FACE MASK DETECTION USING MACHINE LEARNING AND DEEP LEARNING

Main Project work submitted to Avinashilingam Institute for Home Science and Higher Education for Women

MASTER OF SCIENCE IN INFORMATION TECHNOLOGY

Submitted By

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SCHOOL OF PHYSICAL SCIENCES AND COMPUTATIONAL SCIENCES

DEPARTMENT OF INFORMATION TECHNOLOGY

Coimbatore-

641043 May 2020

DECLARATION

DECLARATION

I hereby declare that the project entitled **"FACE MASK DETECTION USING MACHINE LEARNING AND DEEP LEARNING"** is a record of the original work done by Preethi. M (19PIT006) under the guidance of Dr. D. Shanmuga Priya M.Sc., M.Phil., Ph.D., Head and Assistant Professor, Department of Information Technology, school of physical sciences and computational sciences, Avinashilingam Institute for Home Science and Higher Education for Women, in the partial fulfilment for the degree of Master of Science in Information Technology and this project has not formed the basis for any Degree/Diploma/Associates.

Place:

Date:

Signature of the Candidate

_____

Countersigned by

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ACKNOWLEDGEMENT

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ABSTRACT

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The corona virus COVID-19 pandemic is causing a global health crisis so the effective protection methods is wearing a face mask in public areas according to the World Health Organization (WHO). The COVID-19 pandemic forced governments across the world to impose lockdowns to prevent virus transmissions. Reports indicate that wearing face masks while at work clearly reduces the risk of transmission. A face mask detection dataset consists of with mask and without mask and improper mask images ,In this project to use OpenCV to do real-time face detection from a live stream via our webcam.Here to use the dataset to build a COVID-19 face mask detector with computer vision using Python, OpenCV, and Tensor Flow and Keras. Our goal is to identify whether the person on image/video stream is done by wearing a face mask or not with the help of machine learning and deep learning.

CONTENT

INTRODUCTION

1.INTRODUCTION

The trend of wearing face masks in public is rising due to the COVID- 19 corona virus epidemic all over the world. Before Covid-19, People used to wear masks to protect their health from air pollution. While other people are self-conscious about their looks, they hide their emotions from the public by hiding their faces. Scientists proofed that wearing face masks works on impeding COVID-19 transmission. Artificial Intelligence (AI) based on Machine learning and Deep Learning can help to fight Covid-19 in many ways. Machine learning allows researchers and clinicians evaluate vast quantities of data to forecast the distribution of COVID-19, to serve as an early warning mechanism for potential pandemics, and to classify vulnerable populations. People are forced by laws to wear face masks in public in many countries. These rules and laws were developed as an action to the exponential growth in cases and deaths in many areas. However, the process of monitoring large groups of people is becoming more difficult. The monitoring process involves the detection of anyone who is not wearing a face mask.

The model is integration between deep learning and classical machine learning techniques with opencv, tensor flow and keras. In this techniques have used deep transfer leering for feature extractions and combined it with three classical machine learning algorithms.The introduced a comparison between them to find the most suitable algorithm that achieved the highest accuracy and consumed the least time in the process of training and detection.

LITERATURE SURVEY

2.LITERATURE SURVEY

Generally, most of the projects specialize in face construction identity recognition when wearing mask. During this projects, the focus is on recognizing the people that wearing mask, or not help in decreasing the transmission and spreading of covid-19. The scientist has proven that wearing a mask help in minimizing the spreading rate of Covid-19.

the authors developed a face mask wearing condition identification method. They were ready to classify three categories of face mask-wearing. The categories are face mask- wearing, incorrect face mask-wearing and no face mask-wearing. In this poject have applied the principal component analysis on masked and unmasked face recognition to acknowledge the person. Also, The author proposed a way that's used for removing glasses from human frontal faces.The authors used the YOLOv3 algorithm for face detection. YOLOv3 uses Darknet-53 because the backbone. The general is to attenuate the false positive face detection as possible without missing mask detection so as to trigger alarms just for medical staff who don't wear a surgical mask.This deep learning real-time face emotion classification and recognition. They used VGG-16 to classify seven countenance.

Under the present Covid-19 lock-in time, this technique is effective in preventing spread in may use cases. Here are some use cases which will benefit form system.

Airports: the proposed system could also be vital find travelers at airports. there's no mask. The traveler's data are often captured as a video within the system at the doorway . Any passenger who finds no mask will alert the airport authorities send in order that they can act quickly.

Hospital: the proposed system are often integrated with CCTV cameras, and therefore the data are often manage to ascertain if its employees are wearing masks. If you discover some doctors . If the aren't wearing a mask, they're going to receive a reminder to wear a mask.

Office: The proposed system can help to take care of safety standards to stop . The spread of covid-19 or any such airborne disease. If some employees aren't wearing masks, they're going to receive reminders to wear mask.

The choice of the system must be supported the simplest performance. So, This project using the simplest system performance indicators in order that you'll large –scale implementation.

The system has been used with the MobileNetV2 classifier:

MobileNetV2: MobileNetV2 is that the latest technology of mobile visual recognition, including classification, object detection and semantic segmentation The classifier uses deep intelligent separable convolution, its purpose is to significantly reduce the complexity cost and model size of the network, so it's suitable for mobile devices, or devices with low computing power. In MobileNetV2, another best module introduced is that the reverse residual structure. The nonlinearity within the narrow layer is removed. Maintain because the backbone of feature extraction, MobileNetV2 achieves the simplest performance in object detection and semantic segmentation.

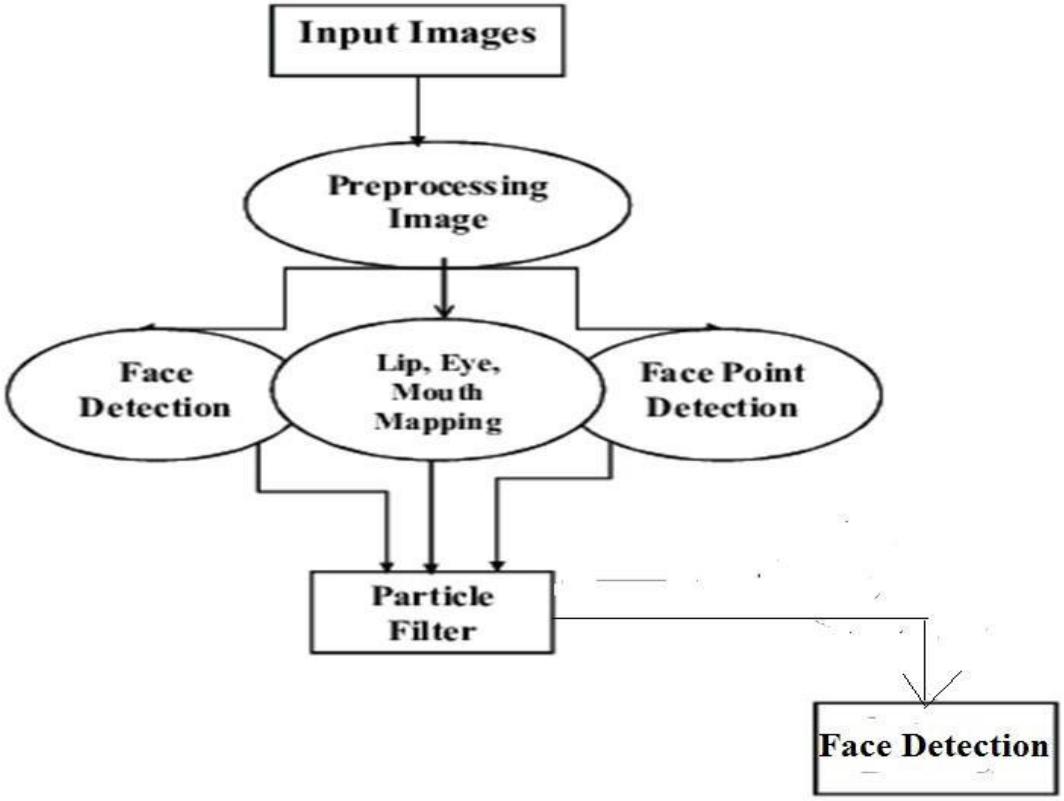
For MobileNetV2 classifier, ADAM optimizer has been applied to see performance:

ADAM: Adam, a stochastic optimization algorithm supported step the target function is predicated on an adaptive estimation of low-order moments. this manner it's computationally efficient and may be executed almost without memory. It’s the diagonal of the gradient is rescaled unchanged, which is extremely suitable for the subsequent problems large in terms of knowledge and/or parameters. Hyper parameters are intuitive explain that they typically don't require much adjustment. The empirical results show that Adam it works well in practice and may be compared with other stochastic optimization method.

SI. NO	TITLE	METHOD	USES	ACCURACY
1	Face mask detection & Real time detector	Machine Learning-Neural Network	Automate detection & accuracy	91%
2	Recognition face mask detection & Real time detection .	Machine Learning-Deep learning	Social distancing monitor	82.6%
3	Recognition and Classification of Face mask using Machine Learning Techniques	Machine Learning-CNN,K-mean clustering and SVM	CCTV feeds and ensures safety	99.0%
4	Face mask detection using deep learning	Deep learning-Convolution Neural Network	high and low computation scenarios, respective	99.3%
5	Face mask detection and real time detection using CNN	CNN classifiers, support vector machine (SVM).	computer vision to monitor the activity	99.8%

METHODOLOGY

3.METHODOLOGY



3.1.Loading the data set

- The data used for this work are gathered from the https://www.kaggle.com/omkargurav/face-mask-dataset
- Dataset created for training face mask detection model using CV techniques.
- The total number of images in the dataset in these three categories. I can see that there are 3725 images in the "with mask" and 3828 images in the "without mask".

