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Social Distancing & Face Mask Detection using Deep Learning Models Comparative study

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Abstract: A novel virus has caused a world epidemic & severe casualties. announced by such World Health Organization (WHO), this coronavirus originated from Wuhan, China in late December 2019. Upon thorough research, the virus has been observed as pathogenic and airborne or acquired by virus is transmitted individual. Several initiatives have been introduced to limit the growth of this disease, including suggested, such as maintaining a social distance, that is, maintaining a proper physical distance between people and lessening close contact with donning a balaclava to escape one another and the droplets from transmitting through the air. In this research paper, we provide a comprehensive background of social distancing and face mask detection including basic concepts, measures, theories, and numerous useful psychological separation strategies and face mask detection scenarios.

Keywords—: Social Distance, Face Mask, YOLOv3, YOLOv4, YOLOv5, Resnet, Mobilenet, CNN, You Only Look Once (YOLO)

i. INTRODUCTION

The unfolding of the COVID-19 Pandemic Disease has created a maximum critical worldwide health globe catastrophe which has had a significant impact on humanity and the manner we perceive our world and our everyday lives. Ever since being found first in Wuhan, China in December 2019, the entire world has been laid low with the COVID-19, triggering an epidemic to be declared by the Health Ministry (WHO). They Centers for Disease Control.

The Centers for Disease Prevention and Control (CDC) has to state unequivocally that limiting strong interaction with several other individuals is the best approach to stop the transmission of Covid-19. Individuals are again advised to practise cleanliness precautions including routinely cleansing their arms, donning masks, and avoidance intimate exposure to infectious individuals in order more to inhibit the growth of the illness people who are ill. Getting a COVID19 vaccine is a safer, more dependable way to make protection than getting sick with COVID- 19. COVID- 19 vaccination helps cover you by creating an antibody response without you having to witness sickness, potentially including severe illness. Since numerous people in the country still aren't completely vaccinated and the threat of breakthrough cases remains, it's best to keep wearing a mask, indeed after getting the vaccine, particularly in high- threat situations.
The globe has been severely impacted by the coronavirus epidemic in 2019. Wearing a costume in society and maintaining positive barrier are two important ways that individuals defend themselves. The only defence against the transmission of COVID-19 is mask use and interpersonal seclusion. The goal of this thesis is to combat the coronavirus. Wearing a mask and avoiding close contact with others have both been shown to be very impactful ways to slow this same progression of the virus. This study also aimed to provide a surveillance system that protects tabs on individuals by effectively utilizing Surveillance equipment and Cameras along with object recognition to locate people without Mask and not following rule of social distancing. COVID-19 Face Mask and Social.

Distancing Detector System (COVID FSD) is a picture automation tool powered by AI and monitoring equipment that addresses Covid-19-related infractions. The COVID FSD Technology employs machine learning to determine if a person is donning a disguise. The device may be attached to every IP or Video camera, old or fresh, to find persons needing masks. It mandates the keeping of the disguise and enables the program to operate continuously. This program gives safety procedures, negating the use of a manually monitoring program. Infractions such as failing to wear protective gear and failing to comply with community Distancing.

This technology may be used in clinics, commercial complexes, municipal buildings, educational institutions, production facilities, airlines, worksites, etc. The COVID FSD Method includes no technological expertise and is quick and easy on using. The method guarantees complete adherence to personal data. The three aspects just send out an audible alarm in the relevant situation; they don't really record any photographs. Through the most sensitive time of the pandemic's struggle, COVID FSD might offer an extra useful feature.

ii. RELATED WORK

To manage the epidemic incident made by the extensive COVID-19 infection,

In small places, social distance was emphasised. Finding the appropriate range was the key problem with this technique, and knowing the solution was essential to restarting companies and institutions. The major justification for the use of lack of familiarity was shown by a research that used a combined Wells-Riley analysis to simulate the transmission risk connected to the infectious agent [3]. According to their research, when taking into account the exchange content of inhaled particles from cough, speaking, blowing, and other activities, a range of between 1.6 and 3 metres is the optimum distance. If a quiet air situation had to be taken into account, an 8.2m separation was recommended. Having verified their design From 20 to 40 percent in the starting 30 minutes, distance can cut down on the bacteria's transmission. Another research, however, concentrated on identifying the method of infection in order to apply the proper controls and slow some growth [4]. A research using ferrets demonstrated that SARS-CoV-2 was quickly transmitted through whatever type of immediate communication and via the environment. In one to three days but between three and seven days following exposure, it was apparent that the foxes were becoming sick.

