FACE MASK DETECTOR

Sapna Singh S
Dept of Computer Science
PES University
Bangalore, India
sapnasingh4120@gmail.com

Shreya Bhat
Dept of Computer Science
PES University
Bangalore, India
shreya1042001@gmail.com

Keerthi Joshi
Dept of Computer Science
PES University
Bangalore, India
keerthi.joshi2822@gmail.com

I. Abstract*— *In the present scenario due to Covid-19, there is no efficient face mask detection applications which are now in high demand for transportation means, densely populated areas, residential districts, large-scale manufacturers and other enterprises to ensure safety. Also, the absence of large datasets of 'with mask' images has made this task more cumbersome and challenging.

II. Introduction

Face Mask Detection system built with OpenCV, Keras/TensorFlow using Deep Learning and Computer Vision concepts in order to detect face masks in static images as well as in real-time video streams. Our face mask detector didn't use any morphed masked images dataset. The model is accurate, and since we used the MobileNetV2 architecture, it's also computationally efficient and thus making it easier to deploy the model to embedded systems (Raspberry Pi, Google Coral, etc.).

This system can therefore be used in real-time applications which require face-mask detection for safety purposes due to the outbreak of Covid-19. This project can be integrated with embedded systems for application in airports, railway stations, offices, schools, and public places to ensure that public safety guidelines are followed.

III. PROBLEM STATEMENT

A. Goal

Our goal is to train a custom deep learning model to detect whether a person is or is not wearing a mask.

B. Methodology

We are using adam optimization algorithm for deep learning which combines the best properties of both AdaGrad and RMS Prop algorithms to provide an optimization algorithm that can handle sparse gradients on noisy problems

We are also using MobileNetV2, a pre trained CNN model. This was developed by google and was pretrained on image net dataset of 1.4M images and 1000 classes of web images.

We will implement a Python script to train a face mask detector on our dataset using Keras and TensorFlow.

We use this Python script to train a face mask detector and we'll proceed to implement two more additional Python scripts used to:

1. Detect COVID-19 face masks in images
2. Detect face masks in real-time video streams

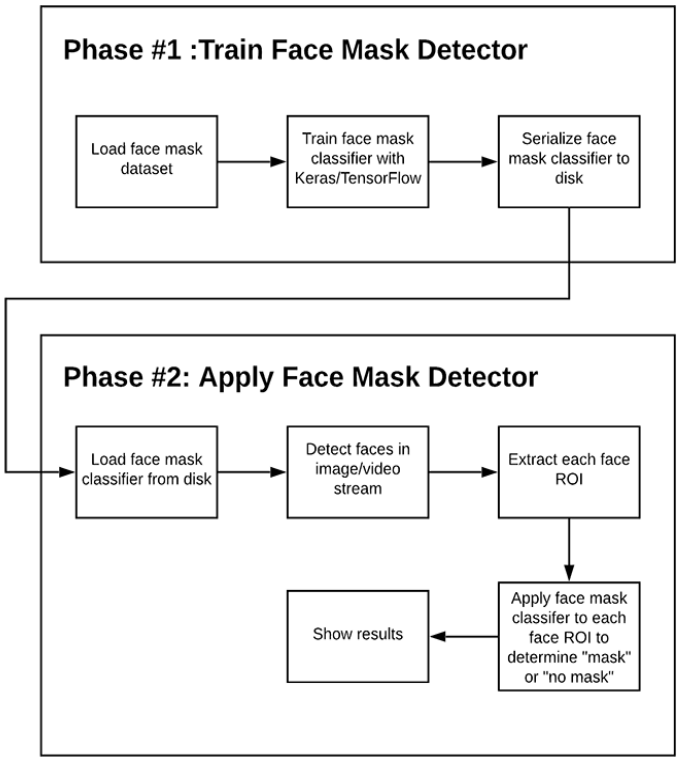
We first apply face detection to compute the bounding box location of the face. We then extract the face ROI, apply landmarks, apply an image of mask using landmarks and create a dataset.

