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Enhanced Mask Detection Using Image Processing

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Abstract: ***In every day-to-day life, we come across a lot of humans around us wearing masks and we can identify by just looking at them which kind of ask they are wearing, or if they are wearing it properly or not. But what if we want to tell about a large number in just a second. To overcome this situation, this system will be designed to detect the face of the person and generate a response whether someone is wearing a mask, if yes then is he/she wearing it properly or not, and at the end what kind of mask is it. And we will be able to process this data for thousands of people at a single instance.***
Keywords: algorithm, accuracy, image, processing, covid19, mask

I. INTRODUCTION

According to the World Heath Organization (WHO) report dated July 12, 2020, the current COVID-19 outbreak has infected over 13,039,853 people and caused more than 571,659 deaths in more than 200 countries around the world, with a mortality rate of approx. 37% compared to less than 1% for influenza.

A novel corona virus has caused person-to-person transmission, but as far as we know, the novel corona virus that causes illness 2019 (COVID-19) can also be transmitted by an asymptomatic carrier who has no covid symptoms. There is no clinically authorized antiviral drug or vaccination that is effective against COVID-19 as of yet

It has swiftly expanded around the world, posing significant health, economic, environmental, and social issues to the whole human population. Currently, WHO recommends that the people wear face masks to reduce the risk of virus transmission and maintain a social distance of at least 2m between individuals to prevent disease transmission from person to person. Furthermore, several public service providers insist that clients only use their services if they wear masks, and maintain a safe social distance. As a result, detecting face masks and maintaining acceptable social distances has become critical image detection job for assisting the global civilization. This research outlines a method for preventing the virus from spreading by monitoring in real time if people are using safe social distance and wearing face masks in public locations.

The Covid19 pandemic is sweeping the globe. The fight against Corona virus necessitates a plethora of crucial tools. Face Mask is one of these requirements. Initially, face masks were not required for everyone, but as the day progressed, scientists and doctors advised that everyone wear them. Now we'll utilize the Viola-Jones technique to see if someone is wearing a face mask or not. Viola-Jones technique uses image processing to determine whether or not a person is wearing a mask. The application can be used with any existing or new IP cameras to identify people wearing/not wearing masks. We will look at several crucial features of face mask detection in this project, not just for Covid19 situations, but also for ordinary cases. The purpose of face detection is to see if the image or video contains any faces. If there are many faces, each one is encompassed by a bounding box, so we can tell where they are. Feature Based Approach and Image Based Approach are two methods for detecting faces.

The melanoma normally occurs in the young and middle aged people. The periodic visits to physicians are must to check and identify these kinds of diseases. But there are occasions like the pandemic situation like the spread of coronavirus diseases (COVID) that the whole world is presently experiencing. It may be very difficult to contact a physician. Therefore, the proposed work would also be very helpful to people who could not contact a physician directly as the methodology involves online based tele-medicine approach.

II. LITERATURE SURVEY

Object identification algorithms based on deep models have made amazing development in computer vision in recent years, and they are potentially more capable than shallow models in tackling complicated problems. Person detection deep models emphasize feature learning, contextual information learning, and occlusion handling. Deep learning object detection models may now be classified into two groups: (i) two-stage detectors like R-CNN, Fast R-CNN, and faster R-CNN, as well as its derivatives, and (ii) one-stage detectors like YOLO and SSD. Two stage detectors execute detection in phases, with the first step computing proposals and the second stage classifying them into object categories. Some approaches, like YOLO and SSd Multibox, regard detection to be a regression issue and just look at the image once for detection.