In [5], By running the design on a Pic Microcontroller 4 to watch activities and identify breaches using webcam, they have suggested an effective machine perception technique centred on the genuine automatic surveillance of individuals to identify both supportive social separation and face shields in public spaces. When a violation is discovered, the raspberry pi4 notifies the sheriff's department control room and the broader population of the situation. Current learning algorithms have indeed been combined with geometrical methodologies in the framework in order to create a reliable modality that addresses the three areas of recognition, monitoring, and verification. Thus, the suggested solution benefits the country by reducing the transmission of the corona virus and speeding up the process.

It may be used efficiently in the existing situation, where the shutdown is loosened to allow for person checks in open shops and meetings of people. Automatic examination may be utilised everywhere and uses less labour to check the general population. They trained their algorithms using a customised statistical model made up of facial photos with various respirators, all of which were tagged. In a which was before stage, they made advantage of the current photo editing technique. The SSD algorithm carries out the true automatic identification of social separation management and the confirmation of whether or not people wear masks. 3165 photos were utilised to teach the suggested helmet sensor in their study.

iii. PROBLEM STATEMENT

Social distancing and wearing face mask has been an effective social measure in terms of the curve's normalisation. People are recommended to keep a respectable distance 2 metres between one another refrain from any individual interaction, such as exchanging pleasantries, to lessen the chance of disease. Constantly monitoring the application of this regulation is not practical. We can designed a program based on machine learning that can recognise these occurrences.

iv. FLOW CHART

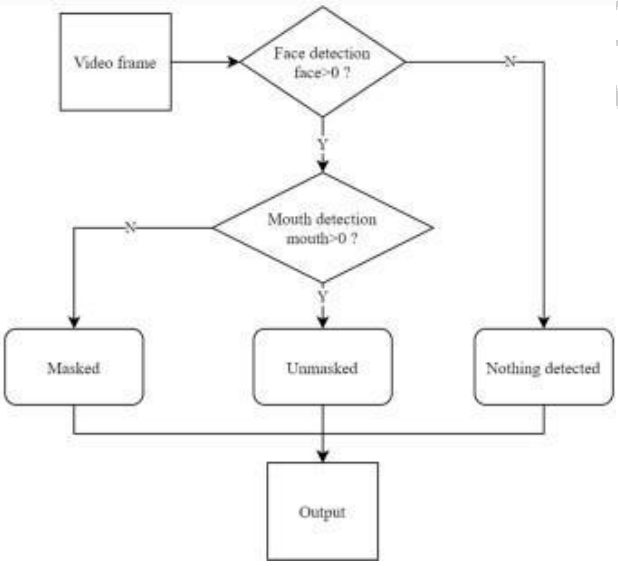

Fig 1 Mask Detection Flow Chart

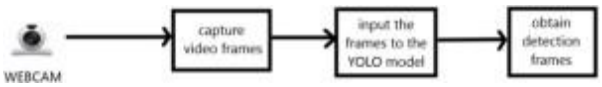

Fig 1a Social Distance Flow Chart

v. PROPOSED WORK

The suggested method works to keep individuals in public areas safe by automatically observing their behaviour to determine if they keep a safe social distance and by identifying persons who are wearing face masks. This section briefly explains the proposed system's design and how it would work automatically to stop the coronavirus from spreading. The suggested approach makes advantage of a transfer using a function built into a local device, a supervised neural system and machine learning are used to continuously watch individuals in open realm and to identify persons wearing masks or not. In addition to image retrieval, we also perform tweaking, which would be an education . additionally training algorithm. The YOLOV3Detector, an artificial neural design that has previously been honed for changes in higher categorization on a big set of images like Googlenet and Pas, is also a component of the method.

The RestNet50 is being loaded with which was before ImageNet values, the networking head is being left off, a new FC head is being built, attached to the foundation in place of the old unit, and the show's foundation layers are being frozen. As during back propagation's good stage, the skull level strengths would be modified but not the values of such backfill material. The system is constructed and tested when the system is processed or the planning and process is established for adjusting. Testa have been conducted with OpenCV, Keras using Profound Learning - Powered Vision to examine the secure separation relationship between discovered individuals and face Helmet repeatedly over an extended period streaming video. Just a really low error rate is used throughout the reskilling of the infrastructure to guarantee that the fully - connected filtration already did learn don't really stray away dramatically. The 3 features of the new system—person recognition, measuring the respectful distance between identified individuals, and face mask detection—are its key contributions. YOLOV3, YOLOV4, and YOLOV5 (You Only Look Once) use Facenet, Mobilenet, and OpenCV to recognise people in real-time. Each individual that is found will have a coordinates seen around them. YOLO is only sensitive enough to detect one individual throughout this setup, even though it can detect numerous things in a picture.

