Real-Time Face Mask Recognition System

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Abstract **- The major way for controlling the widespread of the COVID-19 virus pandemic is maintaining social distancing norms. The avoidance reduces the probability of the spreading of the corona virus. With countries reopening after the COVID-19 quarantine, everyone is also recommending wearing face masks to keep us safe once we venture to the public and go about our day-to-day routine activities. To make the utilization of face masks mandatory, it becomes necessary to develop a technology that forces individuals to wear masks before getting into public places. Hence, it's impossible to trace the customer manually, whether or not they have a mask or not. That's why this system is vital here. We've proposed a method in which we've used a transfer learning approach. We used the CNN algorithm of Deep Learning and utilized the pre-processed architecture of the MobileNetV2 model. This technique will help in tracking the travel area of security breach areas, promoting the utilization of face masks, and ensuring a secure work environment. This project's main purpose is to develop a mask detector that will detect any sort of mask. Even if a person is completely vaccinated, they should wear a mask because the corona virus is constantly mutating and we have new variants like Delta and Omicron showing up. The battle against COVID-19 is still not over. However, only proper preventives and social distancing morals can help, If we want to win this battle.**

Keywords: COVID-19, Corona virus, CNN, Deep learning, Delta, facemask, MobileNetV2, Omicron, precautions, vaccinated, quarantine.

INTRODUCTION

The COVID-19 has hit the earth hard. There will be many public points establish which will require people to use the service and check whether or not they are wearing masks properly. Therefore, it's impossible to manually track the client, no matter whether or not they are wearing a mask or not. That's why this system is vital here. This model also can be utilized to develop comprehensive software to scan everyone before they will attend a general public meeting.

When people wear face masks that sufficiently cover their mouths and noses, a frequency error within the face recognition algorithm occurs. Within the NIST study, it had been found that wearing black masks causes errors quite like wearing blue masks. Also, the more the nose is roofed by the mask, the harder face recognition systems are to spot. While face recognition algorithms work by calculating the distances between a person's countenance , wearing facial masks reduces the accuracy of the system's algorithms because most of the key identifying features are removed or hidden by the mask.

In our project we will be able to identify masked and unmasked faces and this project may be integrated with webcam cameras. This will help us to check the travel area security violation areas, promoting the utilization of face masks and ensuring a secure work environment.

OBJECTIVE

COVID-19 has hit the planet hard. Therefore, it's impossible to manually track the client, no matter whether or not they are wearing a mask or not. That's why this system is vital here. In our project, we will be able to identify masked and unmasked faces and this project may be integrated with webcam cameras. This project will help us to check the travel area security violation areas, promote the utilization of face masks, and ensure a secure work environment.

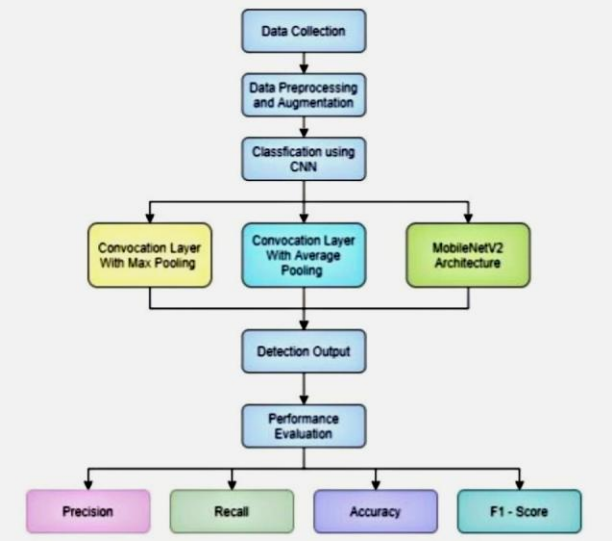
Different practices, mandatory or voluntary, and conflicting claims about the usefulness of mask use are introduced in affected countries. Reshaping the planet began by teaching computers to try to do the work for us and has now reached the purpose where even that straightforward step is over. It allows machines to form decisions with supported data, which is more efficient than explicit programming to perform certain tasks. These algorithms are designed to be exposed to new data which will help organizations learn and improve their strategies. In the future, it'll be interesting to check this experimental hypothesis during a broader scope, perhaps by combining data from many different types of image datasets. This paper presents the approach for detecting face masks publicly placed to scale back the spread of corona virus within the community. By detecting face recognition, mask rule violations, the utility of the system for the general public is increased. Second, the models are often extended to detect face recognition points with face masks for biometric purposes.

