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DETECTION OF FACE MASK FOR ENHANCED SECURITY AND MEASUREMENT OF ITS ACCURACY USING DEEP LEARNING

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ABSTRACT
In the latest studies conducted in Asian countries, scientists have concluded that sporting masks reduce the transmission of now no longer best COVID however many different breathing viruses such as H5N1 with the aid of 60 - 80%. A maximum of the public and non-public sectors are beginning up there is no effective manner to ensure that human beings are sporting masks. To remedy this, we advise a deep gaining knowledge of the software that makes use of updated actual masked photograph datasets with a green actual-time PC imaginative and prescient library and a structure that can run correctly on embedded structures. Our fundamental aim is to leverage mobile embedded structures and install them everywhere from airports to supermarkets without notably converting the prevailing infrastructure and reducing setup costs. This is evidence of the idea in which we will use our current laptop, webcam, and audio system to educate the model, analyse the photos in real time and make a statement while a mask-less face is detected.

KEYWORDS: Facemask; Covid; Accuracy; Machine Learning; Classifier

1. INTRODUCTION

Compared to other contagious diseases mutation rate is slow but it's happening and as we all know the three main ways to safeguard ourselves and also others are maintaining space, washing hands, and wearing a face mask. The most effective of the bunch and easiest thing to control COVID based on previous research is to wear face masks. As most of the public buildings are opening up and more people coming out, there is no effective way to ensure that people are wearing masks. [1] To solve this, we propose a deep learning application that uses an up to date real masked image datasets with an efficient real-time computer vision library and an architecture that can run efficiently on embedded systems.[3] A facemask detection is a technique to find out whether someone is wearing a mask or not our main goal is to leverage mobile embedded systems and deploy them anywhere from airports to supermarkets without drastically changing the existing infrastructure and to reduce installation costs. This is a proof of concept wherein we'll be using our existing laptop, webcam, and speakers to train the model, analyse the footage in real-time, and make an announcement when a mask-less face is detected. A new strain is a new coronavirus (nCoV), which has never been detected in humans before. Coronaviridae is a large group of viruses whose clinical outcomes include the common cold and other serious respiratory diseases, including Middle East Respiratory Syndrome (MERS) and Severe Acute Respiratory Syndrome (SARS). [2]. The first case that could be linked to this virus was reported on December 2019. After that discovery, the virus has spread all over the world, and it has culminated into a pandemic.

2. LITERATURE SURVEY

Alternative security solutions are provided through the use of biometric systems of identifying individuals. Despite the fact that various methods and algorithms of biometric recognition techniques are developed and suggested in the existing literature, the interdependencies between biometric features are under-investigated in the area. Scientists have tried to infer the features of an individual on a different biometric modality of the same person and the result has led to the creation and application of an ingenious intelligent system that creates a mask of the face or face including nose, mouth and eyes using the fingerprint data alone with an error rate of 0.7536 that has been verified to be absolutely accurate.[4] Experimental results have shown that fingerprint can be used to generate a face mask with no prior understanding of the morphology of the face, thus proving a strong connection between the fingerprints and the facial features.[5] As the suggested system can be evaluated as a first study, which is still in its early stages, the first findings are positive and prospective, which highlights its importance as a prospective research field in biometrics[6]Under the present worldwide health exercise that is triggered by the COVID-19 pandemic, the World Health Organization (WHO) recognizes the use of masks in the community as the most effective preventive intervention. The pandemic has forced governments around the world to implement restrictions that would limit the spread of the virus. There is empirical evidence that mask use in the workplace setting is associated with a significant drop in the transmission risk; therefore, the mask recognition relying on artificial intelligence becomes an even more effective and cost-efficient approach to improve the occupational safety in manufacturing plants. A face-mask recognition dataset contains the images of the subjects wearing and not wearing a mask. We suggest using OpenCV to process video streams in order to make face recognition in real time possible through the use of live video streaming. This paper aims at facilitating a computing mechanism to identify whether or not a person in a video or picture stream is wearing a face mask. [8-9].