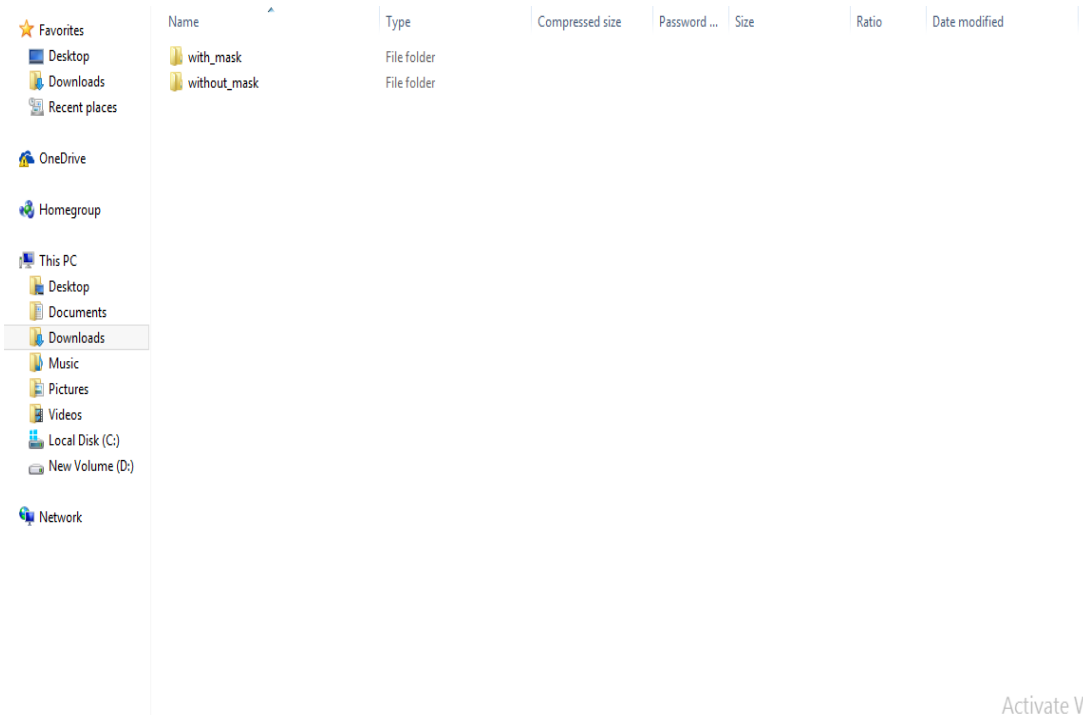


Figure 1 View the dataset

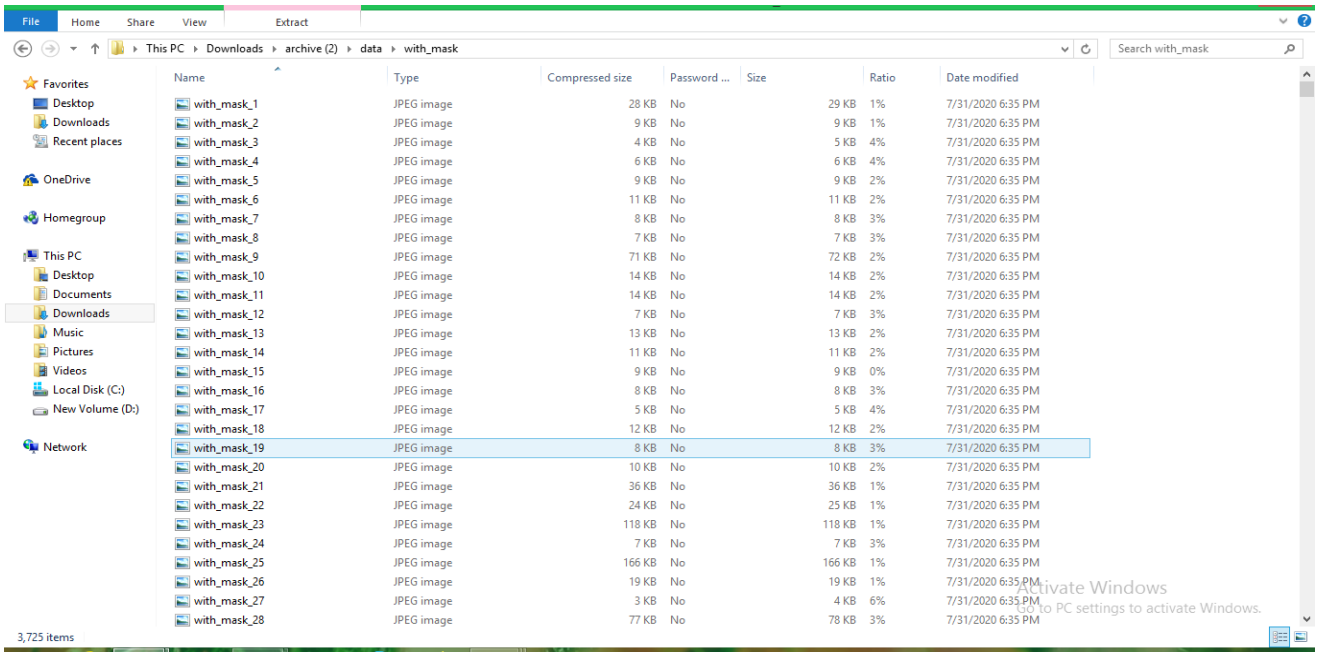


Figure 2

3.1.1Data set description

- Covid-19 pandemic paused our world for a while but people know how to cope up with situations like these.

  My main motive for creating this dataset is because people can use it according to their understanding and create products which would ensure that everyone remains safe.

- This dataset can be used for face mask detection. In this project divided it into 2 categories:

  - People wearing mask

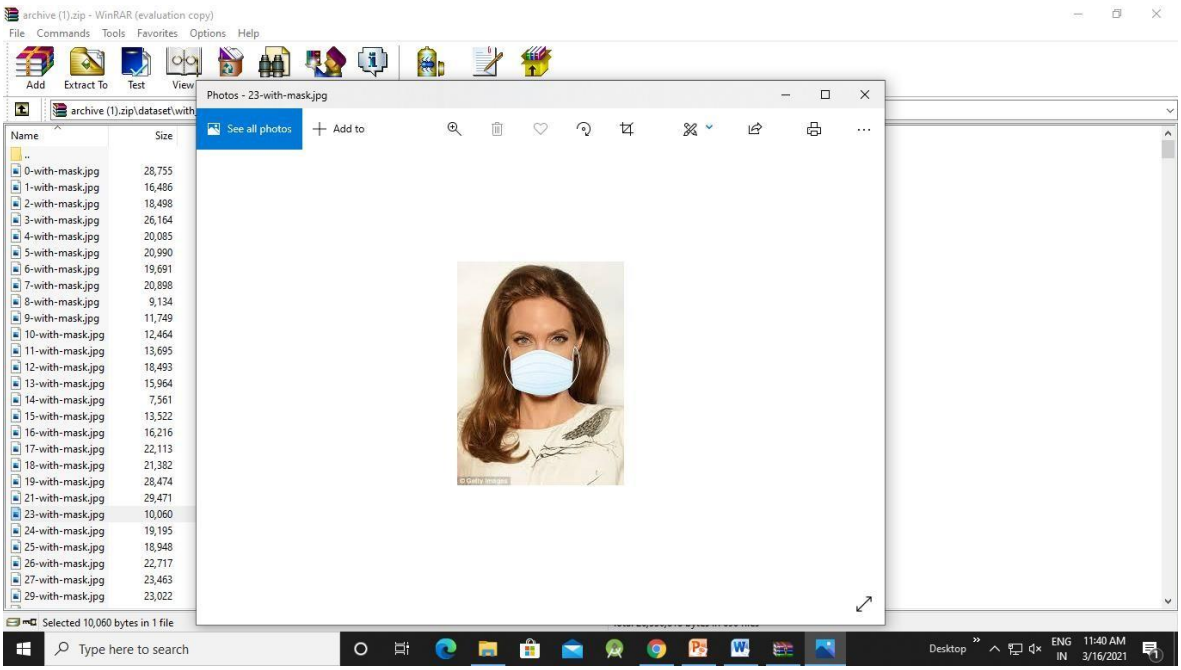


Figure 3 With Mask Image

- People not wearing mask

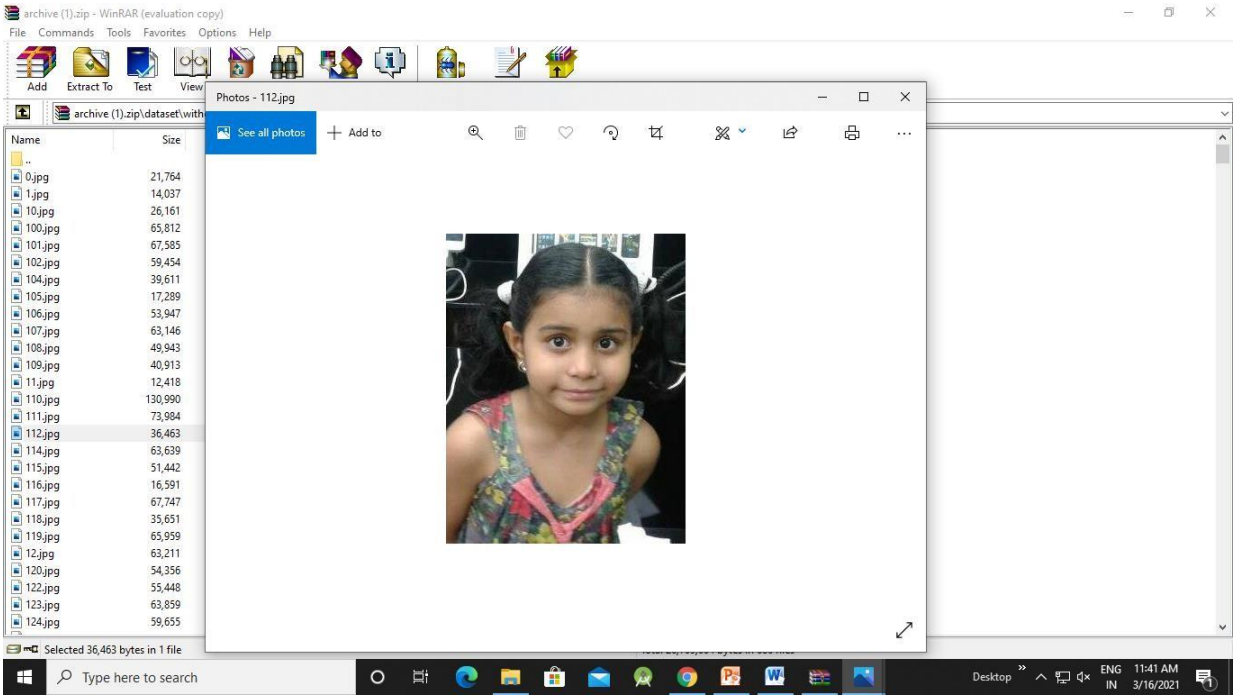


Figure 4 Without Mask Image

3.1.2Attribute description

The total number of images in the dataset in these three categories. Here see that there are 3725 images in the “with mask” and 3828 images in the “without mask”.

Table 1

Categories	**Labeled**	**Total image count**
With mask	Yes	3725
Withoutmask	No	3828

3.2Data pre-processing

preprocessing steps as mentioned below was applied to all the raw input images to convert them into clean versions, which could be fed to a neural network machine learning model.