MOTIVATION

With the rapid spread of the new case of corona virus in China since December 2019, the WHO confirmed that it's a dangerous virus that spreads from human to human through droplets and air. As for prevention, it's mandatory to wear a mask when going out or meeting others. However, some irresponsible people refuse to wear face masks with such an excuse. Also, during this case, it's vital to develop a mask detector. The mask detection system is often used at airports to detect passengers without masks. Mask detection systems often want to check whether their staffs are wearing masks during shifts. Mask detection systems are often used for detection in office buildings. Mask detection systems are often utilized in public places, including restaurants, shopping malls, and public transportation. If workers fail to satisfy workplace safety standards, it can do nothing, but it can help alert safety officials and take protective measures quickly. It helps to avoid any direct contact between individuals and helps to scale back any quiet transmission of virus-containing droplets through human breath. This has been a subject of debate for an extended time with questions like "what may be a safe distance to take care of social distancing?" and "how much further can the droplets spread?" arising. Thus, getting a substantial answer to all or any of those questions was difficult as other factors were also important, like transmission through the encompassing air by evaporation. Therefore, after considering all of those factors, the suggested distance for a secure social distance was recommended to be a minimum of 6 feet, or 2 meters. Some felt that this distance wasn't sufficient and could be increased.

PROPOSED MODEL \

Proposed Model Diagram



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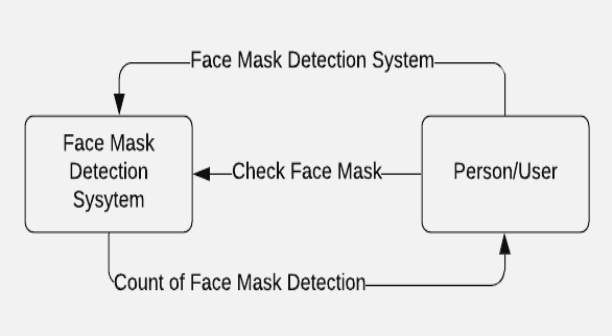
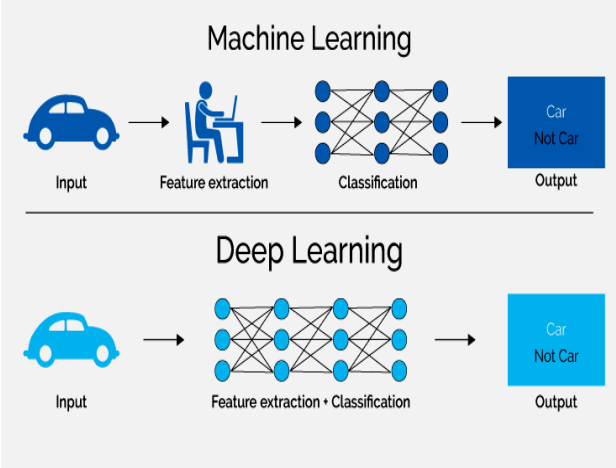