The universal wearing of face mask in the community has been increased worldwide as a way of containing the COVID-19 pandemic. Before the advent of SARS 2 mask wearing was driven mainly by air pollution prevention. [10]. Although people may hide some of their facial expressions, a scientific majority has shown that masks are effective in preventing the spread of SARS-CoV-2, which means the use of masks can have serious health effects on the population.

Facial recognition technology has been extensively popular in the recent past. The use of masks adds further variability, which obstructs the accuracy of recognition. Masking is a common problem in non-cooperating subjects in video surveillance such as in uncontrolled settings. [11]. As a result, the operation of traditional systems of recognition tends to be worsened when masked faces are presented. The topic of face detection and recognition in a variety of conditions is thoroughly researched; however, the peculiarities of the complications caused by masks are often neglected. The paper specifically deals with masked face recognition and emphasizes on improving identification in such conditions. The practical approach would be to initially identify the areas on the face. [12]. The detection of hidden faces was solved by Multitask Cascaded Convolutional Neural Network (MTCNN) and then by the extraction of facial features through the Google FaceNet embedding model. The last classification was done using Support Vector Machine (SVM). [13]. It has been shown in experiments that this pipeline can be used to attain a significant performance on masked face datasets and can be resilient even to heavily occluded faces. Correlational analysis was also performed to enhance the insight into the results. [14]. To conclude, facial recognition is a potential field of application computer vision, where methodology can be used to recognize people using visual information.

2. System Architecture

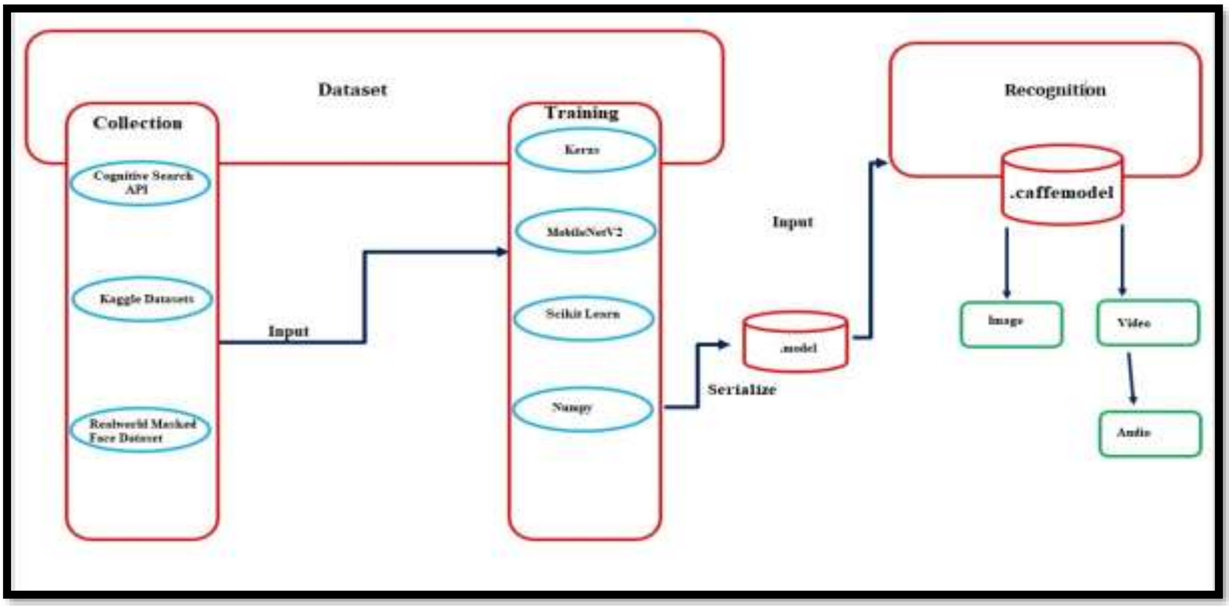

Fig 1: depicts the architecture of the proposed methodology

3.1 *Custom parser*

Custom parsing rules are easy and offer an interface that enables you to demonstrate to us what specifically you desire to extract in the logs [Fig 1]. According to the input, it actively creates the patterns required to isolate the data. The software element is an analyser. Accepts the input data (usually text) and builds a data structure -

typically a form of tree, abstract syntax tree or some other hierarchical structure, which offers a structural description of the input and, simultaneously, verifies the correct syntax.

