Face Mask Detection

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Introduction

During pandemic COVID-19, WHO has made wearing masks compulsory to protect against this deadly virus. Therefore, face mask detection has become a crucial task to help global society.

Now To detect whether a person is wearing Face Mask or not, we will use Face Mask Detection Technique. Face Mask Detection Platform utilizes Artificial Network to perceive if a person does/doesn't wear a mask. The application can be associated with any current or new IP cameras to identify individuals with/without a mask.

To achieve this purpose using some basic Machine Learning packages like TensorFlow, Keras, OpenCV and Scikit-Learn. The proposed method detects the face from the image correctly and then identifies if it has a mask on it or not. As a surveillance task performer, it can also detect a face along with a mask in motion. The method attains accuracy up to 99%.

Literature Survey

- **Deep Learning Based Safe Social Distancing And Face Mask Detection In Public Areas For COVID-19 Safety Guidelines Adherence:** In this approach it uses computer vision and MobileNet V2 architecture to help maintain a secure environment and ensure individuals protection by automatically monitoring public places to avoid the spread of the COVID-19 virus and assist police by minimizing their physical surveillance work in containment zones and public areas where surveillance is required by means of camera feeds with raspberry pi4 in real-time.

- **An Automated System To COVID-19 Using to Limit COVID-19 Using Facial Mask Detection in Smart City Network:** CCTV cameras are used to capture real-time video footage of different public places in the city. From that video footage,facial images are extracted and these images are used to identify the mask on the face. The learning algorithm Convolutional Neural Network (CNN) is used for feature extraction from the images then these features are learned by multiple hidden layers. Whenever the architecture identifies people without face mask this information is transferred through the city network to the corresponding authority to take necessary actions.

Literature Survey

- **Study of Masked Face Detection Approach in Video Analytics:** Distance from camera method is used to see if person is approaching towards the camera or going away. Decreasing distance indicates person is approaching towards the camera and face detection can be triggered. Eye line detection finds out valley in horizontal histogram projection. If eye line is detected, face detection can be applied to see if person is wearing mask or not. As it can be seen, in the cases where person is not wearing mask, face detection and facial part detection take place properly. When person is wearing mask or face is covered with hand or cloth, detection of face might not take place in certain cases.
- **Facial Mask Detection using Semantic Segmentation:** Here, we were able to understand generation of accurate face masks for human objects from RGB channel images containing localized objects.Proposed network can detect non frontal faces and multiple faces from single image. The method can find applications in advance tasks such as facial part detection.
- **MASKED FACE RECOGNITION USING CONVOLUTIONAL NEURAL NETWORK:**FaceNet model trained on masked and non-masked images gives better accuracy for simple masked face recognition. Although we concentrated on masks induced by a hat, sunglasses, beard, long hairs, mustache, and medical mask, our methodology can still be extended to more complex and many other sources of occlusion

Literature Survey

- **Face Mask Detection using Transfer Learning of InceptionV3:** In this paper, we propose a deep learning model that detects persons who are not wearing a mask. This proposed deep learning model is built using transfer learning of InceptionV3. In this work image augmentation techniques are used to enhance the performance of the model as they increase the diversity of the training data. The same work can further be improved by employing large volumes of data and can also be extended to classify the type of mask, and implement a facial recognition system, deployed at various workplaces to support person identification while wearing the mask.
- **Facemask Assistant: Detection of facemask service stage based on Mobile Phone:** In this paper, we understood a service stage detection method based on a mobile microscope which can be used to obtain the micro-photos of the face mask being used. In our detection method, we first get the micro-photos of face mask being used, which may reflect some details such as droplets or other obvious dirt. Then, we extract texture features from the micro-photos using four measures viz. contrast, correlation, energy and homogeneity as the features. Subsequently, KNN method is applied to work on the detect the service stage. In validation experiments, the obtained system achieves a relatively good result with a precision of 82.87% on the testing dataset.

