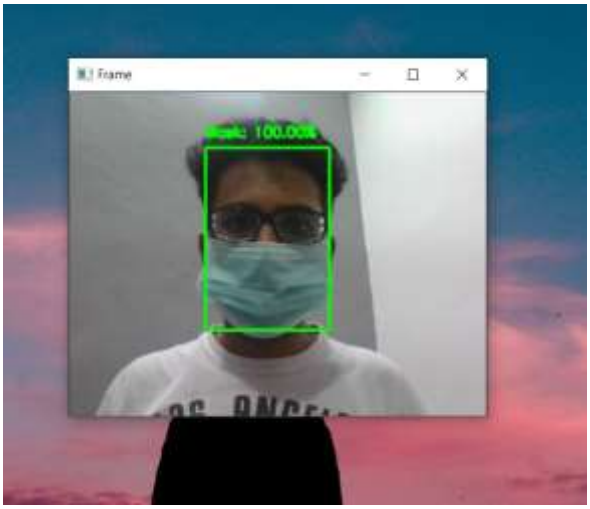

Fig. 4: Person Wearing a Mask

Fig. 5:Mail sent when person is not wearing mask

6. CONCLUSION

The proposed project focuses on automizing the process of violation detection and reporting. Though our approach has its advantages and disadvantages, it is giving the expected outputs for the algorithms that we have tested.

The Face Detection System is an effective tool which uses technology and minimizes any manual human intervention to speed-up the process of face mask detection and also boosts up the accuracy exponentially. The designed algorithm was effectively able to detect the mask violators specified on this project. We proposed a system that works satisfactorily for the wide variation of conditions, however, there is still room for improvement.

Currently the system recognizes the people who violates the mask rules and regulations, in future we can also connect it to the database to store the details of the violators. And also in the reporting part, we can provide an option for the victim to pay the fine.

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