FACE MASK DETECTION – SUMMARY

Problem Statement

The world has started to recover from COVID-19 pandemic and at most places we might not need to cover our face with masks anymore. However, there are certain places where masking is necessary. One of them being health care facilities. While we have returned to pre-COVID life, masks are still necessary. After the contraction of COVID or immunization most people are supposed to have antibodies but there is no surety. Studies have shown that the risk of passing on the virus is still there. The virus is contracted through the respiratory droplets that are produced during breathing, coughing or sneezing. This makes masking, especially in a closed social environment, a necessity. Public places like hospitals, medical schools, universities, airports, etc still have face mask regulations because the probability of virus spreading here is the highest. This brings us to an important question here - How can we efficiently keep the masking regulations in check? Is it possible to automate the process of mask detection? What role could technology play here?

Proposed Solution

This project attempts to automate the process of face mask detection. This can be done by utilizing the techniques Neural Networks and deep learning models offer us. In recent times, face detection/object detection has emerged as one of the promising applications in the field of image analysis. Today, the existing state of art methods for face detection are heavily based on Convolutional Neural Networks and they perform their jobs pretty well. The first step in any facial recognition is to detect the face. This project, similarly, follows this approach of first detecting the face of a person and then classifying it as ‘Mask’ or ‘No Mask’. Here we have used a pre-trained deep learning model named ‘MobileNetV2’ which was launched by Google in 2018. The application aims at detecting the face mask on static images as well as real time video stream.

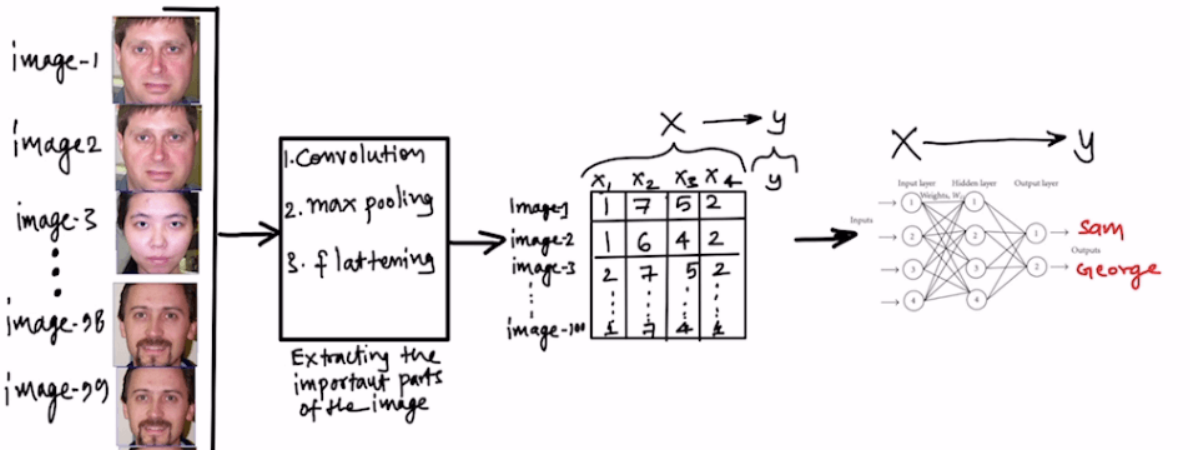
Dataset

The dataset for this project are images. The model is trained on images which classify as ‘masked’ or ‘non-masked’. Basically, they are the headshots of humans either wearing a mask or not wearing a mask.

During the process, data is split into training and test data, following a usual 80:20 split.

Convolutional Neural Networks(CNN)

CNNs has made learning images very simple. CNNs imitates the human brain when given an image - by concentrating on one area at a time then scanning the entire image, simulating how humans interpret an image. Every input image given to CNN is reduced to a vector of numbers that the fully connected Dense layers of ANN can learn.



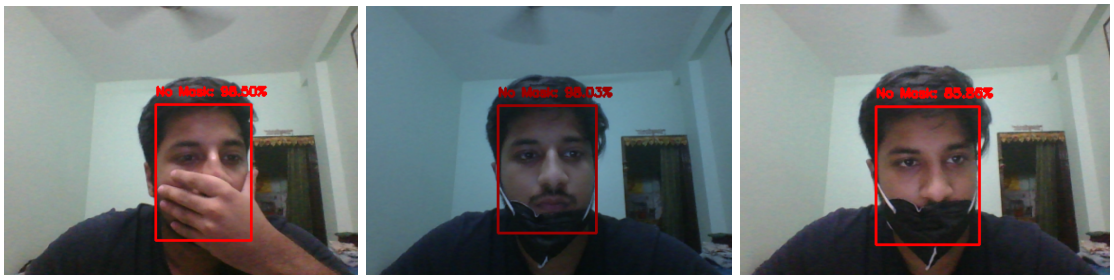
MobileNetV2

MobileNetV2 is a lightweight architecture built on MobileNet which was originally released by Google in 2018. It is a fast and efficient deep learning model which is highly compatible for mobile devices. It is pre-trained on over a million images present in ImageNet Database which enables the model to learn effectively, therefore, giving us accurate results. It is also significantly light making it compatible for embedded devices like raspberry pi, therefore, for a real-time system like Face mask detector. Face mask detectors should require less computation power, image processing and storage which makes MobileNetV2 an ideal choice. MobileNetV2 can be accessed under Keras modules using 'tf.keras.applications.mobilenet_v2.MobileNetV2'

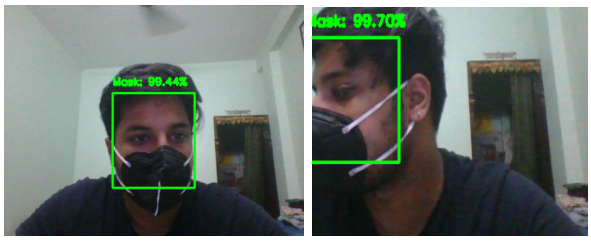
```
tf.keras.applications.mobilenet_v2.MobileNetV2(
    input_shape=None,
    alpha=1.0,
    include_top=True,
    weights='imagenet',
    input_tensor=None,
    pooling=None,
    classes=1000,
    classifier_activation='softmax',
    **kwargs
)
```

Results

In this section, we look at the results of the model when performed on multiple test cases. The model is successfully able to classify the following scenarios as 'No mask' :



It is also able to identify when a Mask is being worn - both with a front view and a side view:



Final Thoughts and Next Steps

The MobileNetV2 is competent in detecting and classifying the images as well as video streams. Moreover, The lightweight architecture of MobilenetV2 makes this project useful for real world applications of a mask detector at public places like hospitals, schools, airports, etc.

In the future we would like to deploy this model on an embedded system like Raspberry Pi and test in real time which would give us an idea on how deployable this system can be.