Literature Survey

- **Real-Time Facemask Recognition with Alarm System using Deep Learning:** This paper manuscript presented a study on real-time facemask recognition with an alarm system through deep learning techniques by way of Convolutional Neural Networks. This process gives a precise and speedily results for facemask detection. The test results show a distinguished accuracy rate in detecting persons wearing a facemask and not wearing a facemask. The trained model was able to achieve a 96% result for performance accuracy.
- **Real Time Face Detection and Tracking Using OpenCV:** In order to locate a human face, the system needs to capture an image using a camera and a frame-grabber to process the image, search the image for important features and then use these features to determine the location of the face. For detecting face there are various algorithms and methods including skin colour based, haar like features, adaboost and cascade classifier Colour is an important feature of human faces.

Literature Survey

- **Covid-19 Face Mask Detection Using TensorFlow, Keras and OpenCV:** Face mask detection involves in detecting the location of the face and then determining whether it has a mask on it or not. The issue is proximately cognate to general object detection to detect the classes of objects. Face identification categorically deals with distinguishing a specific group of entities i.e. Face. It has numerous applications, such as autonomous driving, education, surveillance, and so on. This paper presents a simplified approach to serve the above purpose using the basic Machine Learning (ML) packages such as TensorFlow, Keras, OpenCV and Scikit-Learn.
- **Face Detection By Ping Hsin Lee, Vivek Srinivasan, and Arvind Sundararajan:** In this project, We determined that the more complex classifiers did not work as well as expected due to the lack of large databases for training**. Reasonable results were obtained with color segmentation, template matching at multiple scales, and clustering of correlation peaks. ng. Ideally, neural networks, FLD(** Fisher linear discriminant **), SVM(** support vector machines**), or MRC (maximal rejection classification) could be used after color segmentation and template matching to reject the false positives, non-faces classified as faces.**

Literature Survey

- **COVID-19 FACEMASK DETECTION WITH DEEP LEARNING AND COMPUTER VISION:** An efficient and economic approach of using AI to create a safe environment in a manufacturing setup. A hybrid model using deep and classical machine learning for face mask detection will be presented. A face mask detection dataset consists of with mask and without mask images , we are going to use OpenCV to do real-time face detection from a live stream via our webcam. We will use the dataset to build a COVID-19 face mask detector with computer vision using Python, OpenCV, and TensorFlow and Keras. Our goal is to identify whether the person on image/video stream is wearing a face mask or not with the help of computer vision and deep learning.
- **Masked Face Recognition Dataset and Application:** Most current advanced face recognition approaches are designed based on deep learning, which depend on a large number of face samples. However, at present, there are no publicly available masked face recognition datasets. To this end, this work proposes three types of masked face datasets, including **Masked Face Detection Dataset (MFDD), Real-world Masked Face Recognition Dataset (RMFRD)(** currently the world's largest real-world masked face dataset.**)Simulated Masked Face Recognition Dataset (SMFRD)**. These datasets are freely available to industry and academia, based on which various applications on masked faces can be developed. The multi-granularity masked face recognition model we developed achieves 95% accuracy, exceeding the results reported by the industry.

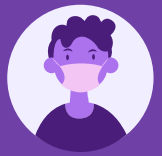
Literature Survey

- **Face Mask Detector: Single Shot Detector:** The basic aim of the project is to detect the presence of a face mask on human faces on live streaming video as well as on images. We have used deep learning to develop our face detector model. The architecture used for the object detection purpose is Single Shot Detector (SSD) because of its good performance accuracy and high speed. Alongside this, we have used basic concepts of transfer learning in neural networks to finally output presence or absence of a face mask in an image or a video stream. Experimental results show that our model performs well on the test data with 100% and 99% precision and recall, respectively.
- **Detecting Masked Faces in the Wild with LLE-CNNs :** Detecting faces with occlusions is a challenging task due to two main reasons**: the absence of large datasets of masked faces, and the absence of facial cues from the masked regions**.**The Proposal module first combines two pre-trained CNNs to extract candidate facial regions from the input image and represent them with high dimensional descriptors. After that, the Embedding module is incorporated to turn such descriptors into a similarity-based descriptor by using locally linear embedding (LLE) algorithm and the dictionaries trained on a large pool of synthesized normal faces, masked faces and non-faces.** In this manner, many missing facial cues can be largely recovered and the influences of noisy cues introduced by diversified masks can be greatly alleviated.