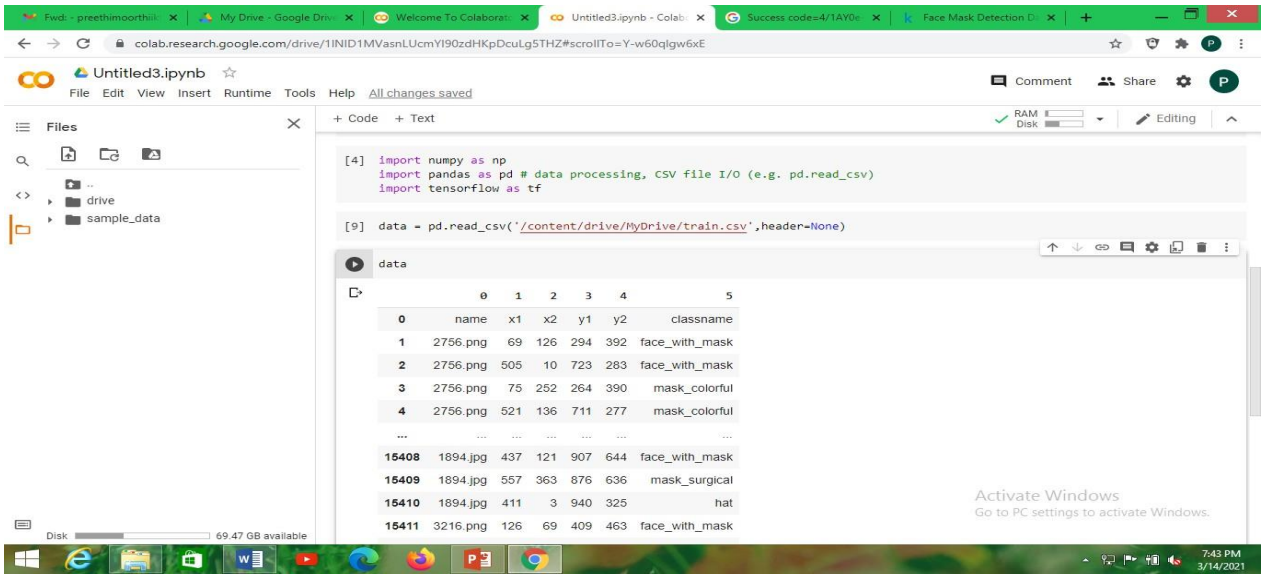


Figure 5 Import Library

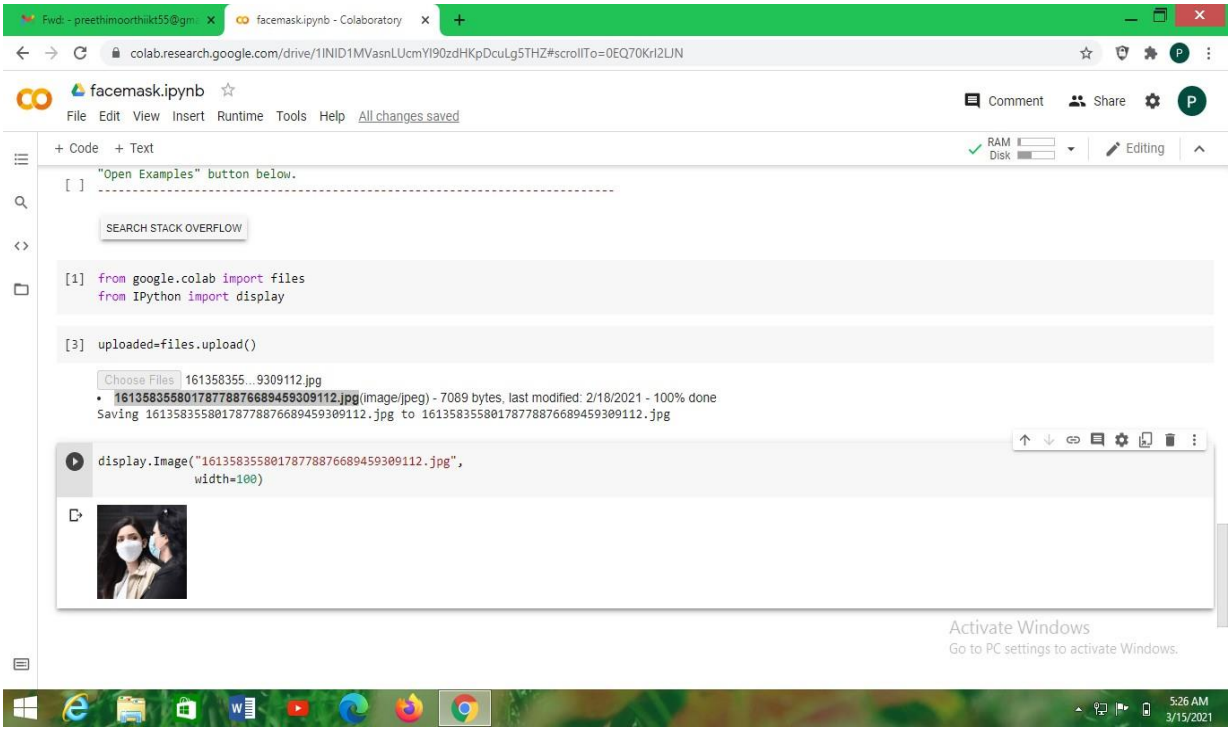


Figure 6 Upload the With Mask Image

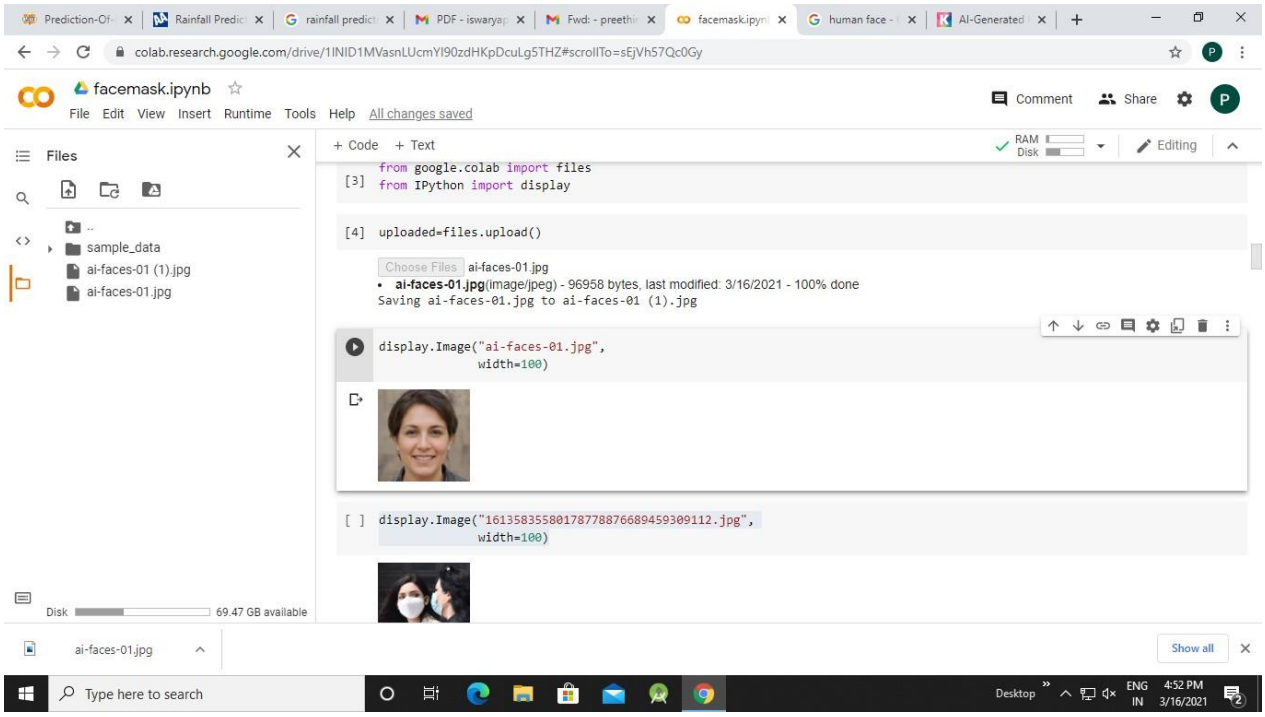


Figure7 Upload without mask image

Noise Removal

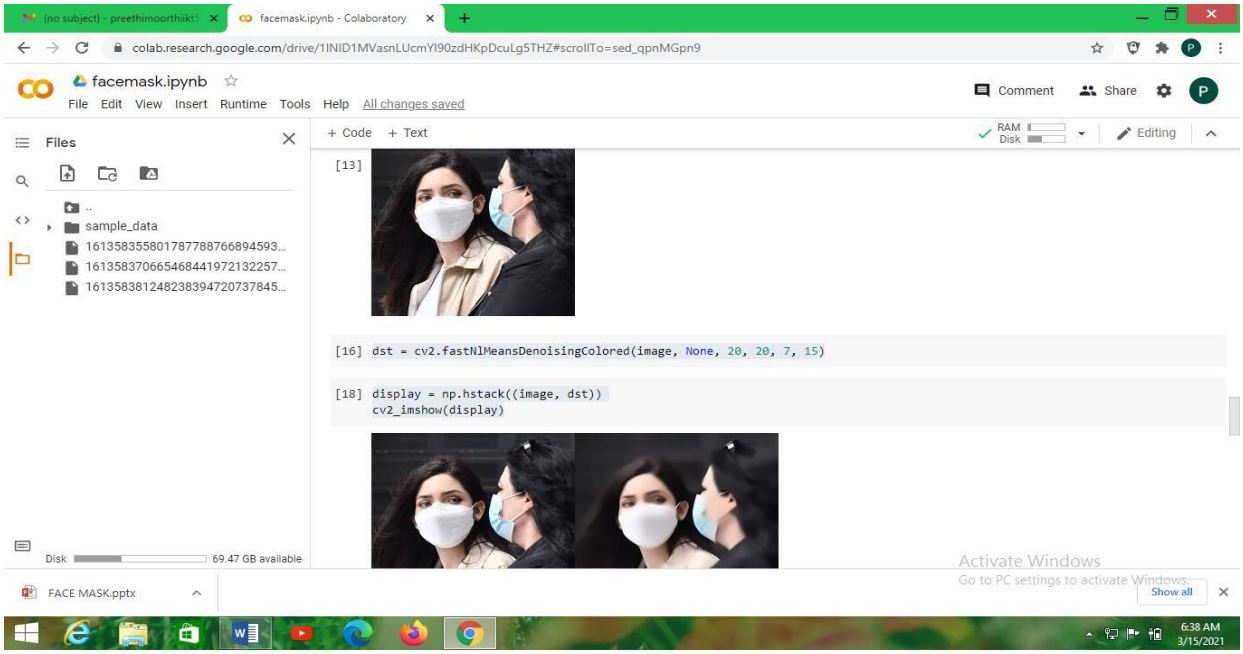


Figure 8 Noise remove with mask image

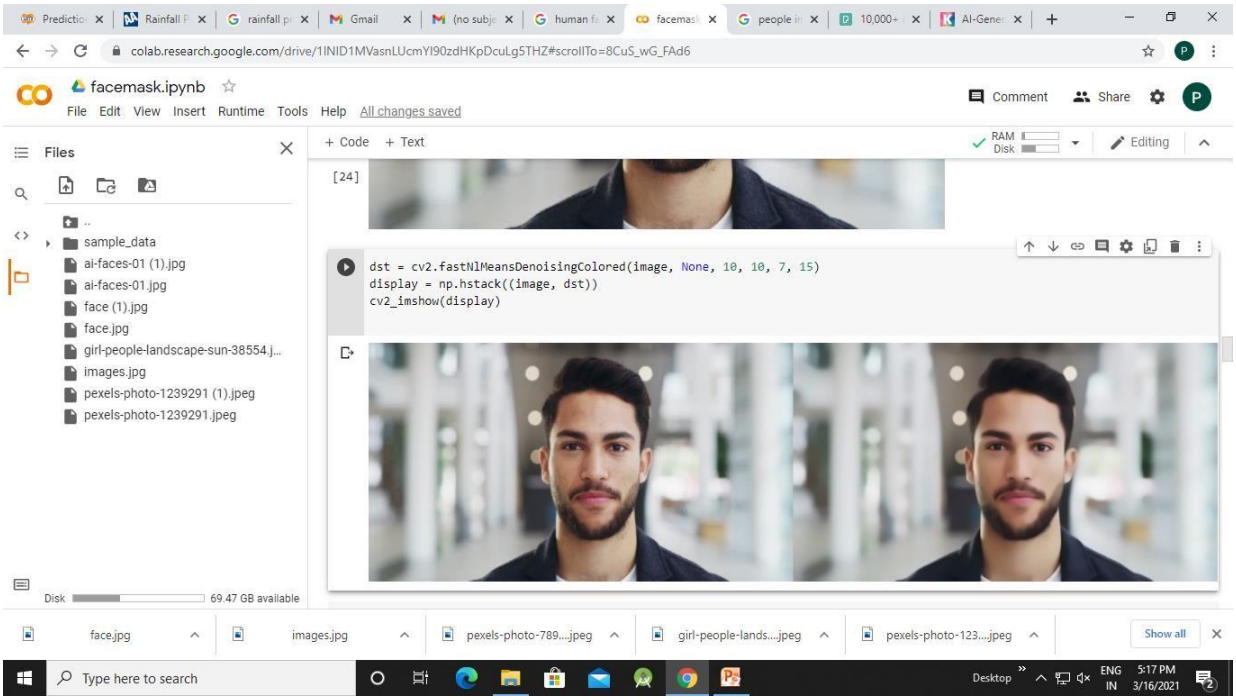


Figure 9 Noise remove without mask

3.3Data Transformation

3.3.1 Feature Extraction

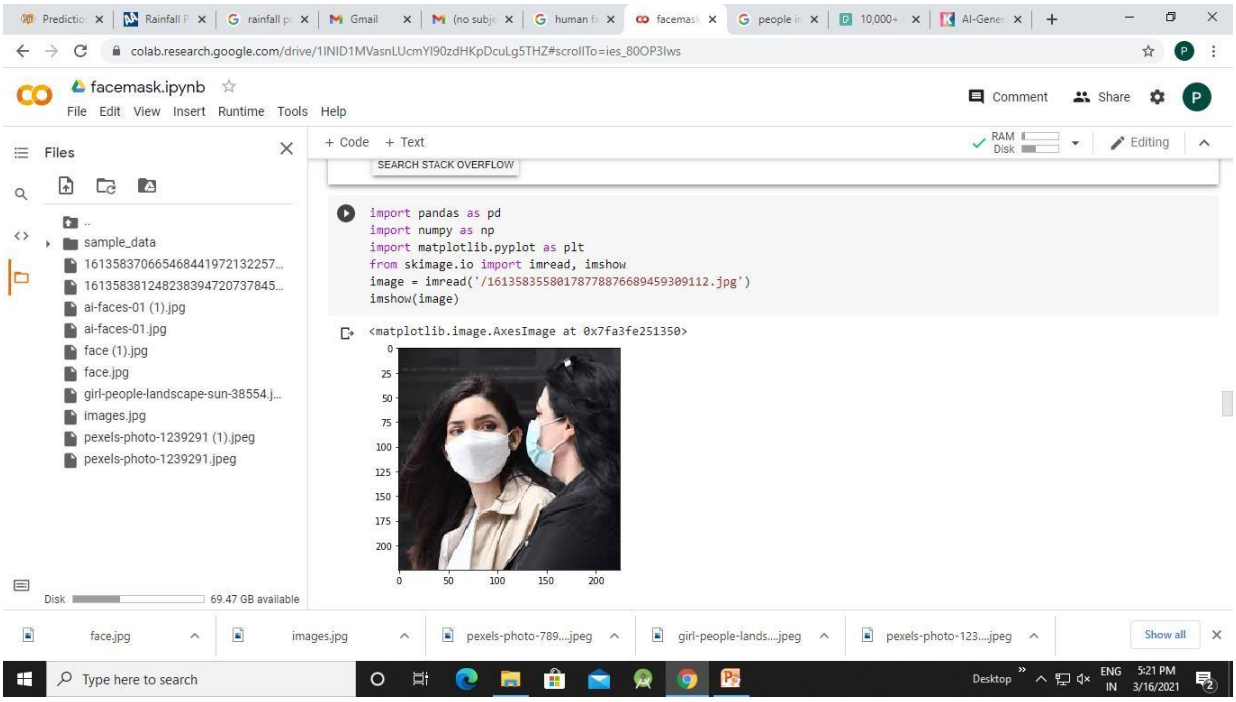


Figure 10 Extract With mask imag

Image extract Gray scale

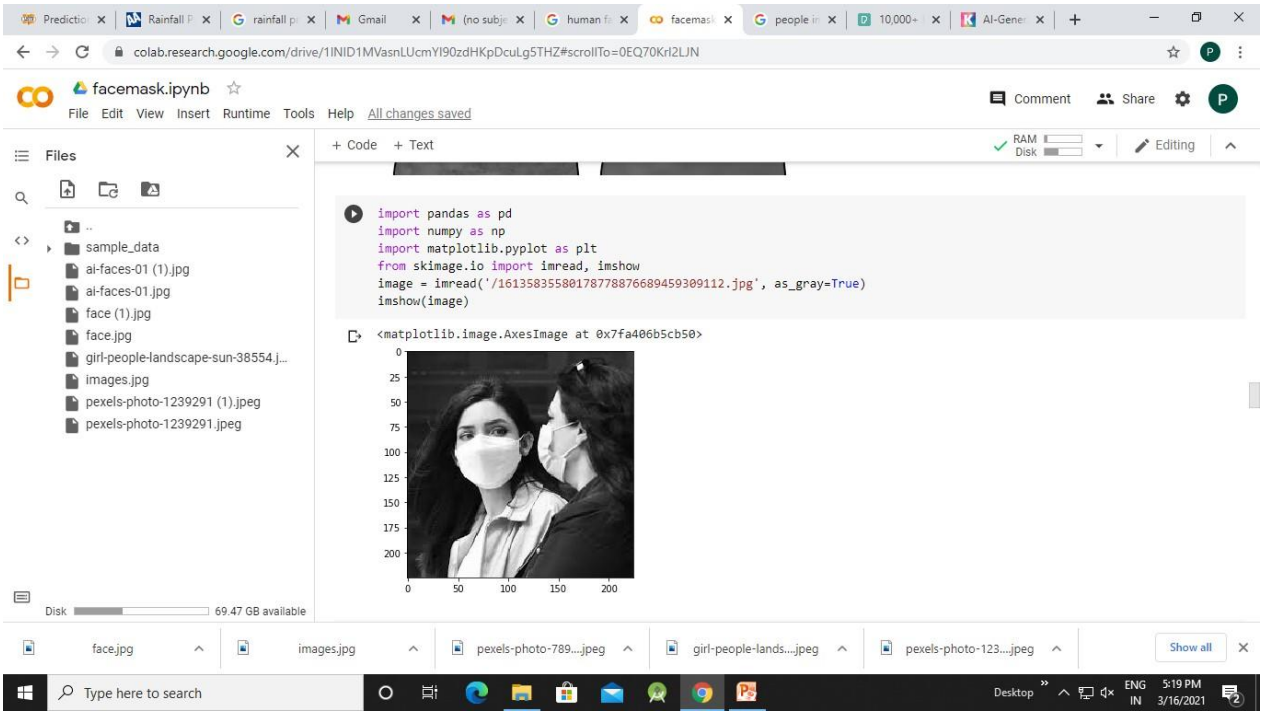


Figure11 Extract With mask to the gray scale image

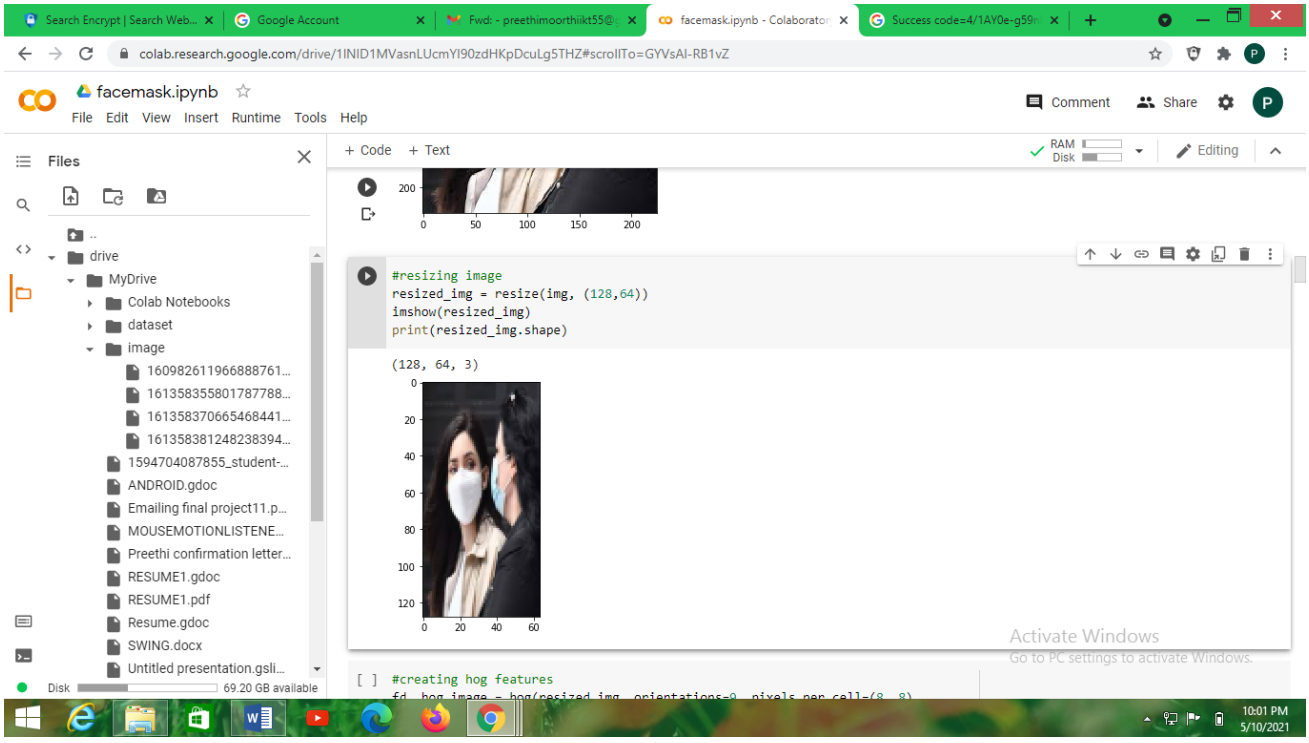


Figure 12 Resizing the image

HOG Algorithm

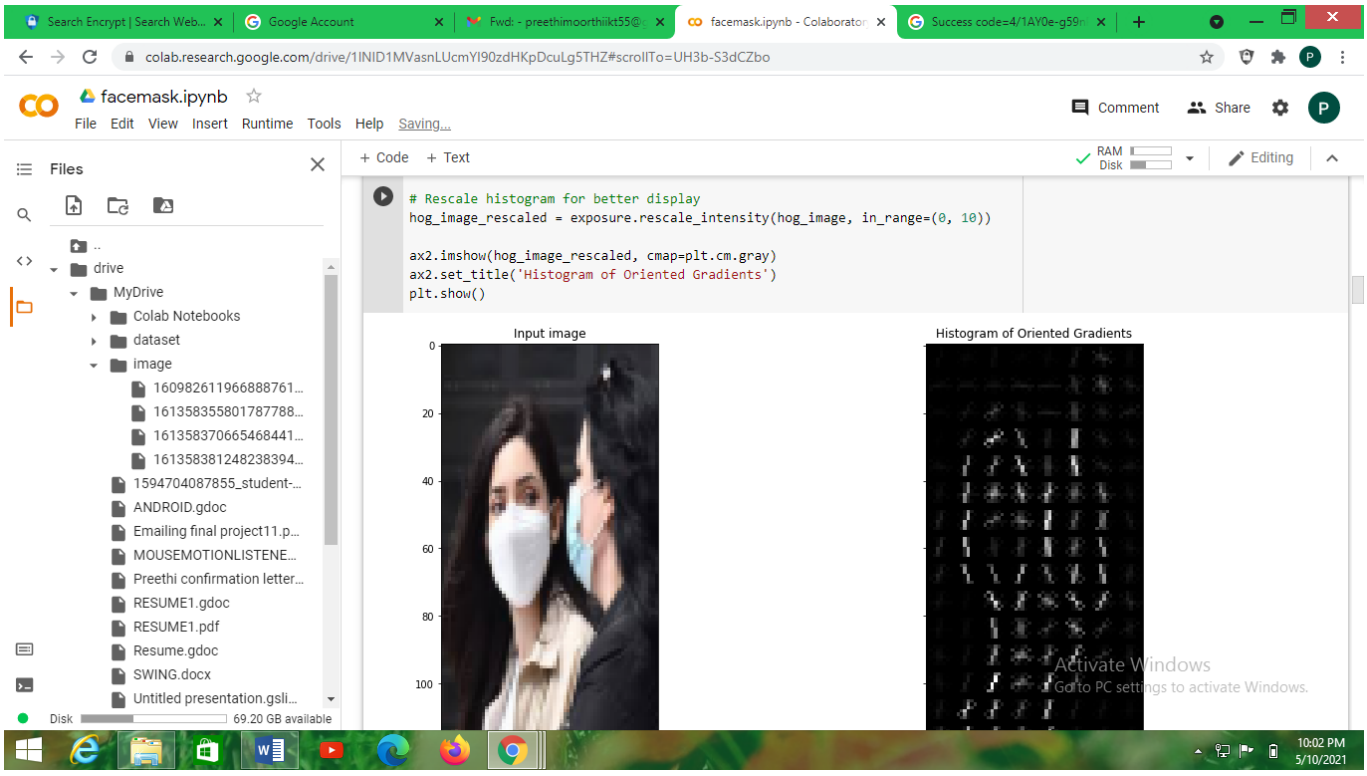


Figure 13 Extract with the HOG algorith

3.4Classification

3.4.1 Importing the packages

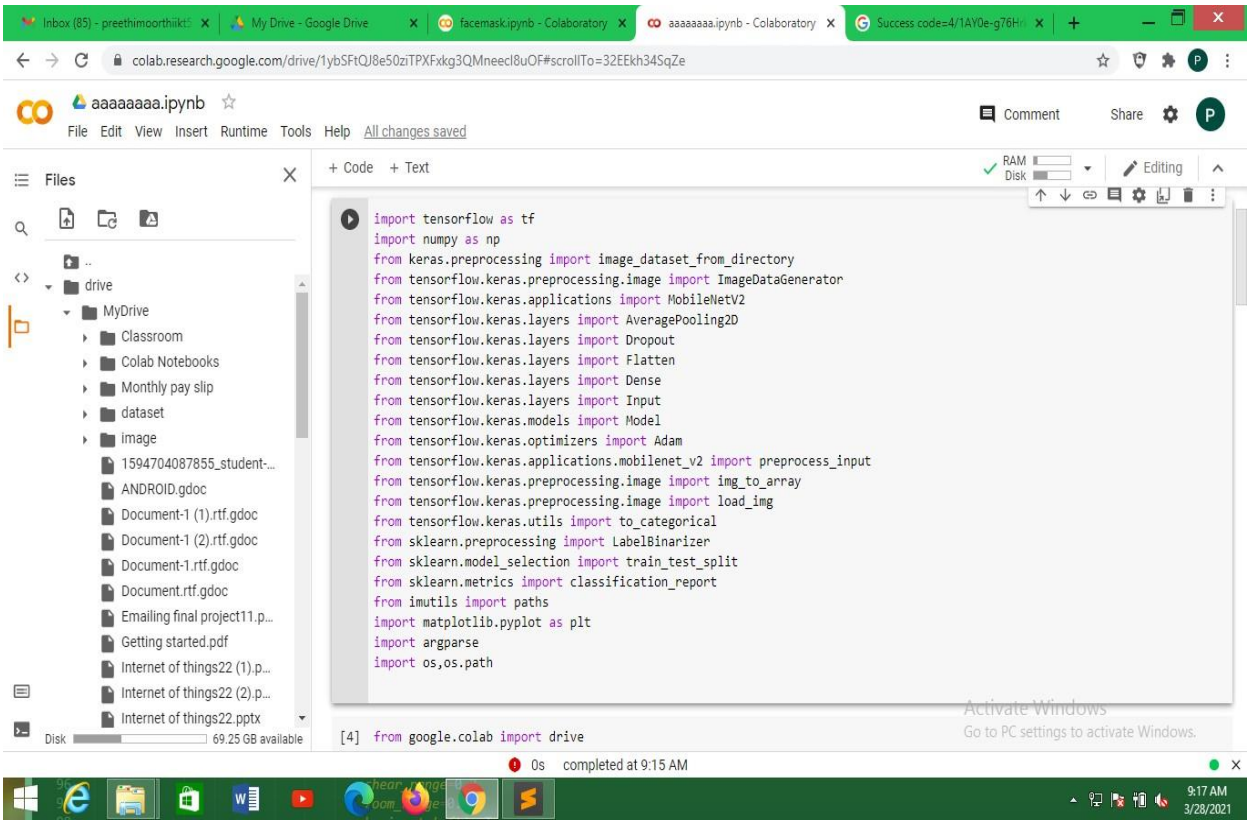


Figure 14 Importing the packages

3.4.2Algorithm specification

3.4.3.1 Support Vector Machine