We then train face mask classifier with Keras/TensorFlow. Load face mask classifier from disk.

Detect faces from image, video stream and extract ROI of each face.

Apply face mask classifier to each ROI to determine face with mask or no mask and show result.

C. Data Flow Diagram.

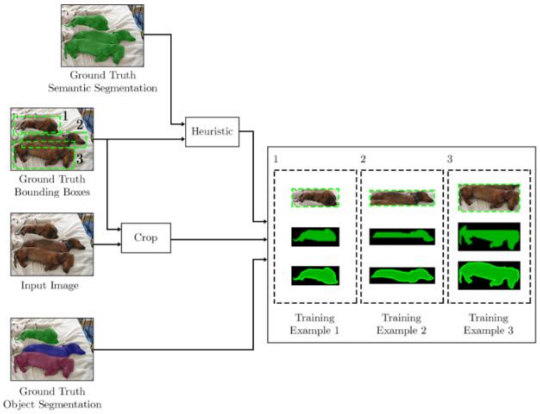


.

IV. APPROACH

- Detecting faces in images/videos
- Extracting each individual face
- Applying our face mask classifier

C. Masknet

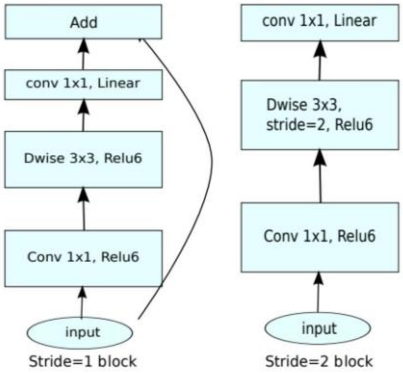


In the first one, the input image is processed by a semantic segmenter CNN, and by an object detector CNN, to provide the semantic maps and bounding boxes for the later stages of the network. These outputs are fed into a heuristic that aims to provide initial guesses for the masks of each region enclosed by the bounding boxes, such that pixels in the mask have a strong likelihood of belonging to the instance that needs to be segmented, but at the cost of consistently leaving parts of the desired instance unmasked. These masks are simply binary images in which pixels with the value 1 denote positions that belong to the instance, whereas pixels with the value 0 do not.

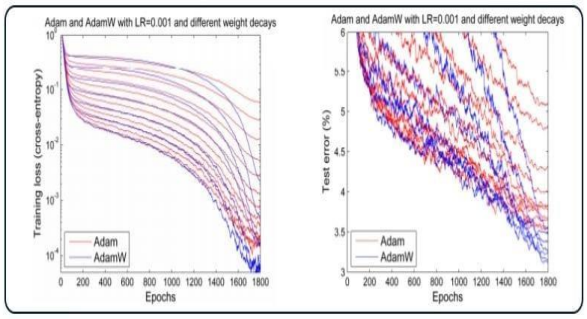
Together with the original patches of the image enclosed by each bounding box, the initial guesses for the masks, henceforth referred to as "partial masks", are then fed into another CNN, the mask proposal subsystem, which finally outputs the instances found in the scene. The idea is that these partial masks can possibly help the system to decide which instance to segment, if more than one is present in the region.

D. Algorithm

- Mobilenetv2
  MobileNetV2 is a convolutional neural network architecture that seeks to perform well on mobile devices. It is based on an inverted residual structure where the residual connections are between the bottleneck layers. The intermediate expansion layer uses lightweight depth wise convolutions to filter features as a source of non-linearity. As a whole, the architecture of MobileNetV2 contains the initial fully convolution layer with 32 filters, followed by 19 residual bottleneck layers.