System Requirement

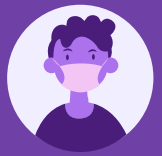
i5 8th gen processor

A good processor is the key for building a ML project



Python 3.7

A programming language used to implement ML project



PyCharm

PyCharm is an development environment used for the Python language.

TensorFlow

Can do range of tasks but has a particular focus on training and inference for DNN

Keras

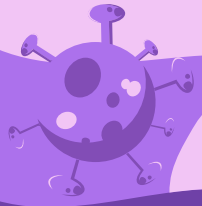
Keras acts as an interface for the TensorFlow library

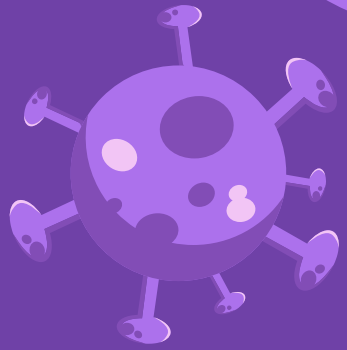
openCV

OpenCV is a library of programming functions mainly aimed at real-time computer vision.

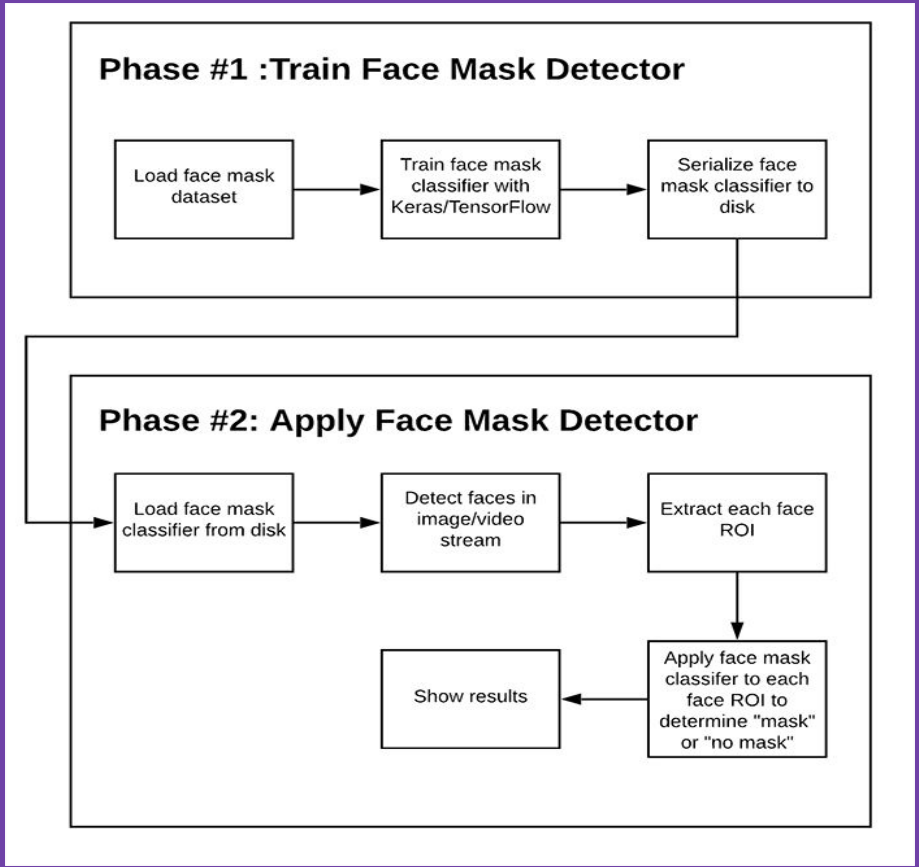
DESIGN

Overall architecture of the project with use case diagram and sequence diagrams with explanation.