SVM in clustering is under research for the unsupervised learning aspect.Here, use unlabeled data for SVM. The topic is under research.The support vector machine uses two or more labelled classes of data. It separates two different classes of data by a hyperplane.The data points based on their position according to the hyperplane will be put in separate classes.

This support vectors would be the facts factors that will be better to the taking away hyper plane; these varieties of factors usually are within the boundary from the slab. The next determine demonstrates these varieties of definitions, along with + showing facts factors regarding form 1, in addition to - showing facts factors regarding form -1. 15: SVM hyper plane for two classes.

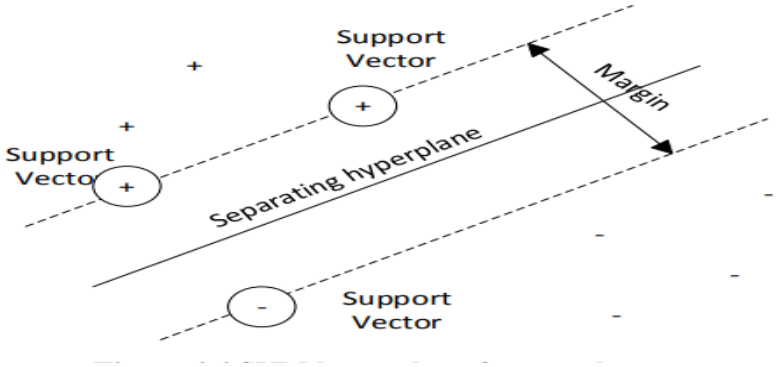


Figure 15 SVM hyper plane for two classes

For the comparative study we have taken only images and used to improve the image quality for better visualization Contrast Limited Adaptive Histogram Equalization is been applied on the RGB images. The enhanced images are been used as input and by using tensor flow with LeNet architecture and Adam optimizer the data is been trained and tested.