3.2 *Dataset Collection*

The images are collected from three different sources
1. Bing search API
2. Kaggle dataset
3. RMFD (Real-world Masked Face dataset) dataset

This work will focus on the loading of the face-mask detector dataset that is stored in the long-term storage, training of a model with Keras/TensorFlow using the dataset and lastly serializing the face-mask detector to be stored. With the trained COVID 19 face mask detector in hand, we now proceed to use two other Python scripts that will be used to detect face masks of COVID -19 in images.

3.3 *Model Training and Serialization*

The dataset to train the model mainly used the MobileNet 2 architecture, which is a lightweight convolutional neural network designed to run on mobile phones to assist in detecting facial masks in real-time when used on video streams.

However, the implementation as it is cannot be easily integrated on existing closed-circuit television (CCTV) architectures that are compatible with the 64-bit applications. The suggested framework will prevent the spread of COVID-19 because it would detect people wearing no masks in a very interconnected smart-city grid where the public places are constantly monitored by CCTV cameras. Once an unmasked person is detected, the system immediately sends alerts to the relevant authorities through the municipal network. This technique is a proactive approach to curbing the spread of coronavirus by reporting the lack of adherence to the mask-wearing measures to the enforcement agencies. The model was trained using annotated datasets of images using facial images that were annotated as masked or unmasked.

3. Proposed work

On the other hand, the proposed system can easily be implemented in existing CCTV networks with any 64-bit compatible system. It uses an updated, advanced, and efficient model called Mobile Net for embedded and mobile imaging applications that is performing well when compared to other popular models in ImageNet Rating. In doing so, actually masked images are used as data sets, which dramatically improve the prediction accuracy.

4.1 *THREE MAIN MODULES*

1. Dataset Collection
2. Model Training & Serialization
3. Live Video Feed Face Mask Detection

4.1.1 Dataset Collection:

The images are collected from three different sources

Bing search API

Bing Search APIs add smart search to your app and combine hundreds of billions of web pages, images, videos and messages to deliver relevant, ads-free results. • The results can be automatically adapted to the locations or markets of your users in order to increase the relevance by • Integrating a fast, simple and ad-free search experience for end users that uses billions of web pages, pictures, videos and messages that are updated for current events and are more sorted with a single API call.

4.1.2 Kaggle dataset

Kaggle offers a platform, on which participants can find and share datasets, build and optimize predictive models in a web-based analytical engine, learn and engage with community members in the field of data science and machine learning, and compete on data-science problems. Its popularity has been explained by the fact that Kaggle.com is one of the most regularly visited sites by the representatives of machine learning and data science. In addition to that, data on Kaggle.com is free to download.

3.1.3 RMFD (Real-world Masked Face dataset) dataset

Real-world Masked Face Dataset (RMFD) is a large data set used to detect masked faces. • This technology opens the door to professional applications in airports and hospitals. • For example, face recognition is one of the practical uses of computers and machine vision. Learning algorithms, the difference is that the algorithms have to be modified and the models retrained with new data sets.

Our automated system of screening unmasked individuals is in place. In the case of the smart city, every public area is covered by CCTV cameras. These cameras will record images of public places and they are analyzed using a system that identifies the presence of faces without face mask. In case a maskless person is spotted, the data are sent to the relevant authority to take relevant measures.

