

Real-time Face Mask Detection for COVID-19

(Tensorflow/Keras + OpenCV + Scikit- Learn)

-Ashish Agarwal

1. Introduction:

Globally, the coronavirus stats say it has more than 16.3M confirmed cases and claimed over 649K lives so far, according to the Johns Hopkins University when I am writing this project repo. As many as 9.41 M people have recovered.

India's coronavirus cases are increasing in an unimaginable rate and is breaking the record in the highest single-day increase so far, every new day. The country's tally rose to 14,35,453 and the toll stood at 32,771. India is now the third worst-affected country by the pandemic and has overtaken Italy, according to Johns Hopkins University.

The World Health Organization said that new information showed that protective masks could be a barrier for potentially infectious droplets. The coronavirus primarily spreads through the transmission of respiratory droplets from infected people. On 5th day of June changed its guidelines about the use of protective face masks in public, saying that they must be worn at all places where physical distancing is not possible. The global health body had said in April that there was not enough evidence to show that healthy people should wear masks to shield themselves from the coronavirus.

WHO also said that high-risk groups should wear medical grade masks in cases where physical distancing is not possible. Several countries, including India, have made wearing masks in public compulsory. In many states, people have been fined for not wearing masks. Maintaining hygiene and using protective equipment has become even more important ahead of the reopening of religious places, malls and restaurants in India from next week.

This motivated me to create a the COVID-19 Mask Detector with some of my ML/DL skills and making it such accurate that it could potentially be used to help ensure your safety and the safety of others (Leaving it on to the medical professionals to decide on, implement in public places).

2. Value to Client(s):

This is a simple image classification project trained on the top of Keras/Tensorflow API with MobileNetV2 deep neural network architecture having weights considered as pre-trained weights. The trained model takes the real-time video from webcam as an input and predicts if the face landmarks in Region of Interest (ROI) is 'Mask' or 'No Mask' with real-time on-screen accuracy. This along with the integration with IoT devices could be installed at public places as an entry barrier making it safe for the people as far as social distancing is concerned.

3. Objective:

The main objective of this project is(are) to:

- Collect images of people with and without wearing a face mask and preprocess it along with some data augmentation.
- Feed the compatible dataset to a Deep Learning Neural Network Model Architecture like MobileNetV2, VGG-16, ResNet-50 etc. and train it with pre-trained weights of ImageNet.
- Integrate the above model with Computer Vision libraries allowing it to use the web-cam of the computer to test the model in real-time.
- Carry out inferences from Model Evaluation.
- Plot the accuracies and losses in training and testing phase.

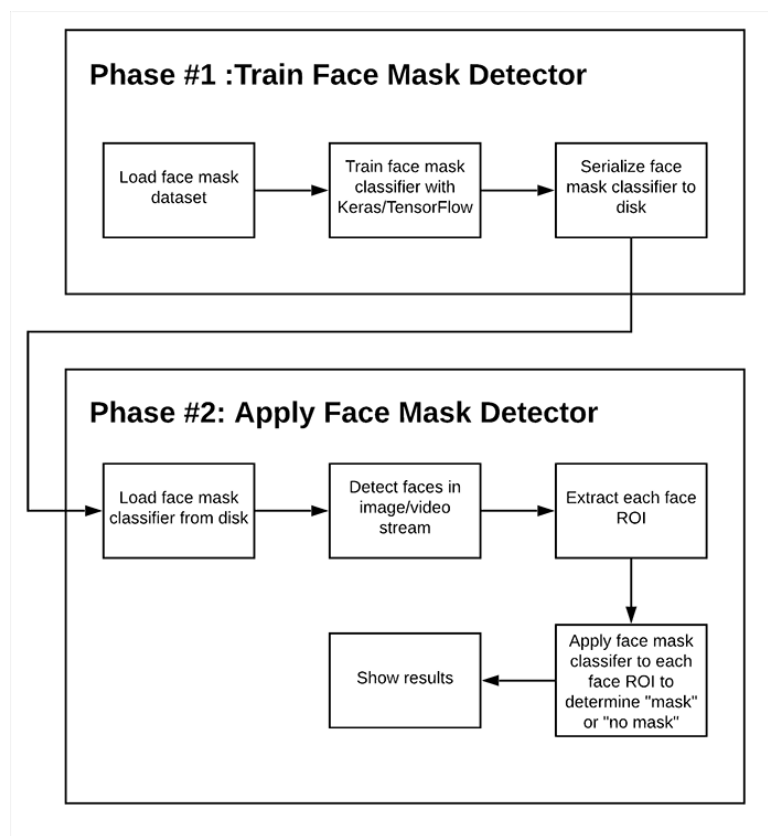
4. Data Sources*:

Data input in this project are images (with_mask and without_mask). Its easily available in Kaggle and if not able to find your custom dataset, we could generate our own dataset by constructing a face mask animation over the facial landmarks where the masks are usually gets wore.

5. Methodology:

In order to train a Face Mask Detector, we need to break our project into two distinct phases, each with its own respective sub-steps:

- Training: Here we'll focus on loading our face mask detection dataset from disk, training a model (using Keras/TensorFlow) on this dataset, and then serializing the face mask detector to disk
- Deployment: Once the face mask detector is trained, we can then move on to loading the mask detector, performing face detection, and then classifying each face as with_mask or without_mask



6. Frequently Asked Questions(s)* (FAQ):

I. *Is this a supervised or unsupervised problem?*

This is a supervised problem as here we will have separate folders in the dataset containing images of with_mask and without_mask.

II. *If supervised is it a classification or regression problem?*

This is a classification problem as here our dependent variable is nominal categorical variable i.e. with_mask or without_mask.

III. What variable is it you are trying to predict?

Here, I will try to predict if the dependent variable falls under the category of with_mask or without_mask.

IV. What variables will you use as predictors?

As, we don't have any readymade dataframe of data, we need to custom create some meaningful inferences from the input images and append it to relevant useful variables which could be eventually used with the progression of the project.

- predIdxs: index of the label with corresponding largest predicted probability
- faces, locs, preds: List of faces, their corresponding locations and list of predictions from the trained model network.
- confidence: Probability associated with the detection

V. What will be your training data?

Training data will be a set of images with_mask and without_mask which will be then splitted to testing data too using then scikit-learn libraries.

Expected Deliverable(s)*:

- Model trained with Deep Neural Network Architecture.
- Classification Report
- Plot of advancement of Training Loss/Accuracy with successive number of epochs while training.
- Output Video for testing

*: Subject to change with advancement of the project