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# Video Based Mask Detection

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***Abstract*: COVID-19 pandemic has rapidly affected our day-to-day life disrupting many different sectors of the industry. Wearing a protective face mask has become a new normal. An individual that doesn't wear a mask poses a threat to the safety of the group of people in the area. As one year has passed living with the virus it has also been shown that many individuals don't wear their mask if they are not told to do so. At this stage it is very important to ensure that each and every one of us wears a mask. In a vicinity that consists of a group of people such as schools, colleges, movie theatres etc. we can use image processing to recognize how many individuals are consistently wearing their masks. This proposed system also ensures that if an individual is to ever remove his/her mask, the relevant authority is informed about it. If deployed correctly, our product could potentially be used to help ensure our safety and the safety of others around us. This allows the college/org to be more efficient and save time compared to the standard methods available.**

***Keywords*: Deep Learning, facial land marking, MobileNet, NumPy, TensorFlow object detection module.**

## 1. Introduction

Using facial land marking to solve issues of mask detection that are simple to accomplish for the consumer. This project aims to ensure organizations can detect if the individuals in the room are wearing a mask, we want to ensure that this takes place in the safest and efficient way possible which is also relatively contactless.

As of now there has been no industrial implementation of this project as it is still in its infancy stage. This product's future also heavily revolves around how the pandemic situation will turn out in the coming years. However, there are many facial recognition software that are in the market that leverage facial landmarks to extract the region of interest which is foundational for both facial recognition and our mask detection software. We hope to take advantage of this to come out with a product that benefits the public.

In this project, we propose an end to end system which solves the issue of individuals not wearing masks using image processing and facial landmarking.

This proposed system can be split into the following phases: the first phase is face mask training where the model is trained using datasets. The second phase is face mask detection where the faces will be detected and also mask will be detected using face mask classifier.

## 2. Methodology

### A. System Architecture

In this project, a real time face mask detection model was developed with the help of deep learning, object detection. In the first step, a frame/image of the user is taken by the camera and the single or multiple faces will be detected in any scenarios using HOG algorithm. The Region of interest for detected faces is considered (in this case, bottom part of the face) and are grouped together. Then a face mask classifier is applied which is CNN based on the faces which determines if the mask is present or not for all the faces in the image and a particular score is given based on how the person is wearing the mask .100 is the maximum score means mask is present correctly, less than 90 means that the person is wearing the mask in a wrong way. Then the model alerts the authority or gives necessary instructions to non-mask users or masked users with less score. As we are using the object classifier where the object is a mask, all the people will be tracked using CCTV to provide a safe environment.

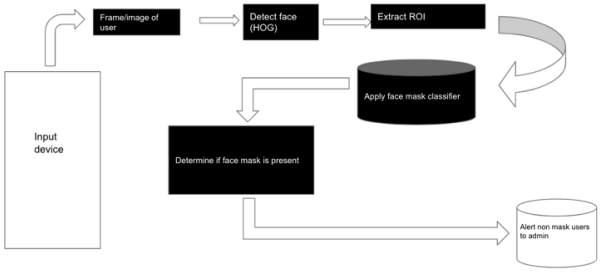


Fig. 1. System architecture

### B. Training and Testing

First we need to take the two datasets, one with mask and other without mask. The more images we have the better will be the model. In the pre-processing part we are converting all our images into a collection of arrays and with the help of those arrays we will create the deep learning model. We need to create 2 empty lists named data and labels. We will append all the images inside the data list. Labels list contain the labels of all the images indicating if they are masked or not and we will loop through them. Once we get the path of the images, the images will be joined with the corresponding paths. Then a function (load_image) is used which is a function of KERAS that is used to size the images. Those images are converted to array with the help of (img to_array) it is also a function of the KERAS

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module. Once the image is converted to an array we use the process (preprocess_input) which is a part of mobilenet (these are classes of low latency low power model that can be used for classification and other common task convolutional neural networks). Then append the image (which is an array) to the data list same with their corresponding labels inside the labels list, now we have all the image and labels array inside the list. All the data is in numerical values but labels are still Alphabetical values, so that needs to be converted into a binary array. To do that you need to use the LabelBinarizer method which is from the sklearn module. After completion of conversion from alphabets to 1's and 0's.