To determine the differences between two people, we must first determine the woman's spacing from the webcam to use the diagonal resemblance technic, determine the camera's perception depth of field, start assuming that the woman's distance from of the photo is D, and that the person's actual height is H, which is 165 cm, and then use the YOLO person detection algorithm to determine the woman's bitmap altitude P using the bounding box. The following formula may be used to determine the phone's telephoto lens using all these values: F = (P x D) / H. Distance of the subject from of the lens. The conventional methods can be used to measure the position from the webcam: D1
= (H x F) / P.

vi. DETAILS OF HARDWARE AND SOFTWARE

Software Requirements

- PYTHON
- OS : Windows

Hardware Requirement:

- Webcam
- Processor-i3
- Hard disk-5GB
- Memory-2GB RAM

vii. DATA SET AND PREPROCESSING

The suggested solution makes use of a unique data set made up of face photos with various face masks that are tagged and utilised to train our models. We do a preprocessing step using the current background removal technique. The YOLOV algorithms carry out the real-time automatic identification of interpersonal separation management and the confirmation of whether or not a person is wearing a mask. 3835 photos make up the dataset that was utilised to train our proposed face mask detector. The data set is split into a train data as well as a testing data set before the custom balaclava image data is tagged.

Fig 2 Dataset Distribution

To successfully develop the model and improve accuracy rate, the supervised learning should contain 80percentage photos, while the data samples set should have 20percentage pictures to evaluate the system's generalization ability. Two methods and also no mask—are assigned to the photos in the learning data gathering.

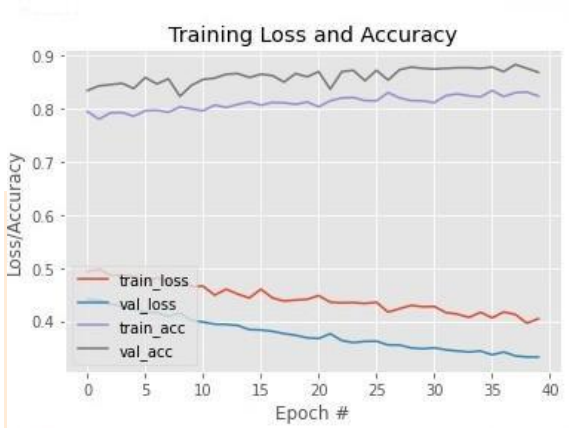

Fig 2. Training Loss Graph

viii. RESULT AND DISCUSSION

In this training process, when the accuracy of the training data increases from the first epoch to the last epoch, the accuracy of the test data varies in the range 0.86 to 0.98. This indicates that the use of the MobileNetV2 model is overfitting and carried out carefully. For a typical form of fluctuating data accuracy using this method, it is recommended that the user stop the training process by using the callbacks function. This callback function is an iteration termination function that is called when a training process has reached a certain level of accuracy. So, it is expected that the model used has the level of accuracy desired by the user. The time needed to run 10 epochs is 6926.81 s.

with_mask	0.98	0.99	0.98	433
without_mask	0.99	0.97	0.98	386
accuracy			0.98	819
macro avg	0.98	0.98	0.98	819
weighted avg	0.98	0.98	0.98	819

Fig 3. Mobile Net Accuracy

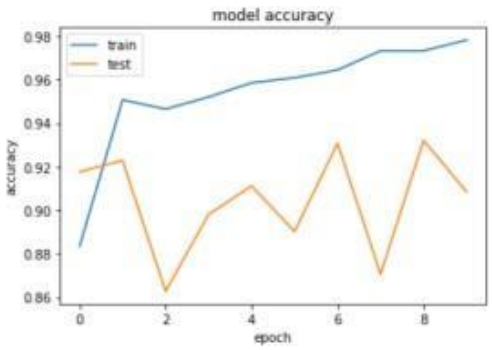

Fig 4. Mobile Net Accuracy Graph

RESNET V2

with_mask	0.90	0.84	0.87	433
without_mask	0.83	0.90	0.87	386
accuracy			0.87	819
macro avg	0.87	0.87	0.87	819
weighted avg	0.87	0.87	0.87	819