4. METHODOLOGY

As for any deep learning application the primary step is to induce the datasets for training. We tend to use 3 totally different sources particularly Real-World covert Face Dataset, Kaggle Dataset and a custom image hand tool victimisation Bing Search API. With these we collect a complete of 3835 pictures during which 1916 are masked and 1919 are mask less images[Fig 2]. We tend to then load the MobileNetV2 design from Keras to construct, compile, train and predict using the testing dataset. As we use real masked images and an economical algorithm, we are able to predict the masks with a high accuracy rate. When the serialization, we initialize the camera device and use Opens to observe faces. If a face is detected, the mask detector model can confirm if the person is carrying a mask or not. If not, an alert are going to be thrown which may be substituted for love or money in an exceedingly real-world application.

The facial-mask recognition system uses deep-learning algorithms to recognise persons regardless of whether they use a mask, and can be easily joined with any existing surveillance systems in the facility. It also helps in verifying the identity of an individual by the authority or administrators and hence verifying the credentials of the individual. In addition, the system will raise an alarm to the authorized personnel whenever an unauthorized person gets into the premises without a face mask. On-demand reporting features will be enabled to allow detailed recording of the events of a system.

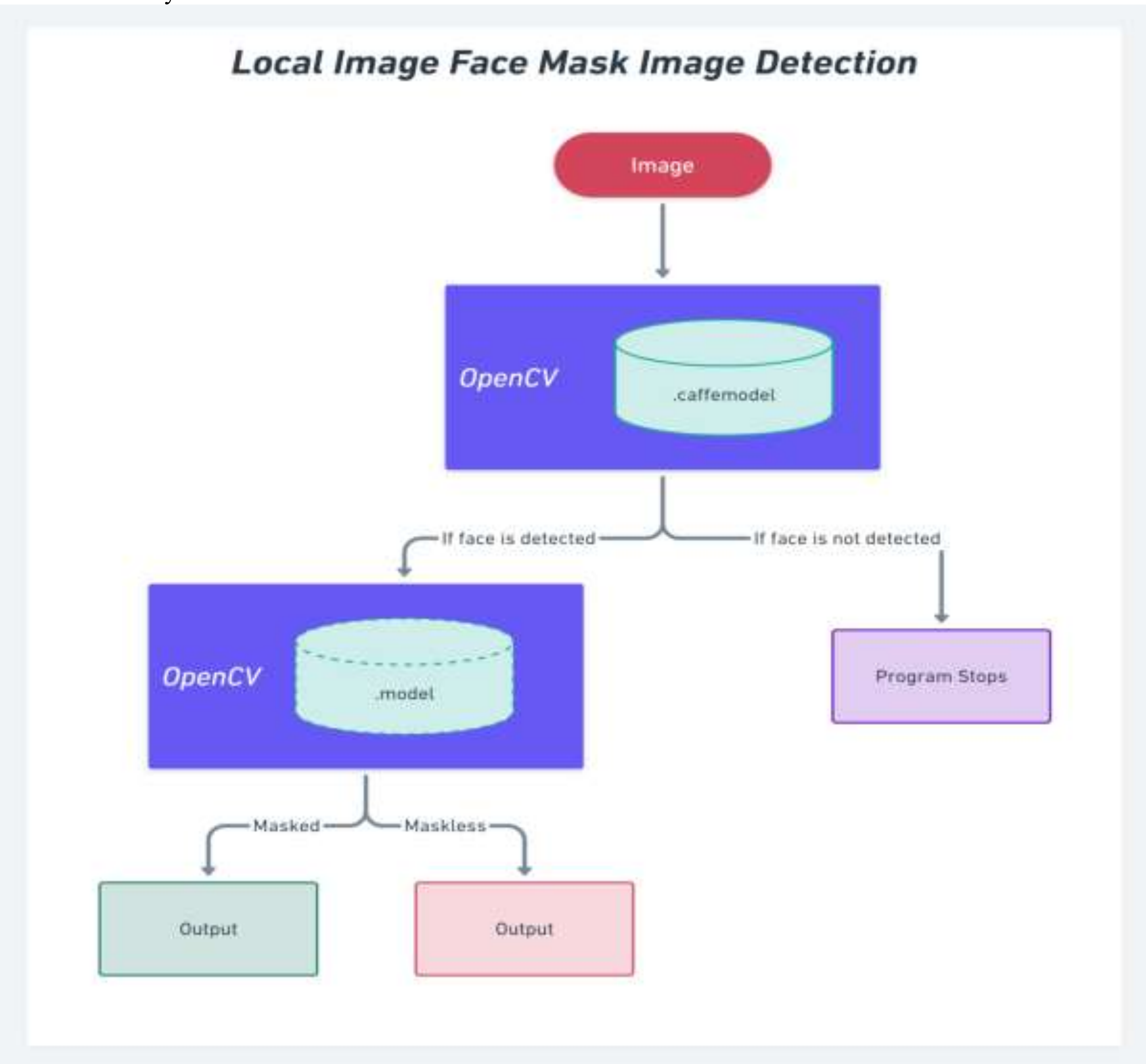

Fig 2: Depicts the face mask image detection

The face mask recognition system possesses the following features:

• The system can be well incorporated into the prevailing organizational structures.

• Custom notifications can be sent to users regardless of whether they wore a mask or not and whether it was visible through the current management system or not.

• No hardware installation is required and the system only gets in touch with pre-existing surveillance infrastructure.