Those arrays are converted to NumPy arrays. We are training the data with the help of convolution neural network but with a little twist, our idea here is, we will ignore the convolution which we usually do and use mobile net instead of that because mobile net is very light as compared to the convolutional neural network and they use less parameters. After the images are processed as an array, we will use them as input to an array, it is sent to the mobilenet. We will perform the maxpooling (it is used for reducing the spatial size of the convoluted features.). max pooling uses the maximum value from each cluster of neurons at the prior layer. Lastly, we will get the fully connected layer of the result and get the output. We need to give less learning rate so the loss in data will be less. Which will result in all over better accuracy. We are also using Image Data Generator which will help in generating more images with a single image by applying various properties such as rotating the image, zooming on it and changing its height and width.

To run the model, go to command prompt and locate where the file is and run it using python filename.py command as shown in Fig. 2.

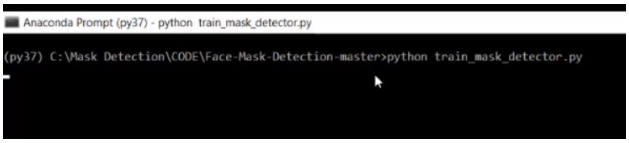


Fig. 2. Running the model

If the training process is successful, the output will be the same as shown in Fig. 3.

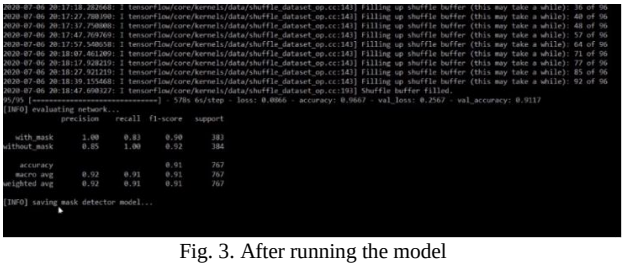

Fig. 3. After running the model

Fig. 4. represents the training and loss graph, which indicates how accurate and how much data we have lost.

To open the camera on your system, use the command python filename.py as shown in Fig. 5.

Once the video starts streaming, it will produce these readings (as shown in Fig. 6) that are updated every second.


Fig. 4. Training and Loss graph

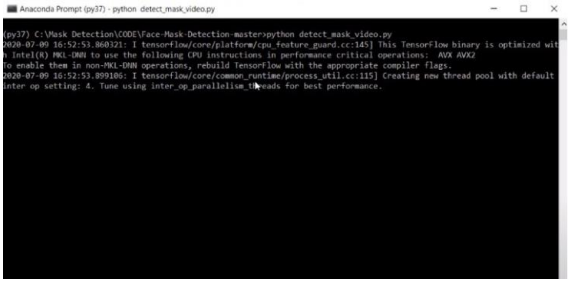

Fig. 5. Command to open the camera

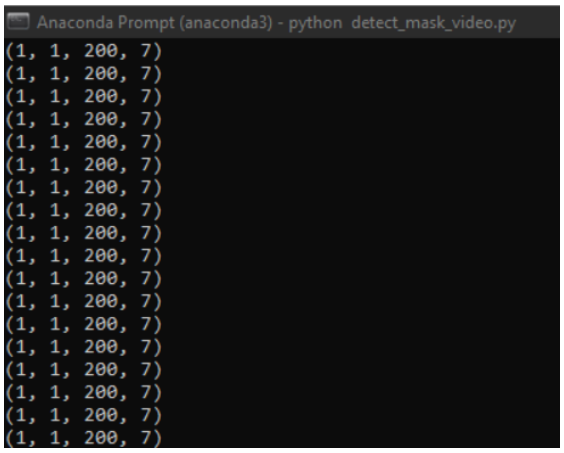


Fig. 6. Readings produced on video streaming

## 3. Results and Discussions

A real time video based mask detection model has been introduced.