Fig 5. ResNet Accuracy

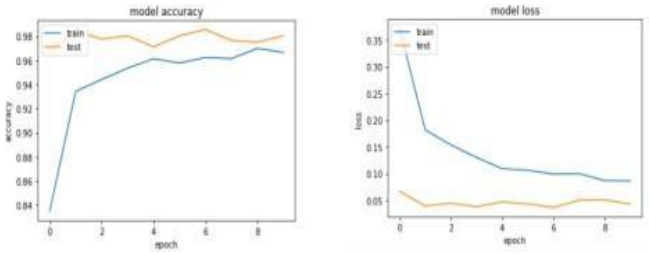

Fig 6. ResNet Accuracy Graph

Different from when training MobileNetV2 using ResNet50V2 data, the accuracy at epoch 0 is usually low. Despite this, the accuracy model derived from the test data, or what we usually call cross-validation, varies in a fairly small range between 0.97 and 0.99, which is constant from epoch 0 to epoch 9. The loss estimate obtained from the training set is lower. This indicates that the resulting learning value will indeed approach the old value that there is more and more training data (as shown by the number of epochs) (indicated by a low loss value). However, the loss value of something like the model using the validation data turns out to be between 0.03 and 0.05.

TABLE FOR COMPARING ACCURACY

Algorithm Name	Accuracy %
YOLOV3	93.3%
YOLOV4	96.8%
YOLOV5	89.5%
MOBILENET	98%
RESNET	87%

ix. OUTPUT SCREEN

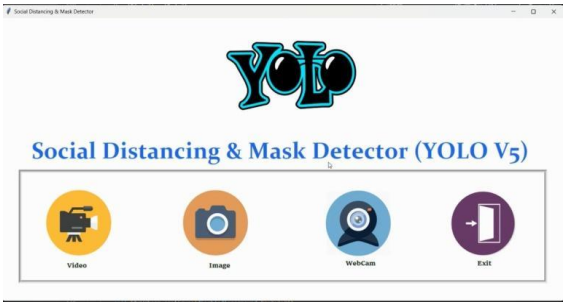

Fig 7.Dashboard UI

Fig 8. Social Distancing

Fig 7. Dashboard UI

x. CONCLUSION

The dataset for sign language was trained with YOLOv3, YOLOv4 and YOLOv5 algorithms. The accuracy, recall and the precision of the result from each of the algorithms were found. By comparing the accuracy values and the results obtained from the three versions, the best suitable version is YOLOv5. But the time taken for YOLOv3 is lower as compared to the time taken for YOLOv4 and YOLOv5. From the outcomes displayed above it is clear that the YOLO object location is appropriate for constant handling and has the option to precisely arrange and confine all the article classes. In this article, we proposed a method that makes use of object recognition and ResNet50 svm classifier to help create a secure environment and ensure additional safety by instantly tracking crowded parks to avoid the growth of the COVID-19 virus and aid law enforcement by reducing their physical eavesdropping work in restraint zones and public spaces that require significant monitoring using video feeds with COVID FSD. As a result, this proposed solution will function effectively in the present lockout scenario and aid in the automated tracking of public locations. The monitoring of social distance and the selection of surgical masks that promote human health while maintaining the safety and confidentiality of user data have both been thoroughly discussed. By installing the model on its own working platform, the execution of this approach was effectively tested in real time (computer). As a result, the face mask recognition and social separation system will be the most popular digital solution in most industries, especially retail, healthcare and business. Find out how we can help you use digital solutions to serve communities. This system can be used in hospitals, government buildings, educational institutions, manufacturing facilities, airports, construction sites and other places. The masked COVID-19 detector we're creating in this location today has the potential to help ensure your safety and the well-being of others. The proposed method would increase public safety by saving time and helping to slow down the spread of the coronavirus as the solution has the ability to drastically minimize offenses through real-time interventions. In the future, we think that this strategy will improve not only the operational efficiency of the power plant, but also the safety of the community in the public space.

xi. FUTURE SCOPE

Exactness are crucial to the success of this application because it may be utilised in any workplace. A higher percentage of false positives might make persons being watched feel uneasy and anxious. Additional steps can be taken to address legitimate security and personal rights issues, such as obtaining prior authorisation for such working settings, generally concealing one's identity, and preserving transparency about its proper usage within a small range of investors.

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