

COVID – Face Mask Detector using Computer Vision

Rahul Roy¹; Mayank Kumar²; Dr. M.L. Sharma³ and Dr. Krishna Chandra Tripathi⁴

^{1,2}IT (Information Technology), Maharaja Agrasen Institute of Technology, New Delhi, Delhi, India.

^{3,4}Professor, IT (Information Technology), Maharaja Agrasen Institute of Technology, New Delhi, Delhi, India.

Abstract: Covid 2019 pandemic has affected the world completely. The protective way world has adopted to wear mask to protect them. The world has adopted this change and now public service providers offers their service to customers wearing mask. However, there are few research analysis made to detect face mask. In this research paper, I present COVID Face Mask Detector which is highly effective and efficient to detect face mask. It's a two phase detector. Phase 1 consists of Training and phase 2 consists of Deployment.

KEYWORDS: COVID-19, Face Mask, Pandemic.



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INTRODUCTION

Report of (WHO) indicated that covid disease 2019 (COVID-19) has impacted globally around 1.73 billion people caused 3.7million fatal. Severe acute respiratory syndrome (SARS) and the Middle East respiratory syndrome (MERS) are some severe acute respiratory syndromes which is most seen in people affected by Covid. Health has become the most important priority for the people and the government is considering public health as the top priority and working to raise the standard of the health infrastructure. The reports and research suggest that few variants of face mask can prevent the spread of coronavirus. World health organization (WHO) suggest that people should wear mask when they get in touch with any person or if taking care of Covid infected person. Public Services have become aware and are not allowing customers to take service until they have mask on their face. So, to prevent global society from this pandemic, efficient and effective face mask detection has become a crucial task for the society. Detecting whether a person has weara mask correctly, the face mask detector will play an important role.

The problem is simplified, to detect the classes of objects and face detection is to detect a particular class of objects. In many areas face detection and its application can be used. Few examples present in the dataset includes images from education, surveillance etc. Handcrafted feature extractors were used earlier for object detection. To dominate the development of modern object detectors, deep learning object detectors played a crucial role in increasing the excellency in performance. Object based detectors are categorized in one stage and two stage deep learning. Single shot detector (SSD) is example of one stage detector that uses a single network to detect objects. Two-stage detectors uses two neural network to perform coarse-to-fine detection, mainly faster R-CNN, convolution neural network (R-CNN).

In this paper, I proposed a face mask detector, which is able to detect face masks and contribute to public healthcare. This Face Mask Detector can be used by Police Authorities. It can also be used by Universities in the way like they can setup an automatic door at the entrance of Universities where the doors will open only

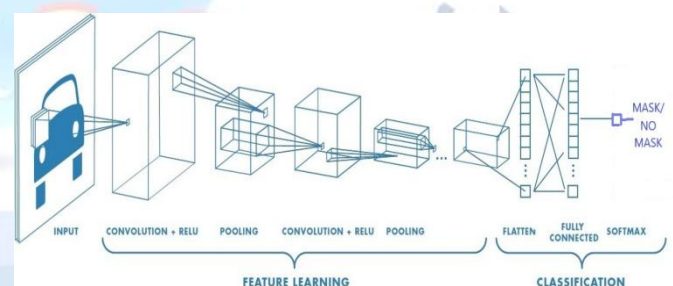
when the person entering the University Premises is wearing a Mask properly. This would minimize the Human Intervention hence reducing the spread of Coronavirus.

This model will be used in the following way-:

A normal system will be connected to the CCTV Server and then by making the use OpenCV it will analyse the live results and then directly it will indicate where the people are not wearing masks.

2.0 OBJECT DETECTION

Traditional object detection uses a multi-step process. Viola-Joins detector which is a famous detector a, which is able to achieve real-time detection. Haar feature descriptor with an integral image method is responsible for the extraction of feature by algorithm, selects useful features, and detects objects through a cascaded detector. To facilitate the algorithm is utilizes internal image that is very computationally expensive. For Human, HOG an effective feature extractor is proposed which calculates the magnitude and direction of gradients over image cell. After that, deformable part-based model (DPM) detects objects parts and the identifies the classes that object belongs.



Architecture of Face mask Detector

2.1 Convolutional Neural Network (CNN)

CNN plays an important role in computer vision related pattern recognition tasks, due to superior spatial feature extraction capability and fewer computation cost. To extract higher-level features CNN uses convolution kernels with the images or feature maps. To design better convolution network in the easiest way is still a challenge for us, so that its usage can be made simpler for the developers. Inception network proposed in allows the network to learn the best combination of kernels. For Training much deeper neural networks, K. He et al propose the Residual Network (ResNet), which can learn an identity mapping from the previous

layer. Usually, object detectors are built and deployed on mobile or embedded devices, where the computational resources are very limited, Mobile Network (MobileNet) is proposed. It uses depth-wise convolution to extract features and channel wise convolutions to adjust channel numbers, so that the computational cost of MobileNet is lower than networks using standard convolutions.