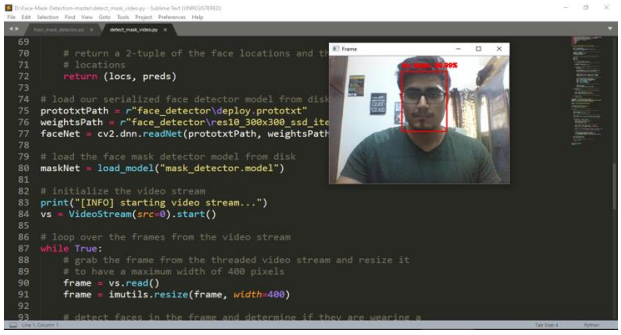

Fig. 7. No mask detection

Fig. 8. shows the accuracy of mask_detection if it's not worn properly.

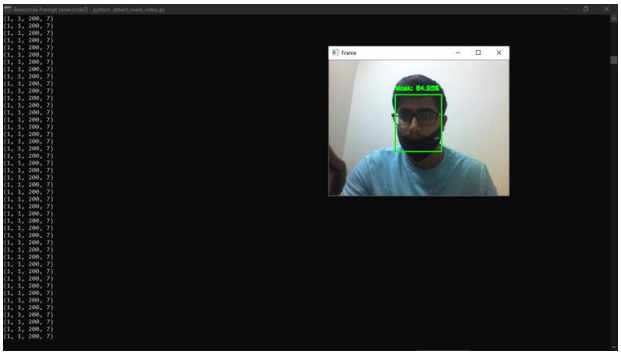

Fig. 8. Mask detection for mask not worn properly

Fig. 9. shows the accuracy of mask_detection which is 100%.

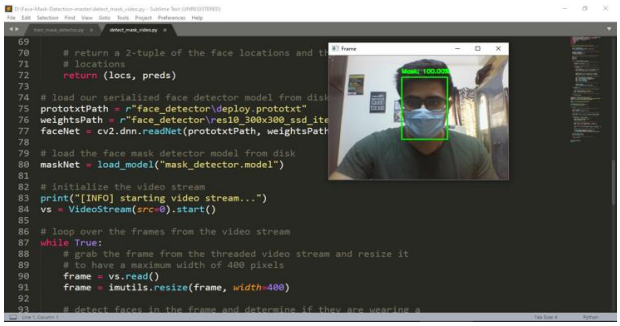

Fig. 9. Mask detection

## 4. Conclusion

The paper titled as "Video Based Mask detection" is a software application. As COVID-19 is a rising concern, it is necessary to ensure that everyone wears a mask, our system ensures it is done in the most hands-free way as possible and our aim as a team to ensure we work towards that problem while also tackling other objectives such as efficiency, cost, portability and implementation.

With enough development we believe this is a product that can be used in different industries all over the world. This software is developed with scalability in mind. Additional modules can be easily added when necessary. The software is developed with a modular approach. All modules in the system have been tested with valid data and invalid data and everything works successfully. Thus the system has fulfilled all the objectives identified and is able to replace the existing system.

## References

[1] Abadi Martín, Barham Paul; Chen Jianmin; Chen Zhifeng; Davis Andy; Dean Jeffrey; Devin Matthieu; Ghemawat Sanjay; Irving Geoffrey; Isard, Michael; Kudlur Manjunath; Levenberg Josh; Monga Rajat; Moore, Sherry; Murray, Derek G.; Steiner, Benoit; Tucker, Paul; Vasudevan, Vijay; Warden, Pete; Wicke, Martin; Yu, Yuan; Zheng, Xiaoqiang, "TensorFlow: A System for Large-Scale Machine Learning," 2016.

[2] Tensor flow "API Documentation."

[3] Chen, S. K; Chang, Y. H. (2014). 2014 International Conference on Artificial Intelligence and Software Engineering (AISE2014). DEStech Publications, Inc. p. 21. ISBN 9781605951508.

[4] Yan Holly, "Why face mask guidance has changed so much -- and how wearing masks can protect the economy," June 2020.

[5] "Python 3.9.2 documentation". docs.python.org. March 2021.

[6] Sebastian Raschka "Chapter 1: Introduction to Machine Learning and Deep Learning," 2020.