Ref No.	Author	Title	Methodology	Year
1	Mohamed Loey, Gunasekaran Manogaran, Mohamed Hamed N. Tahad, Nour Eldeen M. Khalifa	A hybrid deep transfer learning model with machine learning method for face mask detection in the era of covid-19 pandemic.	A hybrid deep and machine learning model proposed for face mask detection. The model can impede the coronavirus transmission, specially COVID-19. Three face mask dataset have experimented with this research.	2021
2	G. Saranya, Dipshikha Sarkar, Sayan Ghosh, Lokesh Basu, K. Kumaran, N. Ananthi	Face mask Detection using CNN	The main aim is to identify whether a person's face is covered with mask or not as per the CCTV camera surveillance or a webcam recording. It keeps on checking if a person is wearing a mask or not.	2021
3	Faisal Najib Abdullah, Mohamed Nurkamal Fauzan, Noviana Riza	Multiple Linear Regression and deep learning in body temperature detection and mask detection	Multiple Linear Regression and deep learning in body temperature detection and mask detection.	2021
4	Gedik, Onur, Demirhan, Ayse	Comparison of the Effectiveness of deep learning methods for face mask detection	Performance comparison of the automated deep learning based models including the ones that use transfer learning for face mask detection o images was performed.	2021
5	Devrim Kayali, Kamil Dimilier, Boran Sekeroglu	Face Mask detection and classification for COVID-19 using deep learning	A dataset was obtained by adding face masks to the existing Labeled Faces in the Wild (LFW) dataset to detect three mask-wearing conditions; correct, wrong, and no mask. The NASNetMobile and ResNet50 networks were trained using the considered dataset.	2021
6	Yazid Rahman Arif, Aji Gautama Putrada, Rizka Reza Pahlevi	An Evaluation of a Modified Haar-Like Features based Mask Detection in the COVID-19 spread prevention	The System proposes a a face mask detection model using the HAAR cascade method to detect faces that have been modified and trained to detect face mask features on human faces.	2021
7	Stephanie Anderson, Suma Veeravenkatappa, Priyanka Pola, Seyedamin Pouriyeh, Meng Han	Automatic Face Mask Detection using Deep learning	Introduced a face mask detection model using deep learning. We have taken into consideration three different categories to train our model; Mask, no mask and incorrect mask.	2021
8	Shashi Yadav	Deep learning based safe social distancing and face mask detection in public areas for COVID19 Safety guideline Adherence	The system favors the society by saving time and helps in lowering the spread of corona virus. It can be implemented effectively in current situation when lockdown is eased to inspect perope, public gathering, shopping malls, etc. Automated inspection reduces manpower to inspect the public and also can be used in any place	2020
9	Minghu Wu, Hanhui Yue, Juan Wang	Object Detection Based on RGC mask R-CNN	First, they compared ResNet with different layers, finding that Resnet-101-64 x 4d is superior to other backbone networks. Secondly, during the training of the test model, the performance of mask R-CNN suffered from a small batch processing scale, resulting in inaccurately calculated mean and variance	2020
10	Yanwei Pang, Jin Xie, Muhammad Haris Khan, Rao Muhammad Anwer, Fahad Shahbaz Khan, Ling Shao	Mask Guided Attention Network for Occluded Pedestrian Detection	Empirically demonstrate that course-level segmentation annotations provide reasonable approximation to their dense pixel-wise counterparts.	2019

III.PROPOSED METHODOLOGY

The system is designed to detect the face of the person and generate a response whether the person is wearing a mask, if yes then is he/she wearing it properly or not, and at the end what kind of mask is it. The use of Viola-Jones Algorithm specifically in order to read the Haar features of a human face on a grayscale contrast to enhance the image processing.

Digital image features called Haar-like features are employed in object recognition. They were utilized in the first real-time face detector and got their name from their intrusive resemblance to "HAAR Wavelets".

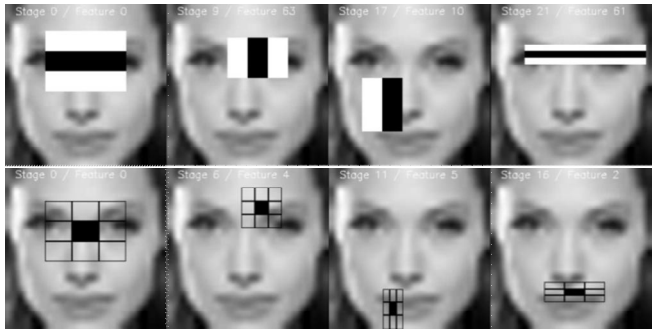

Fig. 1 HAAR Features highlighting the detection window on the parts

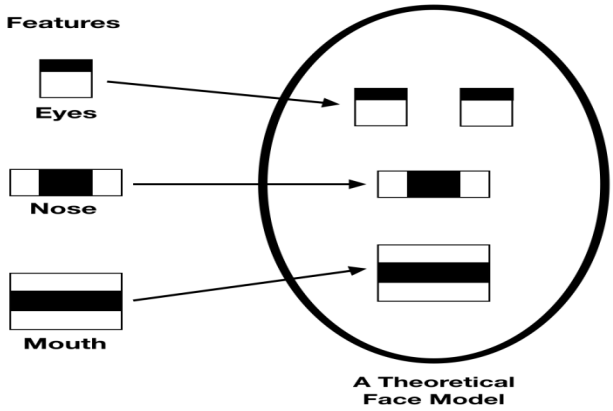

Fig. 2 Distributive pattern of HAAR details on a theoretical face model

A. Viola Jones Algorithm

The Viola-Jones object detection framework was proposed by Paul Viola and Michael Jones in 2001 as an object detection framework. Although it may be trained to recognize a number of object classes, the problem of face detection was the driving force behind it.