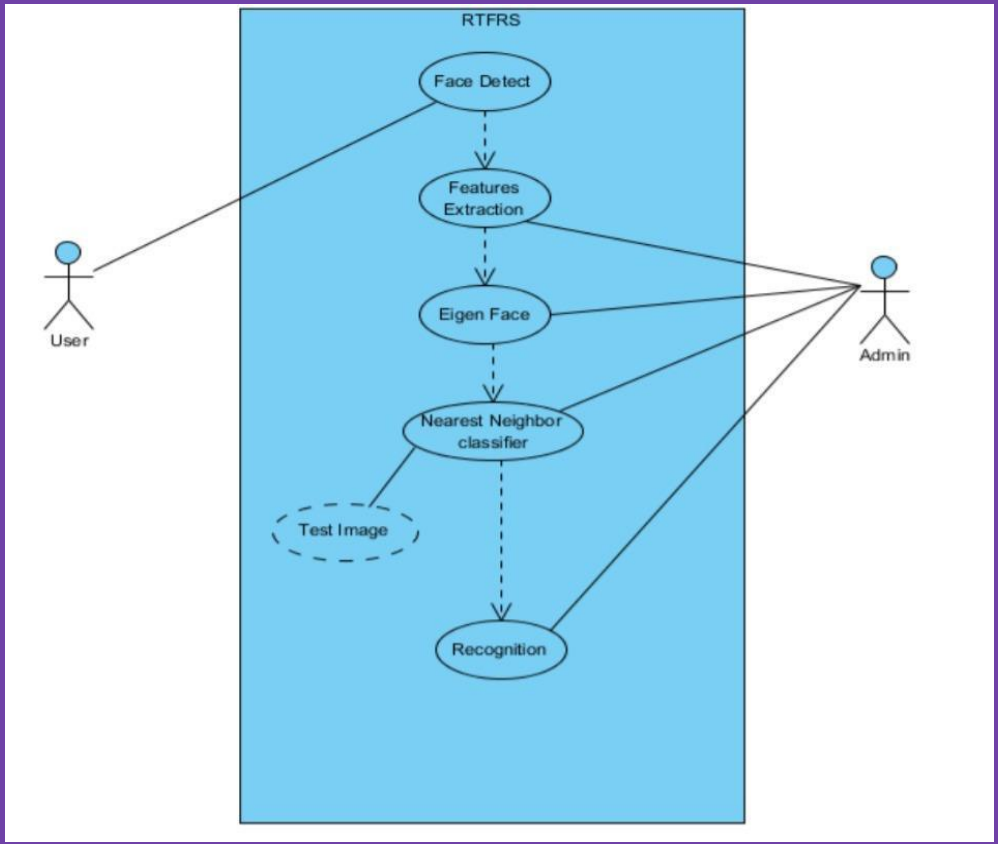




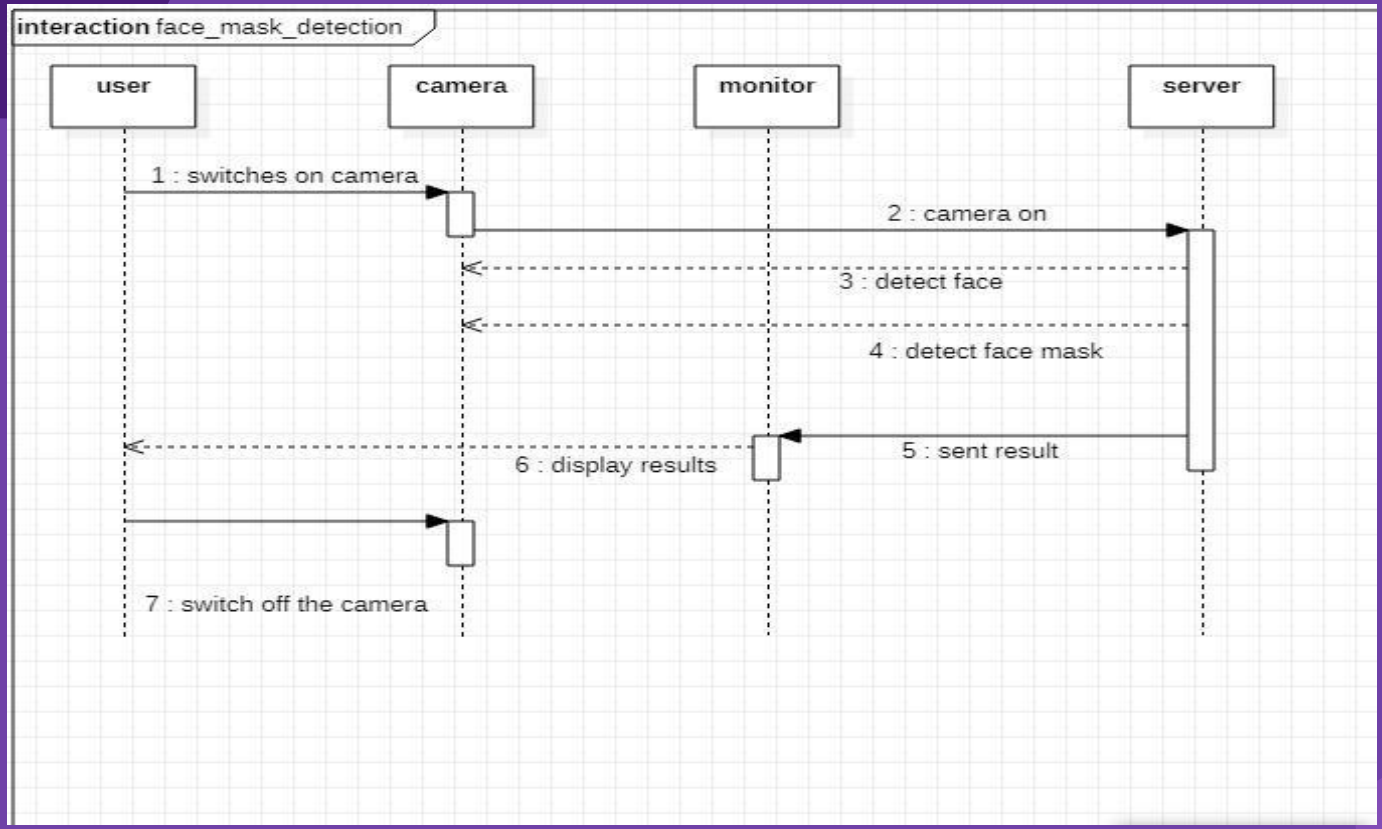
Architecture



Use Case Diagram



Sequence Diagram



Test Cases

Test Case 1