ALGORITHMS USED

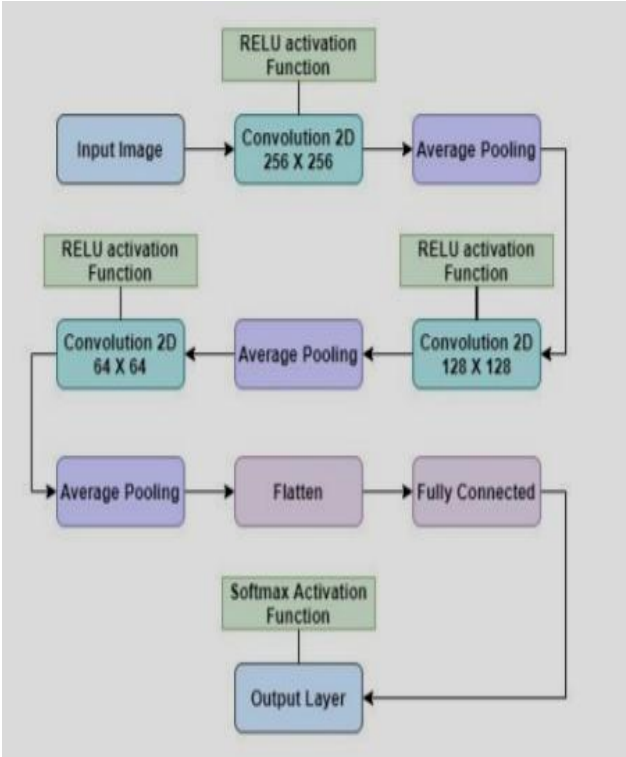
Deep learning

Deep learning is a technique used in the field of machine learning which allows the computer systems to learn by use of examples and this methodology comes very natural to the human beings. The deep learning technique allows us to use in automatic and driver less cars and it can also enable the cars to check if there is a stop sign and to differentiate any obstacle on the road from a walker. It helps in voice control in many smart gadgets such as mobile phones, tablets, LCD/LED monitors and amplifier. This technology is becoming very popular in the recent times and for a good cause. It is getting outcomes that are unbelievable and that were not at all possible earlier.
The deep learning algorithms allow the models to learn with experience important tasks by taking images, text and sound as input. These models are able accomplish very advanced targets, which may occasionally indeed exceed mortal- position performance. The models have been trained by utilizing an enormous set of the labeled dataset and infrastructures that consists of numerous layers.



Convolutional Neural Networks (CNN)

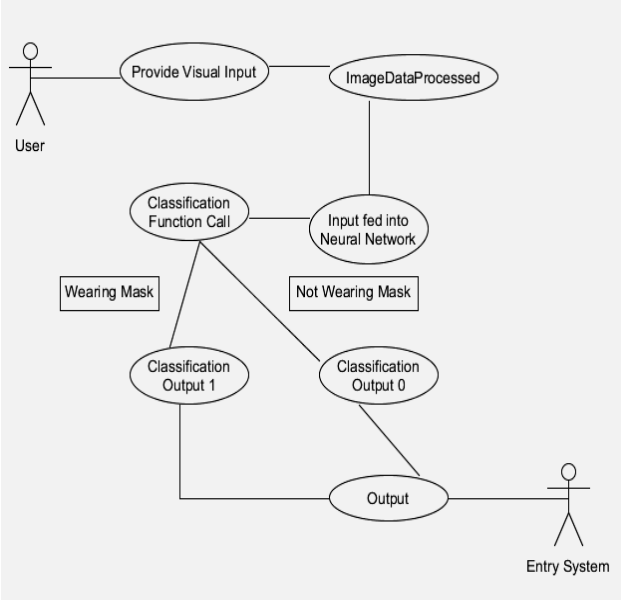
A CNN may be a quite huge probabilistic lattice that is used in big research to look at optic images. It uses an ordered model that builds a funnel-shaped lattice then executes a totally connected layer during which all neurons are connected and data is stored. In general, neural networks are used to perform equivalent tasks as classical machine learning algorithms. However, the other isn't the case. We have used deep CNN with 3 layers. Convolution provides mathematical functions. Max pooling is a sample dependent finite difference method.



Transfer Learning

It is a problem in ML that aims on keeping gasped knowledge while solving a drag and applying it to a special. Knowledge received from learning to acknowledge is often applied to recognizing trucks. Deep learning models is very good at learning an outsized number of labeled examples, but don't generalize to conditions not observed during training process.