• The system can be used with a large variety of cameras, as well as with regular surveillance cameras.

• Non-mask wearers have a restricted access and an appropriate notification to the corresponding authorities.

Customization of face mask recognition system can be done to match certain organizational needs.
System generated reports could be cross-validated with the results of analysis.
• It is possible to control and monitor movements of any device through the corresponding face mask recognition applications.
Faces that are half covered by masks, hair or covered hands can be recognized accurately.

The developed technology of detection has the following attributes:
1. The delineation of facial locations was made in the form of square-shaped bounding boxes.
2. Facial orientation including frontal, left, left-front, right and right-front pose.
3. Eyes localization, which involves the eye centres being marked.
4. Rectangular region based annotation of masks.
5. Typology of masks, including hand-made masks with or without logos, and masked faces.
6. The degree of occlusion, which divides the face into four parts, including eye, nose, chin and the mouth.

Image-based face mask recognition at the local level:
A Caffe-based model is used with additional OpenCV to identify isolated faces in the input image. The trained model finds out when to use a mask on detection and it gives the accuracy of detection against the subject.

5. RESULTS AND DISCUSSION

Table 1: Results of the MobilenetV2 classifier with test size 90/10 and epochs 20

Optimizer	Train Loss	Train Accuracy	Test Loss	Test Accuracy
SGD	0.1555	0.9520	0.0220	0.9870
ADAGRAD	0.2465	0.9160	0.1820	0.9825
ADAM	0.0095	0.9986	0.0075	1.000

From Table 1 and Fig 3 it is inferred that with the implementation of Mobilenet V2 Classifier the Accuracy using the optimisers SGD is 98.7% and with the ADAGRAND is 98.2% and with the ADAM is 100%.There is a good improvement in the accuracy using ADAM optimiser. Also the test loss is decreased and with only 0.75%.