Single person with mask

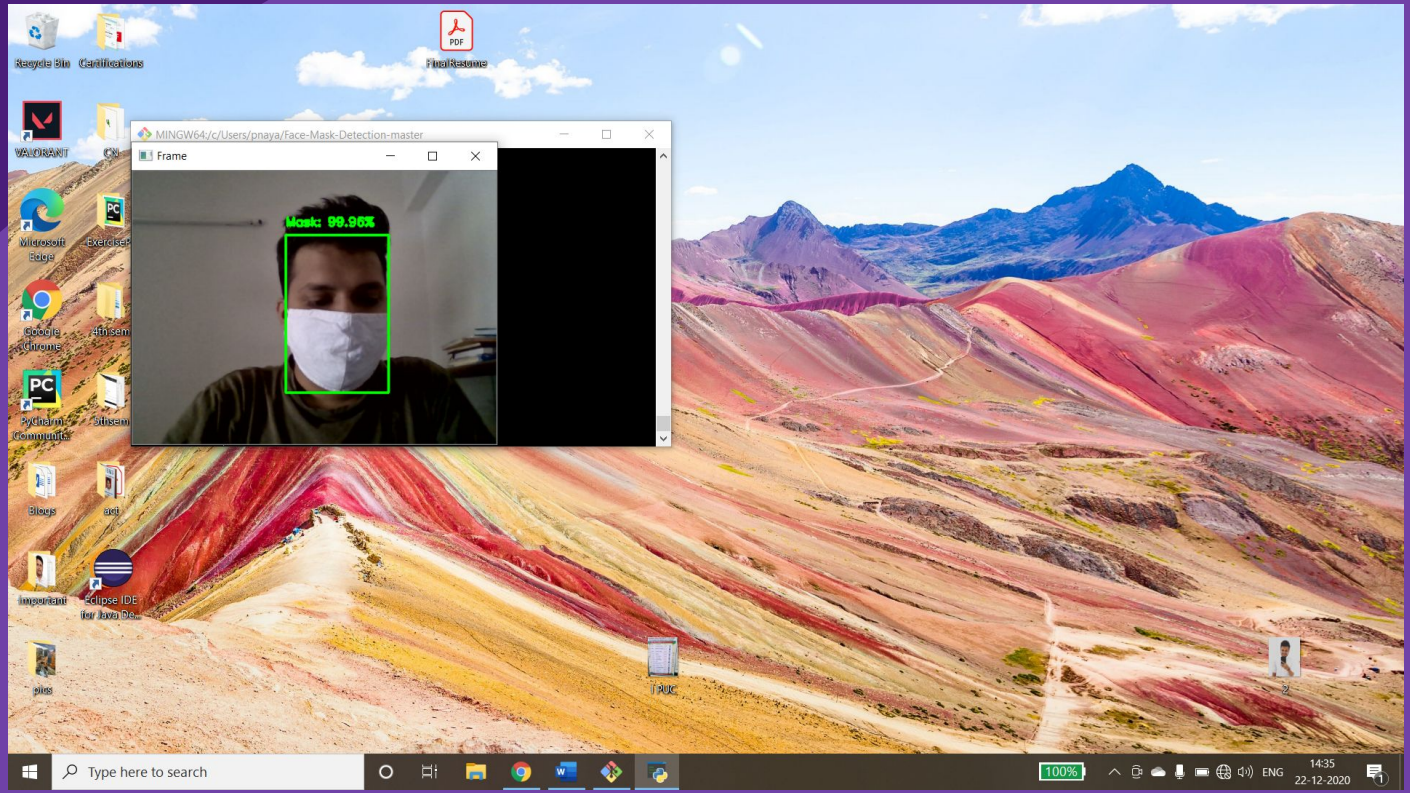
Test Case 2

Single person without mask

Test Case 3

Multiple people with/without mask