Many times we see that many road accidents take place. This can be due to driver's ignorance of traffic sign board and road signs. As the road traffic is increasing day by day there is a necessity of following the traffic rules with proper discipline. Traffic signboard detection is an important part of driver assistant systems. The basic idea of proposed system is to provide real time voice signal to the driver about the presence of traffic sign board at a particular distance apart. The project is divided in to two parts:

1. Training

2. Implementation

The system provides the driver with real time information from road sign board, which consist the most important and challenging tasks. It generates a voice signal to the driver in advance of any danger. This warning allows the driver to take some appropriate actions in order to avoid the accident.

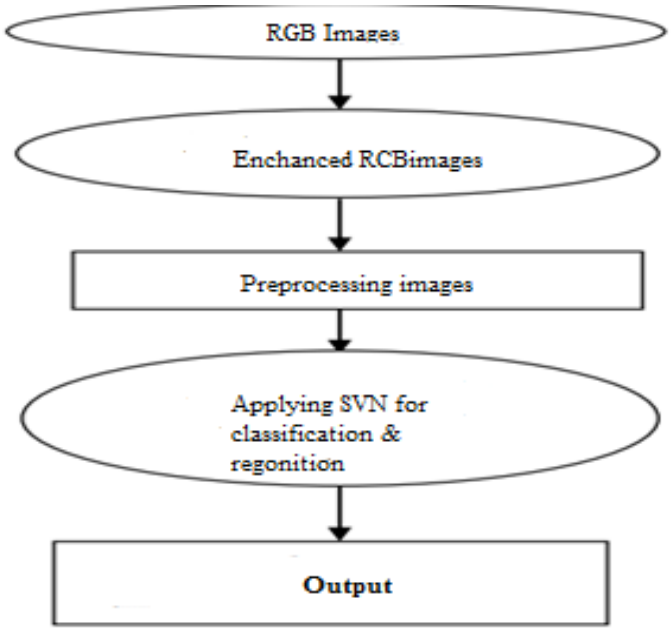


Figure 16 Flow diagram of the proposed system

The alertness to the driver is given as a voice signal through speaker as an output. There are two method to classify the images in machine learning, convolution neural network (CNN) and Support Vector Machine (SVM). The proposed system uses support vector machine (SVM) for classification.

