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Analysis of Face Mask Detection Techniques

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Abstract: The world is experiencing severe health issue as a result of the rapid spread of coronavirus disease-2019 (COVID-19). According to the World Health Organization (WHO), the best way to prevent the spread of COVID-19 is wearing a mask and keeping a distance. But there is huge neglect of the guidelines by people which is resulting in daily increase in an infected patient. In these regions, manually monitoring the citizens is quite challenging. So, in this paper, we study ideas to monitor people using the automation process to identify the people who are wearing the mask and who are not. Many incipient trained models are being developed utilizing pre-subsisting datasets to make the algorithm as precise as possible.

Keywords: Semantic Segmentation, OpenCV, Convolutional Neural Network(CNN), YOLO, Deep Learning,

I. INTRODUCTION

The challenge of identifying masks is challenging. Because of the expansion of coronavirus illness, there has been an upsurge in this time. Many nations follow the guideline of thumb like “No access without mask”. Many researchers say that masks reduce capability publicity chances from an inflamed person, whether they have got signs or not.
Hence, face masks detection is to end up a completely important and difficult issue. The face reputation without masks is simpler however face reputation with masks is an essential one due to the fact function extraction of the masked face is very complex than regular face. That is such a lot of face functions which include nose, mouth, and chin are absent in the masked face. So many face masks detection can be focused on following steps

1. Face Recognition
2. Feature Extraction

In the face recognition step We want to come across the face from an image. Mainly there's a hassle such as detecting more than one mask and unmasked faces in an image.

Various object detection approaches can be used to overcome this challenge. Different methods for object detection are Semantic segmentation, YOLO, MTCNN, Viola–Jones object detection framework and R-CNN.
Here such a lot of papers are studied which help to learn how face masks detection can be done. Several strategies are used for masks detection along with video analytic, image semantic Segmentation. All of those strategies are analyzed for checking someone wearing a mask or now no longer and additionally discover the face reputation of someone.
In this research study, various techniques are applied to construct a classifier to gather images of an individual wearing a mask and not wearing from the database and scan the video footage frame by frame to differentiate between those classes of facemask wearing and not facemask wearing and calculate the number of individuals who are wearing a mask and who isn't. To let the authority know the person isn't wearing a mask. It'll contribute to the greater use of masks in crowded areas. The artificial neural network has proven to be an active process for extracting features from unprocessed data.

II. LITERATURE SURVEY

Many techniques have been developed and can be used for extracting faces from images and identifying if that person is wearing a mask or not. Some techniques are explained below.

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In 2019 In paper titled “Facial Mask Detection using Semantic Segmentation” Toshanlal Meenpal, Ashutosh Balakrishnan and Amit Verm [1] explained that how we can use convolution networks to semantically segment face present in any picture. They demonstrated how training is performed on fully convolutional networks and created a model capable of detecting multiple faces in a single image at pixel level accuracy of 93.884% from any arbitrary size image. They started from RGB image and used as input for predefined training weight of VGG-16 architecture to achieve this performance. Their methodology was very good which can be used for face mask detection systems with good accuracy for frontal as well as non- frontal faces. It's focused on removal of erroneous predictions.

In 2020 paper titled “Real-time Face Mask and Social Distancing Violation Detection System using YOLO” proposed by Krisha Bhambani, Tanmay Jain and Kavita A. Sultanpure [2] used a trained YOLO model to detect face and social distancing violation with a mean precision score of 94.75%. By Training model based on YOLOv4 architecture and functioning by using a dataset consisting of more than 7k images. YOLOv4 comes from a family of YOLO models with some major changes from its predecessors. It consists of CSPDarknet53 as backbone[3], spatial pyramid pooling [4] as neck and object detection block at head. The performance they achieved is very accurate, and they are able to perform this detection technique at 38 fps on the NVIDIA Tesla P100 GPU.

According to Paul Viola and Michael Jones in the paper “Rapid Object Detection using a Boosted Cascade of Simple Features”[5] they described a machine learning approach for object detection capable of processing and identifying object detection very quickly. They employed Adabost and an innovative picture representation termed "integral image" to choose a few key feature vectors from a wider collection, resulting in a high efficiency classifier. The method they used combined a more complex classifier in “cascade” and allows it to remove background of image quickly while spending more time and compute power on object detection.

According to “Thor: A Deep Learning Approach for Face Mask Detection to Prevent the COVID-19 Pandemic”, [6] they described a machine learning algorithm to object detection as an end-to-end approach for face mask detection based on deep learning for low-quality images that are taken from challenging angles, distances, and available lighting quality. The method is highly robust and complex as well.to implement [7]. This technique which utilizes a set of deep learning techniques to preprocess images taken of human subjects in public spaces, generate features for masked and unmasked faces, and detect unmasked faces in public spaces.

Multi-Stage CNN Architecture for Face Mask Detection (2020) suggested by Chavda, Amit & Dsouza, Jason & Badgujar, Sumeet & Damani, Ankit utilised Multi-Stage CNN Architecture for Face Mask Detection.
According to them, A classic object detection approach can tackle the challenge of finding several masked and unmasked faces in pictures [8]. Object detection is primarily concerned with locating and categorizing things in photographs (in the scenario of many subjects). Existing old algorithms such as Haar Cascade and Histogram of oriented gradient have been found to be effective for these applications, despite the fact that they mainly dependent on Feature Engineering. In the age of Deep Learning, it is feasible to train Neural Networks that can outclass these methods while requiring no additional Feature Engineering.

In real-time, the MTCNN approach employs tailored CNNs to handle the problems of face identification and orientation. It is broken down into sub that evaluate the facial attributes in order of coarseness to fineness.
It offers a greater performance and better detection speed than traditional approaches, although it may perform poorly on low-quality photos. In these situations, robust features produced with traditional CNN's such VGG16 are used to improve image recognition.

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MODEL / PARAMETER	Semantic segmentation	YOLO	MTCNN	Viola–Jones object detection framework	R-CNN
● Precision	0.93	0.91	0.81	0.93	0.89
● Intersection over Union(**IOU**)	0.92	For Threshold 0.50 =0.89	.77	-	0.90
● Average Precision(**AP**)	0.91	0.95	.82	.90	0.91
● MeanAverage Precision(**mP)**	-	0.94	.56	.91	0.90

Table 1. Comparison of the models based on the parameters

III. CONCLUSION

A variety of mask detection algorithms may indeed be developed using image processing machine learning (ML). In this review paper, We mentioned different strategies that can help to build facial mask detection systems. Mask detection, since we all know, might just be a challenging process these days. The application of Facial Mask Detection is employed particularly for the prevention of spreading Coronavirus.

Every one of this paper has a distinct selection of methods, algorithms and approaches are all examples of distinct methods. However, their purpose seems to be the same: to recognize a face and its traits. Such as the eyes, nose, and brows, and to determine if a person's face is hidden by a mask. Different types of algorithms such as Semantic segmentation, YOLO, MTCNN and Viola–Jones object detection framework, will easily detect whether people are wearing masks or not.

After a thorough examination of everything, using our algorithms, we've determined that each of these Techniques have their own set of benefits and drawbacks, however YOLOv3 and CNN are two more algorithms that have been compared. Algorithms produce better, more accurate outcomes. In real life, they are more successful.

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