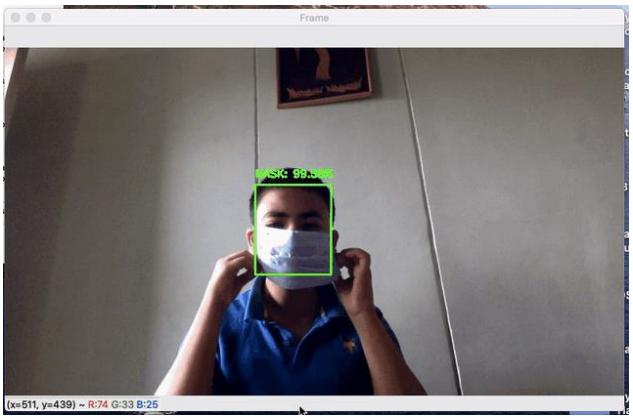


- Adam
  Adam is a replacement optimization algorithm for stochastic gradient descent for training deep learning models. It is an adaptive learning rate method, which means, it computes individual learning rates for different parameters. Adam uses estimations of first and second moments of gradient to adapt the learning rate for each weight of the neural network. The method is also appropriate for non-stationary objectives and problems with very noisy and/or sparse gradients. The hyper-parameters have intuitive interpretations and typically require little tuning.

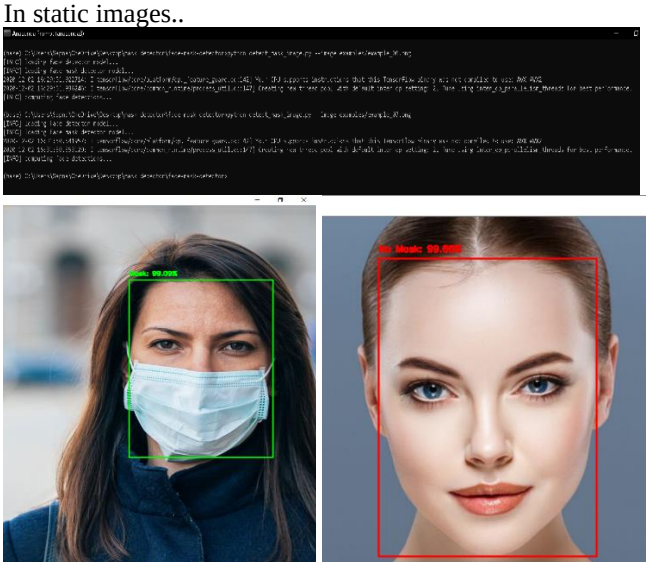


V. IMPLEMENTATION

In real-time video streams..



In static images..



VI. REFERENCES

[1] http://publications.lib.chalmers.se/records/fulltext/250417/250417.pdf

[2] https://machinelearningmastery.com/adam-optimization-algorithm-for-deep-learning/

[3] https://www.kaggle.com/ashwingupta3012/human-faces

[4] https://www.kaggle.com/andrewmvd/face-mask-detection

[5] https://ai.googleblog.com/2018/04/mobilenetv2-next-generation-of-on.html?m=1

[6] https://github.com/prajnasb/observations/tree/master/experiements/data

[7] https://arxiv.org/pdf/1412.6980v9.pdf

VII. EXPECTED RESULT

This model is able to detect person with or without mask in static images as well as real time video stream. We fine-tuned MobileNetV2 on our mask/no mask dataset and hence we are able to obtain a classifier that is ~99% accurate.

Below is the link for the complete project:

https://github.com/sapnasingh2041/Face-Mask-Detector

VIII. CONCLUSION

In this paper, we have given a brief explanation of our project of face mask detector, If deployed correctly, the COVID-19 mask detector we're building here today could potentially be used to help ensure your safety and the safety of others. The project should be able to fulfill the expected end result.

IX. ACKNOWLEDGEMENT

We are sincerely thankful to our course instructors for their most support and encouragement and our project guide who gave us a correct picture on how to take this project forward. This gives us the experience on how to cooperate and engage ourselves in a serious project.