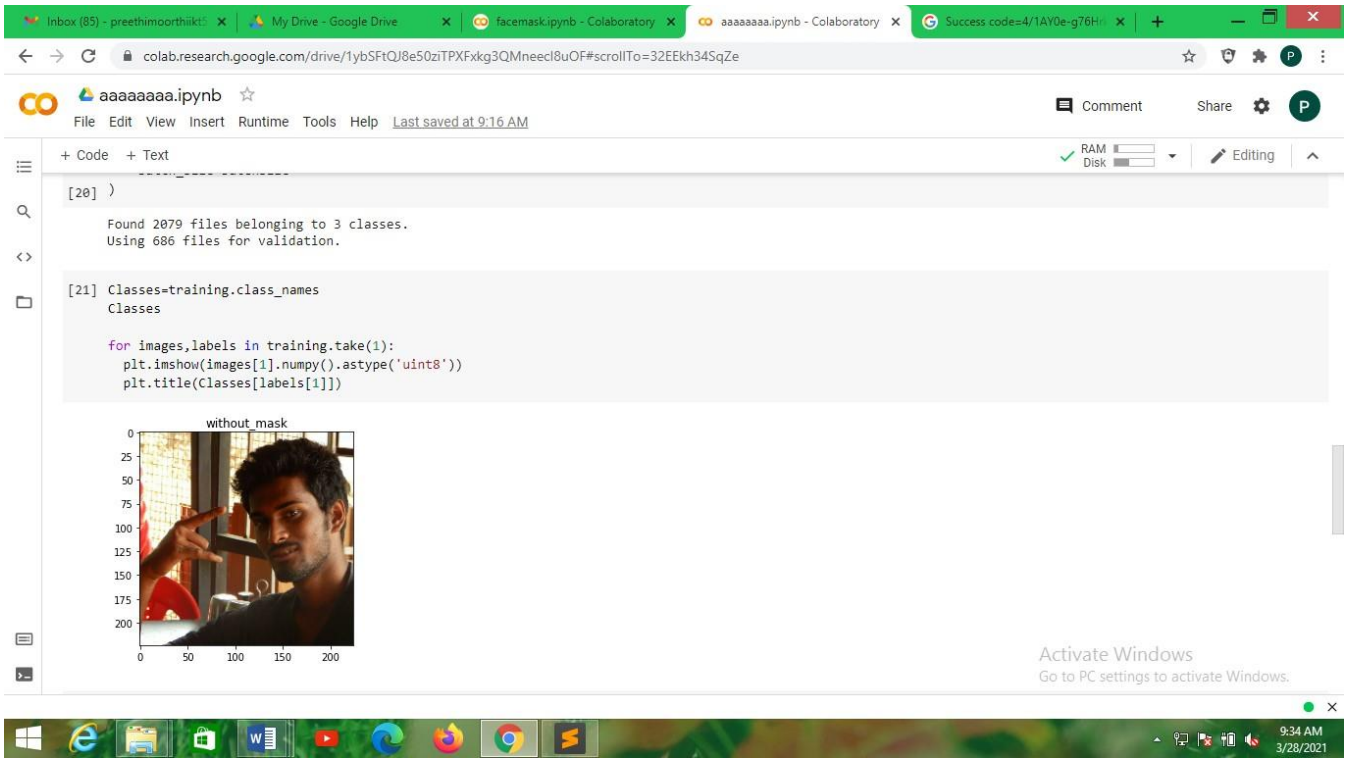


Figure 17 Training the image

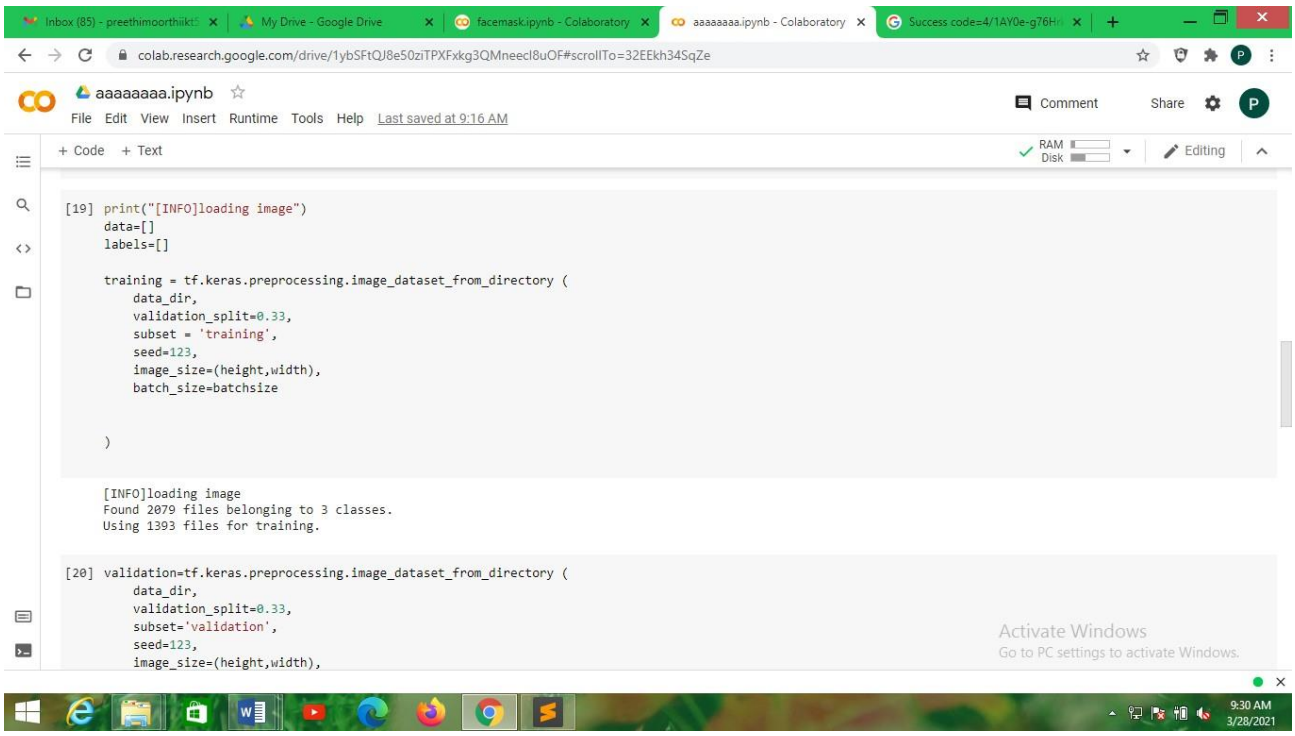


Figure 18 training and validating

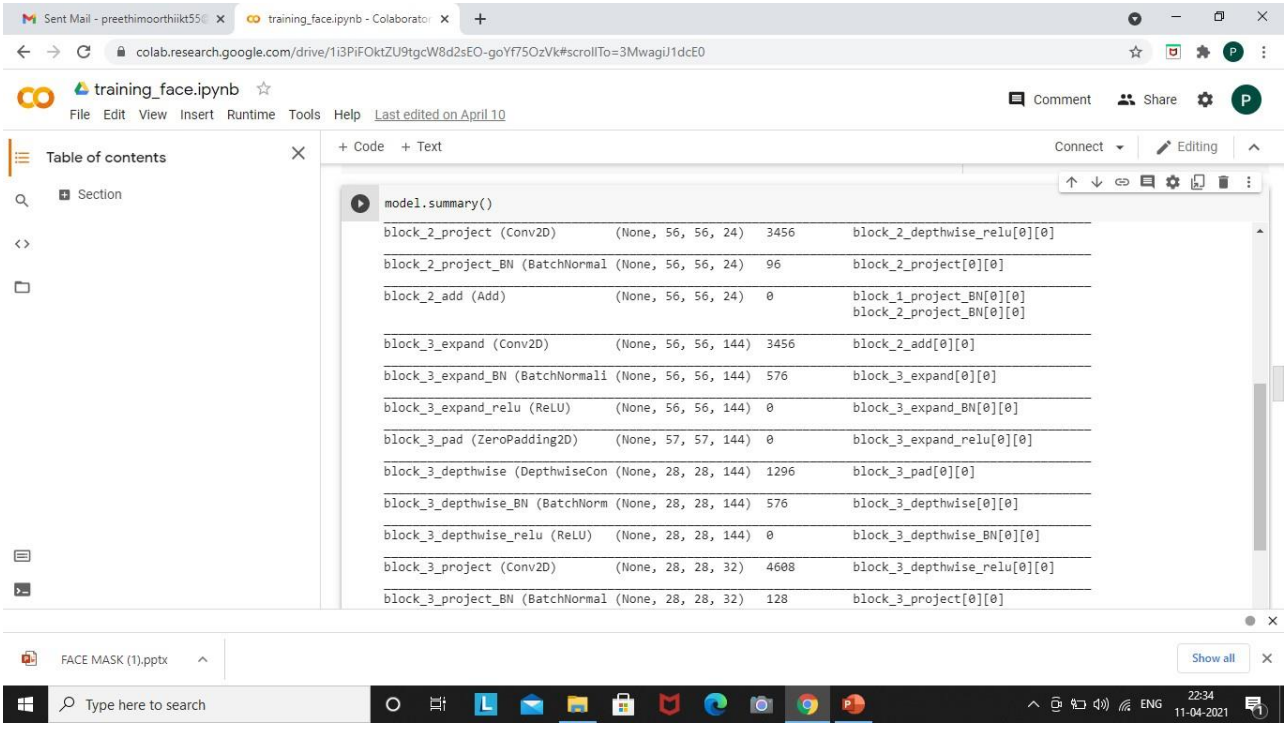


Figure 19 model summary

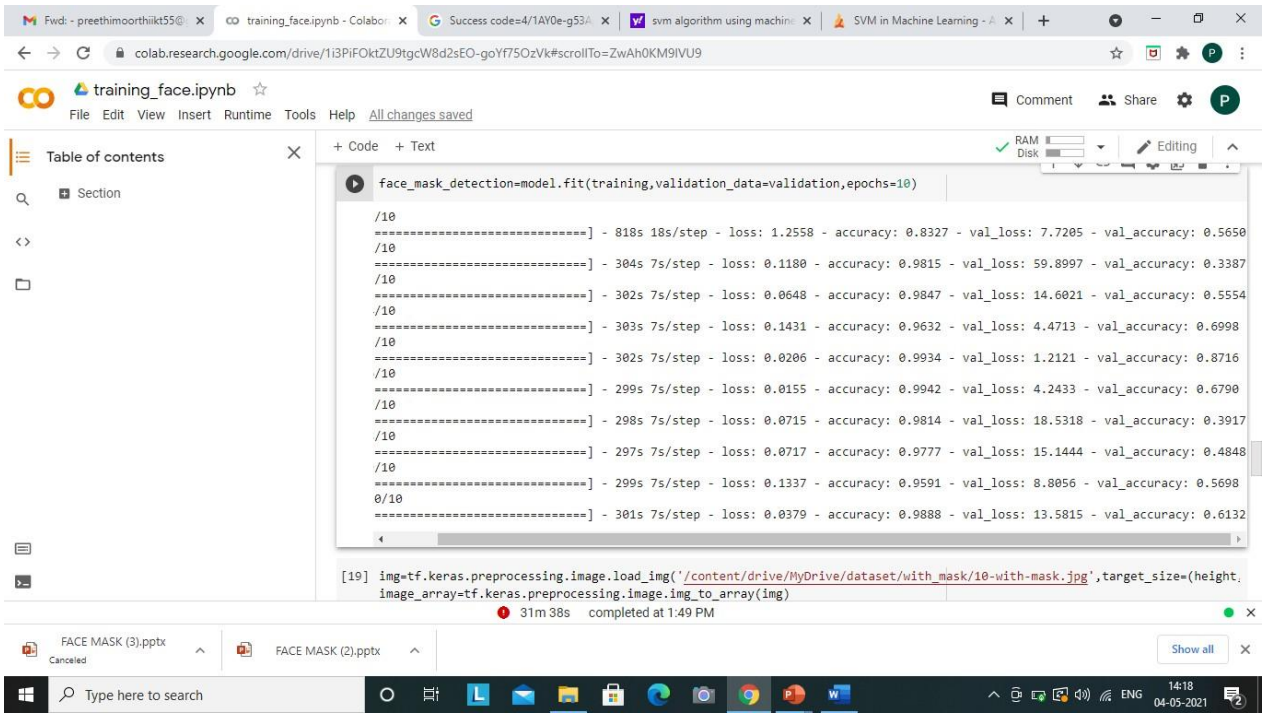


Figure 20 Accuray

3.4.3.2 Convolutional Neural Network

CNN plays an important role in computer vision related pattern recognition tasks, because of its superior spatial feature extraction capability and fewer computation cost. CNN uses convolution kernels to convolve with the original images or feature maps to extract higher- level features. However, how to design better convolutional neural network architectures still remains as an opening question. Inception network proposed allows the network to learn the best combination of kernels. In order to train much deeper neural networks, K. As object detectors are usually deployed on mobile or embedded devices, where the computational resources are very limited, Mobile Network (MobileNet) is proposed. It uses depth-wise convolution to extract features and channel wised convolutions to adjust channel numbers, so the computational cost of MobileNet is much lower than networks using standard convolutions.