3.0 METHODOLOGY

To create our face mask detector, we will train a two-class model of people wearing masks and people not wearing masks

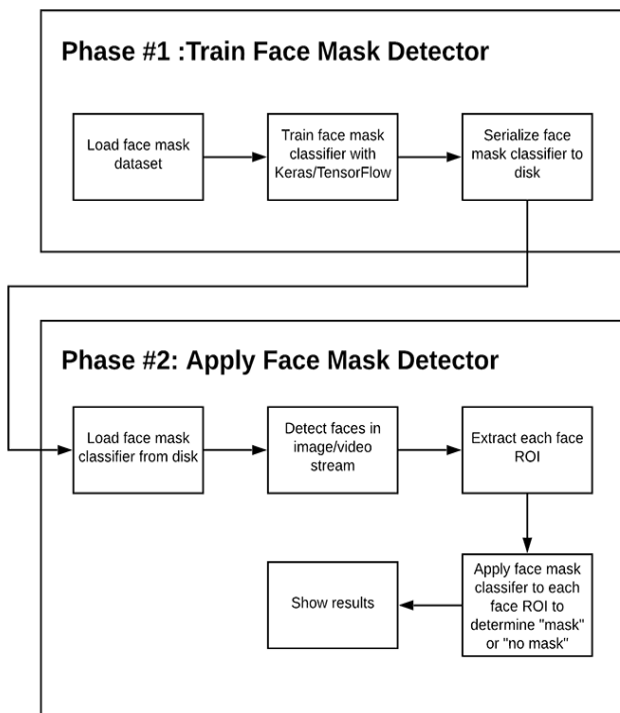
We will fine-tune MobileNetV2 on our mask/no mask dataset and obtain a classifier that is accurate.

We will then take this face mask classifier and apply it to both images and real-time video stream by:

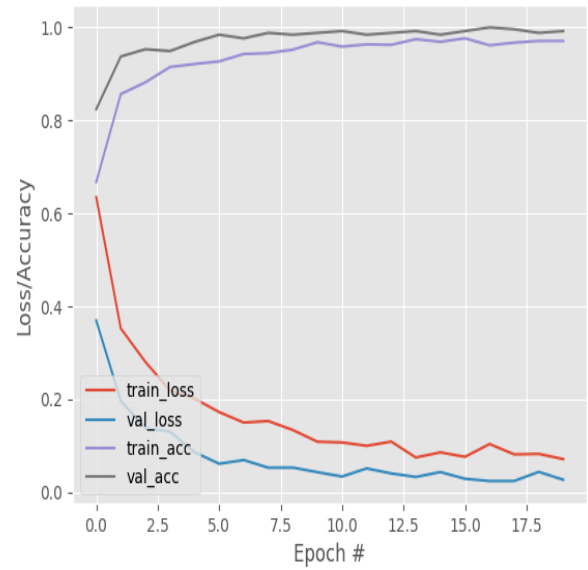
1. Detecting faces in images/video
2. Extracting each individual face
3. Applying our face mask classifier

Our face mask detector will be effective, accurate and efficient in the results, and we are using MobileNetV2 architecture, it's also computationally efficient, making it easier to deploy the model to embedded systems (Raspberry Pi, Google Coral, Jetson, Nano, etc.)

3.1.2 Phase COVID-19 Face Mask Detector Model



Training Loss and Accuracy on COVID-19 Dataset



4.0 RESULTS

Model	Face		Mask	
	Precision	Recall	Precision	Recall
Baseline	89.5%	85.2%	91.5%	88.8%
COVID Face Mask + Mobile Net	83.1%	95.8%	82.5%	89.3%
COVID Face Mask + Res Net	91.8%	96.4%	93.2%	94.8%

5.0 APPLICATION

Face mask detector has been a key role in protecting people from getting in touch with this deadly virus. Peoples have been using when they are getting in touch with anyone. But still its usage needs to be improved and monitored by government, society, organizations to ensure the safety of its fellow co-workers, neighbours and society. This monitoring can be done by utilizing today's technology, that's computer vision to detect whether a person has wearied a mask, or if wearied whether he has attached it properly. This will ensure the person gets detected and certain actions can be taken against him. Taking an example of the society, A society can have records of all the person living within, If any person that gets detected that he is not wearing a face mask correctly can be easily identified by its name using Computer Vision. This will increase the safety of the other people living there. The need of this technology today is immensely growing as due to removal of

restrictions and peoples carelessness has increased. A slight wave can cause a huge fatal within any public gathering which can be prevented by monitoring the face mask of different people with complete effective and accuracy. The application of this can be monitored by any government as they hold each person identity, so the restriction of knowing persons for getting their images trained can be removed.

6.0 CONCLUSION

This Face Mask Detector can be used to analyse whether people are wearing face masks or not in a workplace as well as in a public area and carry out necessary actions to better deal with the pandemic. Automating the task will lead in effective actions taken in short time hence equipping us better to deal with the situation.

Due to COVID-19 pandemic we need these types of resources to deal with the virus until a vaccine is generated. Finally, this Face Mask Detector will make sure that the virus does not spread too much by taking necessary measures like Face Masks.

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