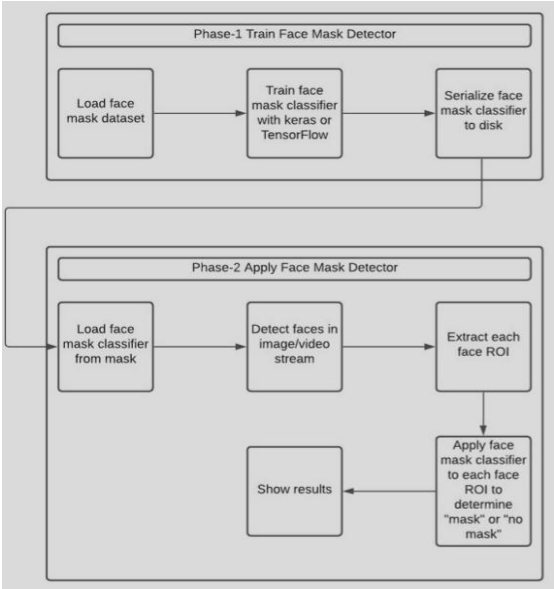
USE CASE DIAGRAM



We've used a two- phase COVID-19 mask sensor, using the MobileNetV2 model. A python script is used to train a face mask sensor and dissect the outputs. After training the corona virus face mask sensor, we will continue to apply 2 fresh python code which will be used to:

-Check corona virus face masks using dataset images.

-Check corona virus face masks in live video.



Implementation Details

Software and Hardware Requirements-

Software requirements are:-

1. Anaconda Navigator
2. Jupyter Notebook
3. Python Programming
4. Advanced libraries of python for example Numpy, pandas, Scikit-learn, Seaborn and matplotlib.

Hardware requirements are:-

1. Minimum i3 processor
2. Minimum of RAM 8 GB

Assumptions and dependencies

1. The end-user must have a Laptop with a working camera.
2. The Computer should meet all the hardware and software requirements.
3. The Model will work perfectly even if we change the whole dataset.
4. Internet access.

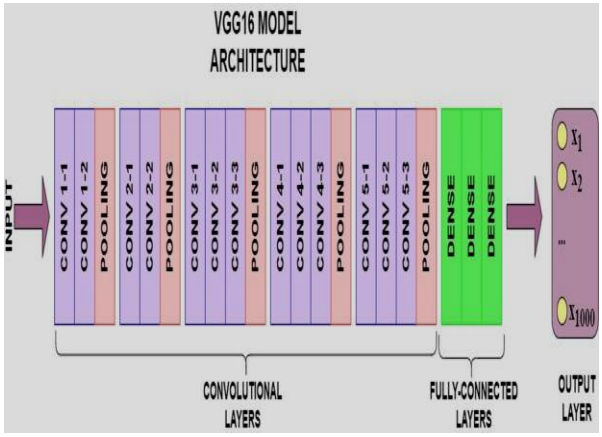
DATASET

The data set consists of 1376 RGB images stored in two folders named as with mask and without mask images. Images are named as labels with masks and without masks. Images of faces with masks are 690 and images of faces without masks are 686. Our target is to train a model to check if a person is with or without a mask.