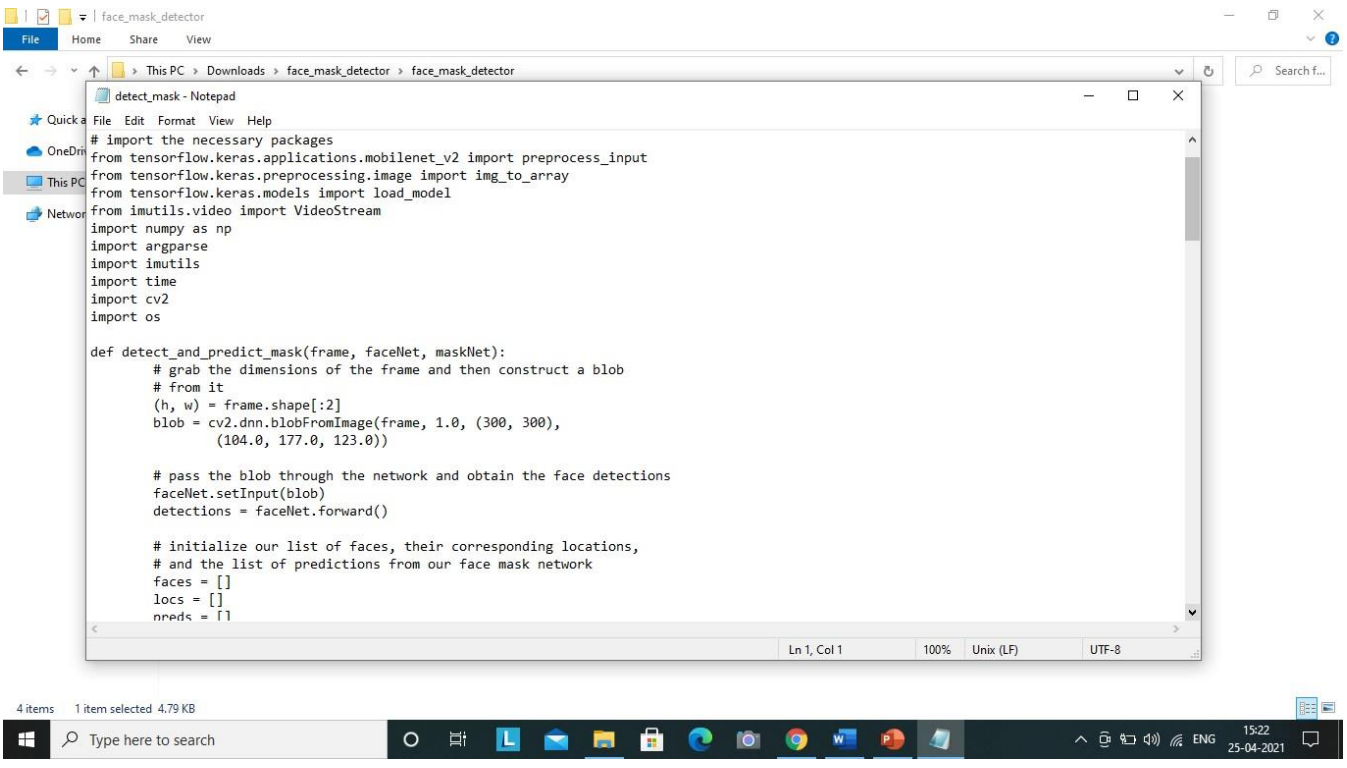


Figure 21

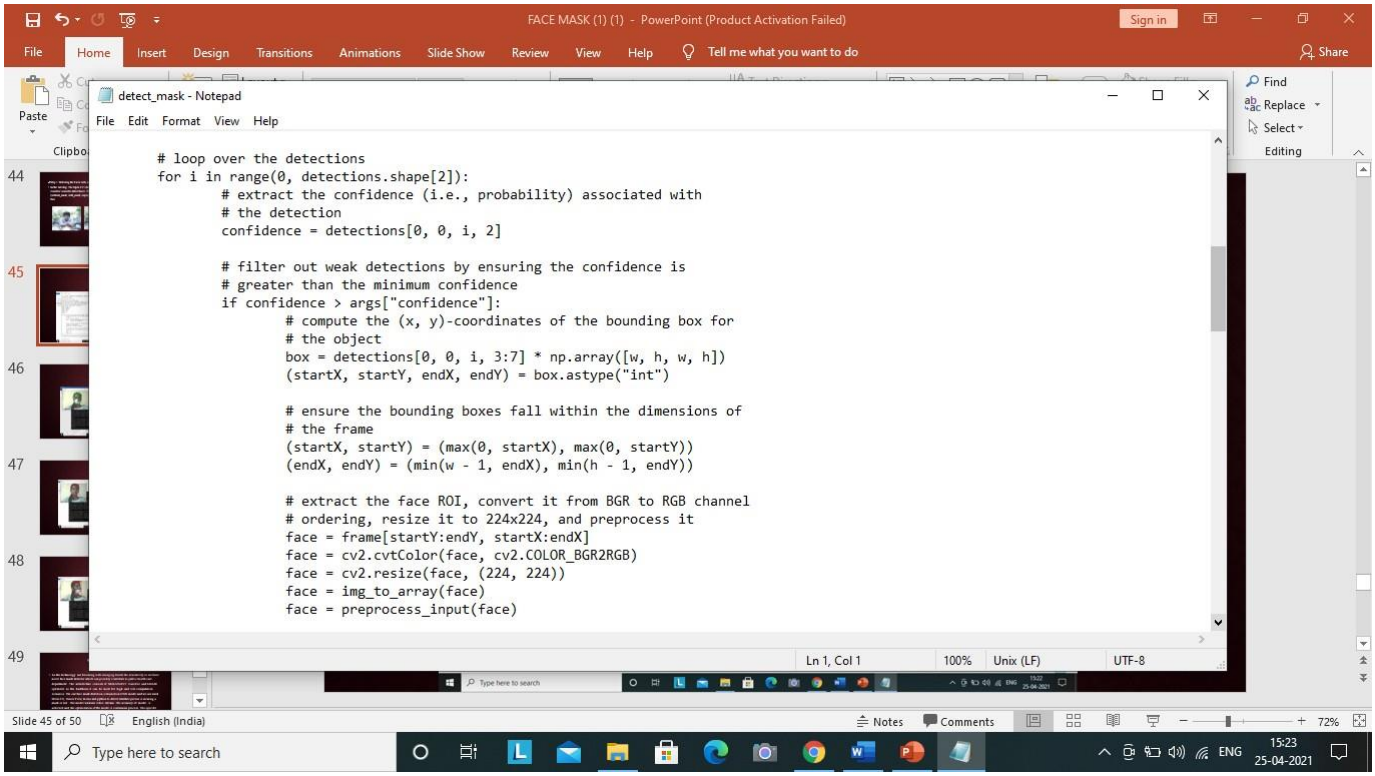


Figure 21

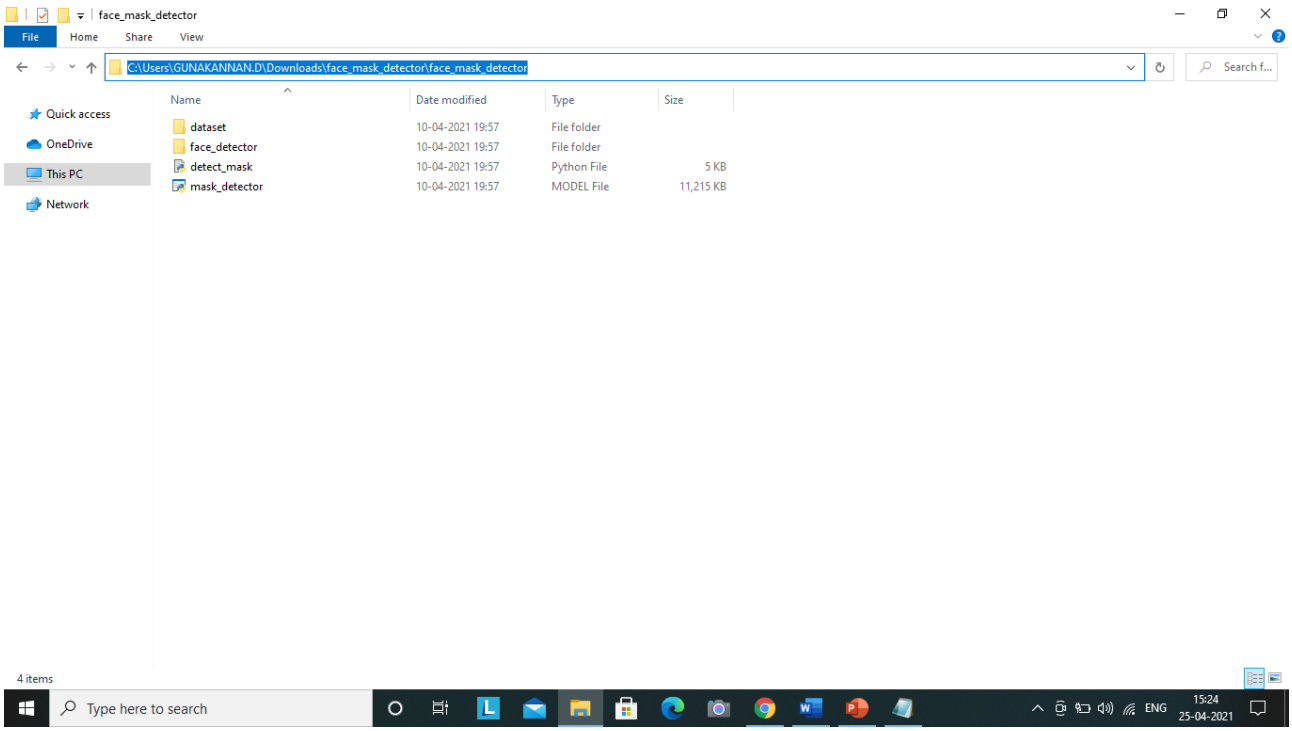


Figure 23 Copy the path

3.5 SYSTEM SPECIFICATION

HARDWARE SPECIFICATION

Intel(R) Pentium(R) CPU A1018 @ 2. 10GHz (2 CPUs), ~2. 1GHz (Processor).

2048 MB RAM

512 KB Cache Memory

Hard disk 100 GB

Microsoft Compatible 101 or more Key Board

SOFTWARE SPECIFICATION

- Operating system : Windows 10
- IDE : VSC
- Framework : Tensor flow
- Front End : PYTHON/ML

RESULT AND DISCUSSIONS

4.RESULTS AND DISCUSSIONS

The performance of RetinaFaceMask is compared with a public baseline result published by the creator of the dataset .Due to the limited methods proposed for this dataset, This also used ResNet and MobileNet as different backbones for comparison.