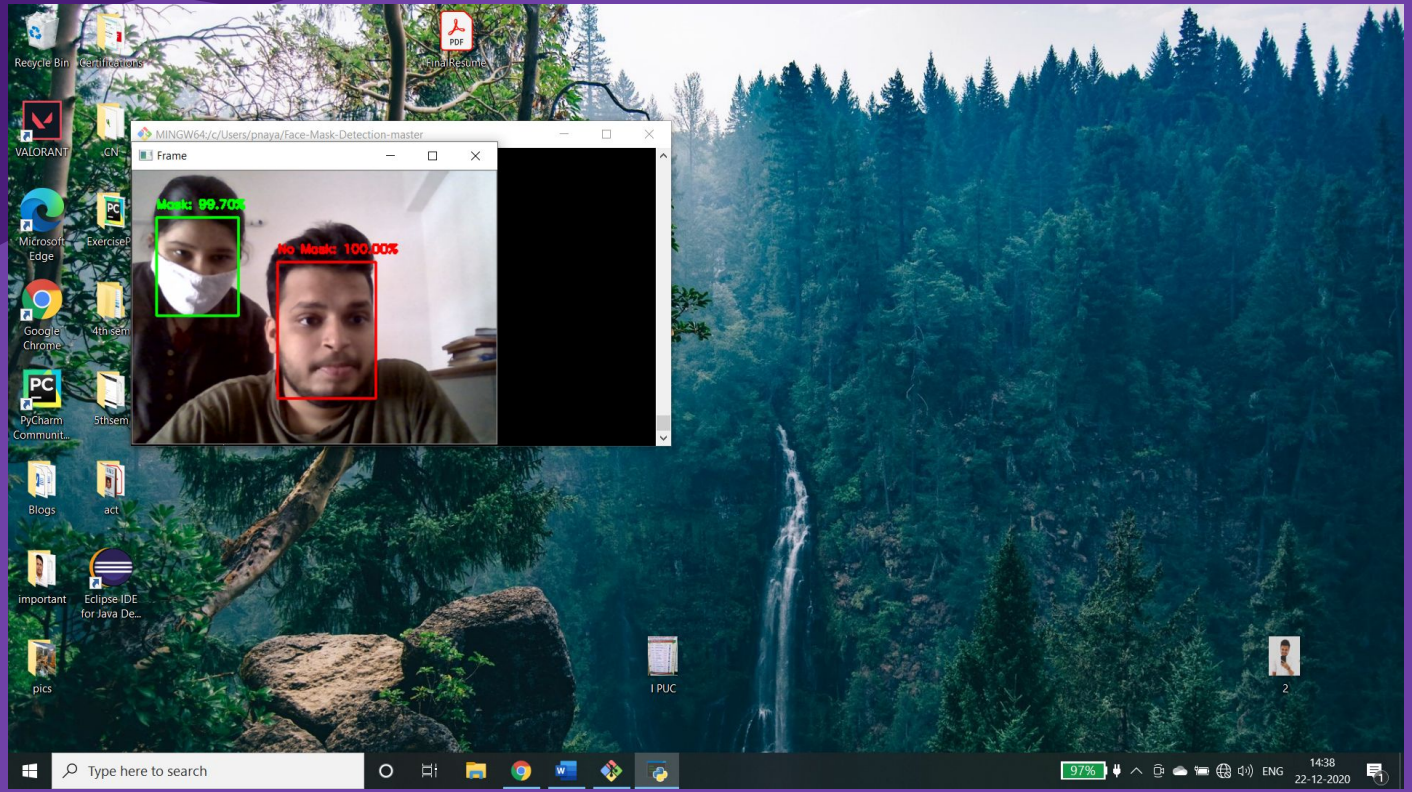
Test Case 1


MINGW64:/c/Users/pnaya/Face-Mask-Detection-master
Frame
Mask: 99.96%
Recycle Bin
Certifications
Final Resume
VALORANT
CN
Microsoft Edge
Exercises
Google Chrome
Athisem
PyCharm Community
Bthisem
Blogs
act
Important
Eclipse IDE for Java De...
pins
T PUC
Type here to search
100%
ENG
14:35
22-12-2020