COMPARING DIFFERENT MODELS

VGG-16

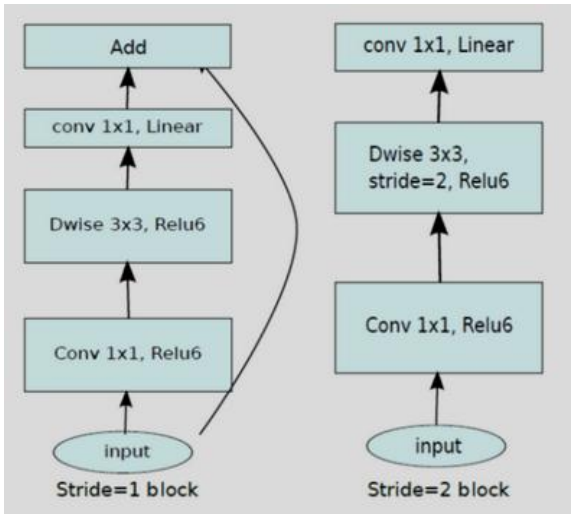
VGG16 model was proposed by two people from Oxford University-A.Zisserman and Simonyan. The image resolution of 224 x 224 RGB has been given as an input to the convolution1 layer of the given model. Through some convolutional layers the input image is passed with the filter size of 3x3 windows. 5 max-pooling is performed by using a 2x2 pixel. A model in which the affair of one subcaste is taken as input for the coming subcaste is known as a succession model. There have been various studies performed that show that VGG16 gives the most effective results when compared with all the former models.



MobileNetV2 Architecture

It is an image sorting tool. The bottom MobileNetV2 layer is detached and a replacement controllable layer is also added. This helps to enable briskly and more accurate discovery of masks in the videotape sluice. It has two main factors

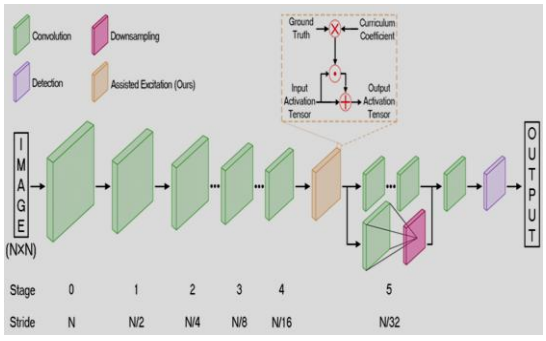
- Inverted Residual Block
- Bottleneck Residual Block



YOLO-v2

YOLOv2 is an architecture that is one of the most efficient and is also quicker than most of the object discovery models which vary across detection datasets. It can also match the average perfection chart which is better than briskly R-CNN by creating numerous new ways similar as high-resolution classifiers, training with multi-scale, dimension clusters, and direct position vaticination to increase perfection discovery delicacy. YOLOv2 increases confluence by the use of batch normalization to help to over fit data.

In the corona virus real-time face mask detection system, YOLOv2 has been applied along with Res Net50 to check face masks where YOLOv2 was used for object discovery and ResNet-50 for point birth. In comparison with the other models, the performance of YOLOv2 model also performs 81% accuracy.



RESULTS

In this paper, we have a dataset of images of people wearing mask and not wearing mask which are processed earlier and have been applied as input to neural networks for training purpose and it checks if a person is with face mask or without face mask.

• The comparison of these three algorithms YOLOv2, VGG16 and Mobile Netv2 have been taken place for face mask detection..

• Dataset which has been applied for training purpose is also used for testing of the algorithms.

• In this paper, 80% of the dataset images have been given as input for the training purpose and 20% have been given for testing purpose.

• We have taken 1376 images in total, out of which 1100 dataset images have been given for the training purpose and 276 images have been given for testing.

• Vgg16 obtained an accuracy of 89%.

• YOLOv2 obtained an accuracy of 81%.

• Mobile Netv2 obtained an accuracy of 94%.

• In comparison to YOLOv2 and VGG16, the Mobile Netv2 obtained the most accurate results also it is more lightweight and very efficient.

• Mobile NetV2 is a model which enables to detect a person with side faced and with mask efficiently.

CONCLUSION

In the paper of Real-time detection of face mask system, the model has been trained with the use of architecture of YOLOv2, VGG16 as well as MobileNetV2 using the dataset of Face Mask detection system. These algorithms help us to detect if a person is wearing a face mask or not wearing it. If we compare YOLOv2 and VGG-16 architectures, then the Mobile Netv2 model architecture gives the most efficient accuracy of 94%. MobileNetv2 is a model which will check if a person with both front way and side face wears masks. In real-time, the proposed model system takes input from the webcam of the user and detect if a person wears mask or not wearing it.

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