Multiple HOG features were used for detection, and sparse representations were adopted for classification, thereby achieving good recognition performance. The accuracy of the experiment 1 is 62.3% and the accuracy of the experiment 2 is 92.6%.

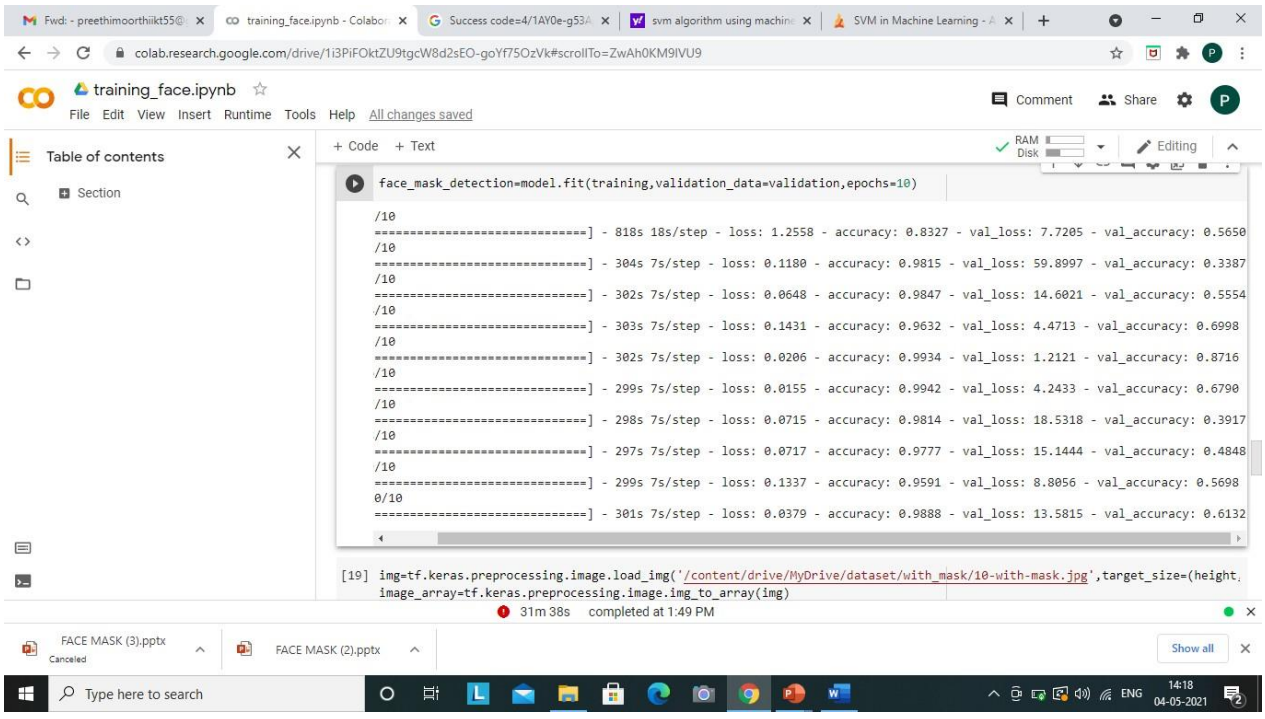


Figure 24 SVM face mask accuracy

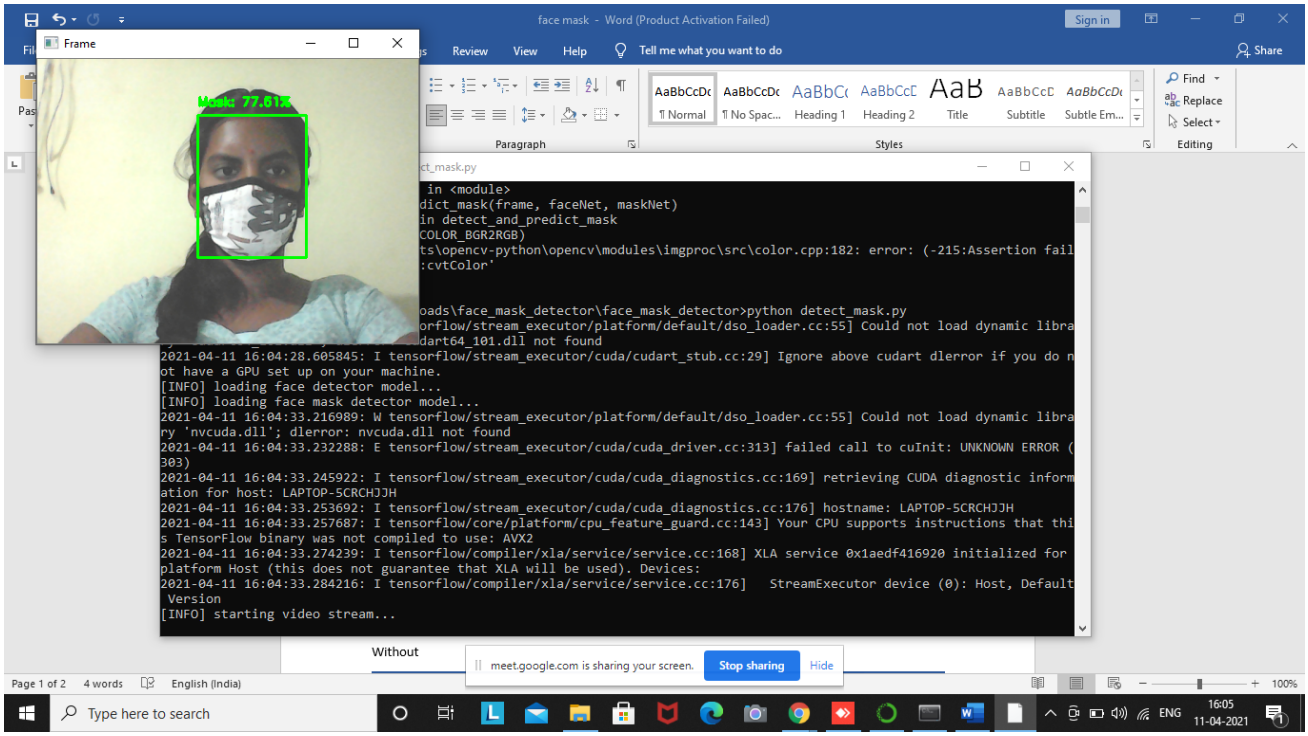


Figure 25 Detect the with mask in real time streaming

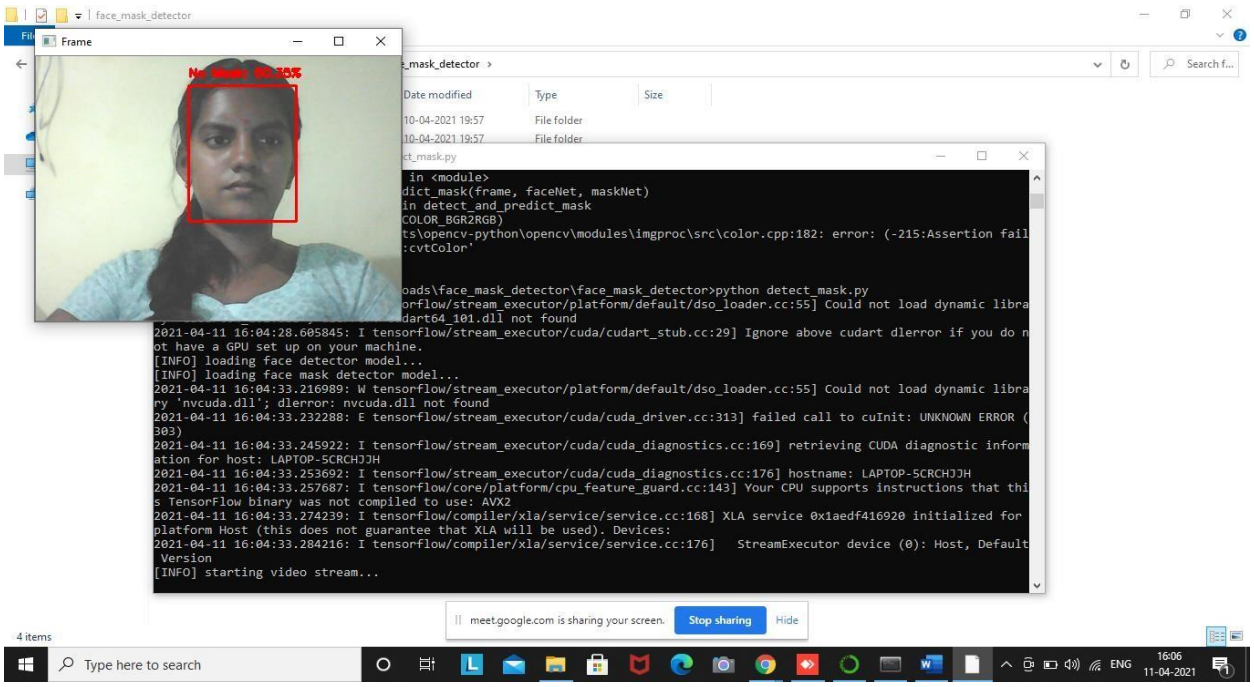


Figure 26 Detect the without mask in real time streaming

4.1.1 Predictive accuracy

Predictive accuracy is expressed as the correlation between the prediction and actual score. Accuracy is often the starting point for analysing the quality of predictive model.

Classifier	Accuracy
SVM	62.3
CNN	92.6

Table 4.1.1: Table for accuracy of algorithms

The above table describes the accuracy value of two classifiers on Indian traffic sign dataset. The accuracy of CNN is efficient than the SVM classifier. The accuracy levels are calculated by using the formula:

Accuracy = (TP+TN)/nrow(set)*100

CONCLUSION

5.CONCLUSION

To mitigate the spread of COVID-19 pandemic, measures must be taken. This modeled a face mask detector methods in neural networks. To train, validate and test the model, In this project used the dataset that consisted of 1916 masked faces images and 1919 unmasked faces images. These images were taken from various resources like Kaggle datasets. The model was inferred on images and live video streams. The work includes processing images gives more accuracy 92.6%. This algorithm has a best speculation, and it can be trusted that it is used to identify more conventional face mask.

SCOPE FOR FUTURE ENHANCEMENT

6.SCOPE FOR FUTURE ENHANCEMENT

The current ongoing system is gracing with MobileNetV2 classifier one of the best system which would be implemented along with the interface of alarm and alerting system in future generation. This system will be integrated with the system implementing social distancing that would make it a complete system which can bring a dramatic impact on the spread of. The new world will be well being of high demand of mask as faceless future and that will be a big security concern.

Expertise say, CNN that using face mask proves to be the best solution to mitigate the spread of air borne virus like corona, but as a big security concern headed to challenge the nation as it would create a massive opportunity for people who cover their faces for nefarious reason. And also experts say the mass no of mask wearing in could complicate in crime investigation in the coming days, as facial recognition is an important part in tracking of the criminals. The pandemic covid-19 getting over, then this system comes into play for chemical factories, bank, glass factories etc. If a person enters the bank while wearing a mask he would be not allowed to enter and also if the person does not wear masks in glass factories chemical factories and etc. then the person would not be allowed to enter to the industry.

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7.REFERENCES

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