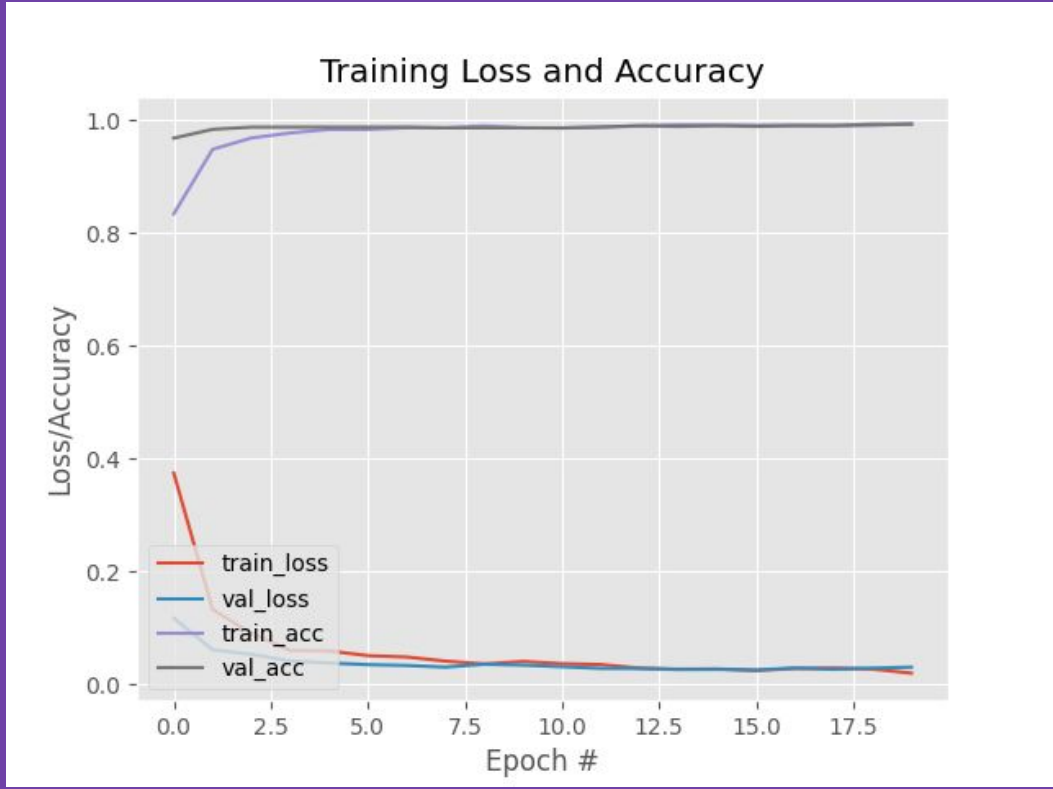
Test Case 2


Recycle Bin
Certifications
Final Resume
VALORANT
CN
MINGW64:/c/Users/pnaya/Face-Mask-Detection-master
Frame
No Mask: 100.00%
Microsoft Edge
Exercises
Google Chrome
4thsem
PyCharm Community
5thsem
Blogs
act
Important
Eclipse IDE for Java De...
piss
T PUC
Type here to search
98%
ENG
14:37
22-12-2020

Test Case 3


MINGW64:/c/Users/pnaya/Face-Mask-Detection-master
Frame
Mask: 99.70%
No Mask: 100.00%
Recycle Bin
Certificates
Final Resume
VALORANT
CN
Microsoft Edge
ExerciseP
Google Chrome
4th sem
PyCharm Communit...
5thsem
Blogs
act
important
Eclipse IDE for Java De...
pics
I PUC
2
Type here to search
97%
ENG
14:38
22-12-2020

Analysis


Training Loss and Accuracy
Loss/Accuracy
Epoch #
train_loss
val_loss
train_acc
val_acc
1.0
0.8
0.6
0.4
0.2
0.0
0.0
2.5
5.0
7.5
10.0
12.5
15.0
17.5

Conclusion

We created a COVID-19 face mask detector using OpenCV, Keras/TensorFlow, and Deep Learning. To create our face mask detector, we trained a two-class model of people *wearing masks* and people *not wearing masks.*

We fine-tuned our model on our *mask/no mask* dataset and obtained a classifier that is ~99% accurate.

We then took this face mask classifier and applied it to both *images* and *real-time video streams* by:

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

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THANK YOU

Hope you liked the presentation :)