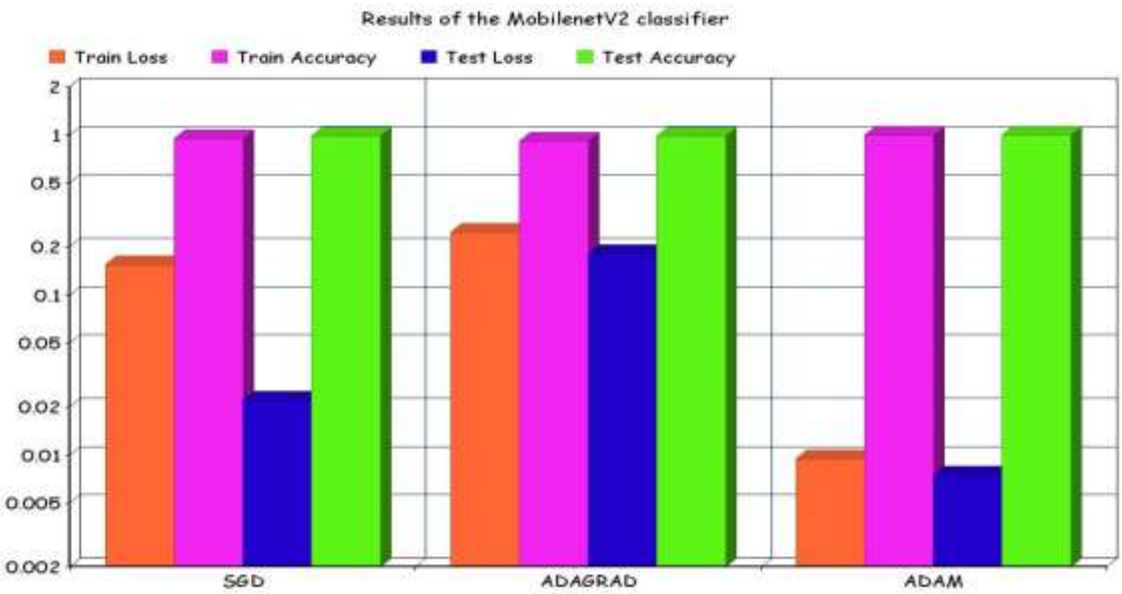

Fig 3: Depicts the results of the Mobilenet V2 Classifier

Table 2: Results of the Resnet50 classifier with test size 90/10 and epochs 20

Optimizer	Train Loss	Train Accuracy	Test Loss	Test Accuracy
SGD	0.1119	0.9698	0.0109	1.0000
ADAGRAD	0.1091	0.9698	0.0024	1.0000
ADAM	0.0075	0.9981	0.0562	0.9862

From Table 2 and Fig 4 it is inferred that with the implementation of Resnet50 Classifier the Accuracy using the optimisers SGD is 100% and with the ADAGRAND is 100% and with the ADAM is 98.62%.There is a good improvement in the accuracy using SGD and ADAGRAD optimiser. Also the test loss is decreased and with only 0.1%.

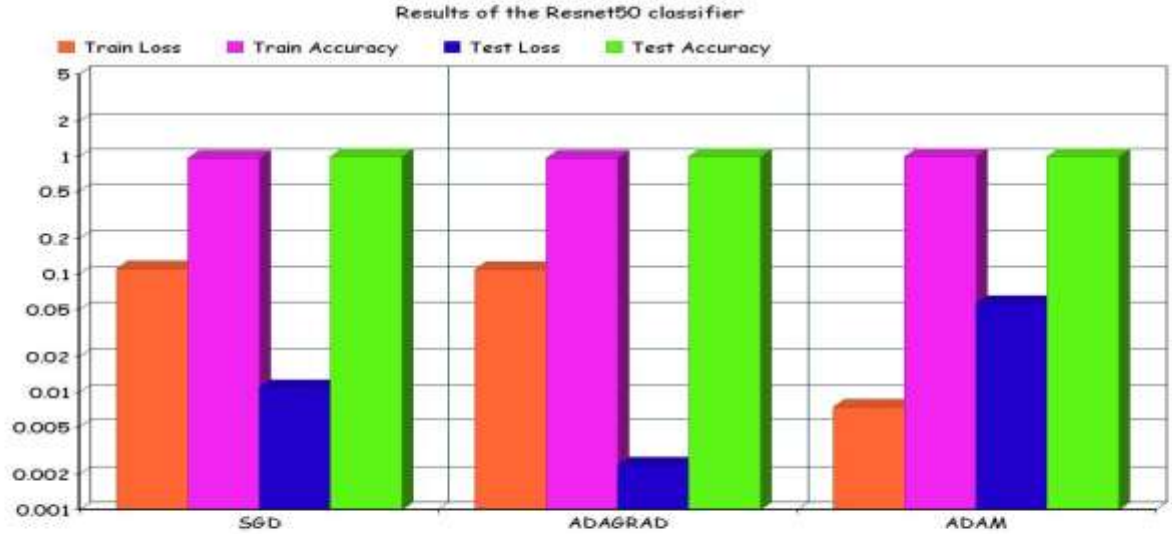

Fig 4: Depicts the results of the Resnet50 Classifier

Table 3: Results of the VGG16 classifier with test size 90/10 and epochs 20

Optimizer	Train Loss	Train Accuracy	Test Loss	Test Accuracy
SGD	0.5140	0.9541	0.1060	0.9935
ADAGRAD	1.7918	0.8430	0.4250	0.9642
ADAM	0.2151	0.9832	0.0011	1.0000

From Table 3 and Fig 5 it is inferred that with the implementation of VGG16 Classifier the Accuracy using the optimisers SGD is 99.3% and with the ADAGRAND is 96.4% and with the ADAM is 100%.There is a good improvement in the accuracy using ADAM optimiser. Also the test loss is decreased and with only 0.1%. We can conclude that using the ADAM optimiser the accuracy is improved and the loss is decreased significantly.

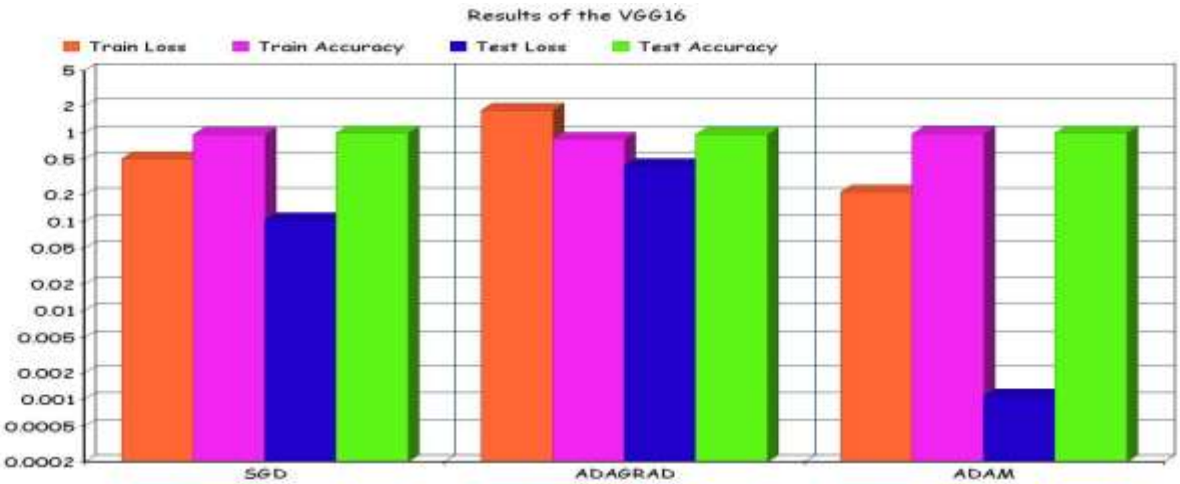

Fig 5: Depicts the results of the VGG16 Classifier

6. CONCLUSION

The current COVID scenario and the increase in COVID cases are in themselves an alarming situation to face. Tests on humans are still ongoing. Until a viable booster vaccine is developed and tested, caution is the only

option, so wearing a mask is the maximum precaution that can be taken. The bad attitude of people who wear masks all the time when away from home needs to be monitored. Corona, but not yet (proven / asymptomatic) the virus can spread exponentially if the infected person does not wear a mask. Guards / men cannot be deployed throughout the facility to ensure that everyone wandering around wears a mask at all times. Controlling the command to always wear a mask when you are away, instead of a manual check, you can resort to the use of technologies that do more than just automate the recognition task. It also avoids a significant diversion of work in order to maintain manual control of the defaulting persons.
The proposed model is currently in operation and the direct application will be developed, however, in the future the following enhancements / enhancements may be overlaid to facilitate usability and ease of use.

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