The speed with which the features may be evaluated does not adequately compensate for their number, however. For example, in a standard 24x24 pixel sub-window, there are a total of M=162,336 possible features, and it would be prohibitively expensive to evaluate them all when testing an image. Thus, the object detection framework employs a variant of the learning algorithm AdaBoost to both select the best features and to train classifiers that use them. This algorithm constructs a "strong" classified as a linear combination of weighted simple "weak" classifiers.

$$h(\mathbf{x}) = \operatorname{sgn}\left(\sum_{j=1}^{M} \alpha_j h_j(\mathbf{x})\right)$$

Each weak classifier is a threshold function based on the feature f_j.

$$h_j(\mathbf{x}) = \begin{cases} -s_j & \text{if } f_j < \theta_j \\ s_j & \text{otherwise} \end{cases}$$

The threshold value θ_j and the polarity $s_j \in \pm 1$ are determined in the training, as well as the coefficients α_j.

Input: Set of N positive and negative training images with their labels **(xi, yi).** If image I is a face yi=1, if not, yo= -1

1. Initialization: assign a weight $w_1^i = \frac{1}{N}$ to each image i.
2. For each feature f_j with $j = 1, \ldots, M$
    1. Renormalize the weights such that they sum to one.

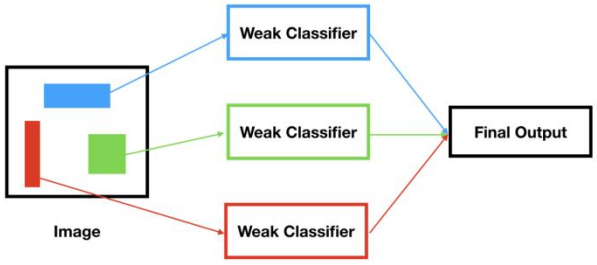

Fig. 3 Viola Jones Classification

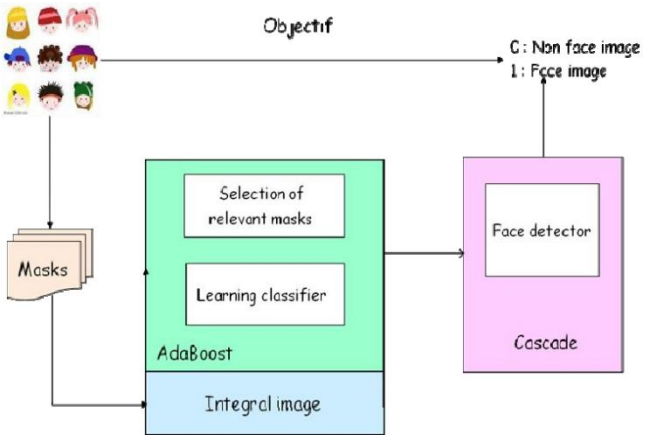

Fig. 4 System Framework

B. Applications

1) *Monitoring:* One of the main applications of this system is to monitor the public areas with people covering their faces with proper masks or not.
2) *Statistical:* The second important application of this system is providing the collected data for statistical purpose. To calculate the ratio of the people wearing masks in public areas and use the statistics for research purposes.
3) *Industrial:* The industries can rely on the system in order to keep an inspection and maintain the discipline among the employees to make sure they follow the protocol of wearing mask all the time during work.

IV. IMPLEMENTATION

The language that is used in this system will be Python as it is a high-level, interactive, general-purpose programming language that is widely used. It is employed in web development, machine learning applications, and all other cutting-edge software technologies. Its language elements and object-oriented approach are designed to assist programmers in writing clear, logical code for both small and big projects. Python's concise, easy-to-learn syntax prioritizes readability, which lowers software maintenance costs.

The library that is used in this system will be OpenCV as it is a large open-source library for computer vision, machine learning, image processing, and it currently plays a critical part in real-time operations, which are critical in today's systems. It maybe used to detect items, faces, and even human handwriting in photos and movies. Python can process the OpenCV array structure for analysis when it is combined with the modules such as NumPy. We employ vector space and execute mathematical operations on these features to identify visual patterns and their various features.

Some other important libraries used are TensorFlow, Keras, Numpy, MatPlotLib, Scipy and the instructions will be put down in Jupyter Notebook. It is an open source project that allows you to create beautiful, high-quality books and documents out of computational data.

The accuracy of the system in detecting the presence and absence of mask on the human face is approx. 99.34% which is very decent amount of accuracy being achieved using the image processing technique.

A. Results

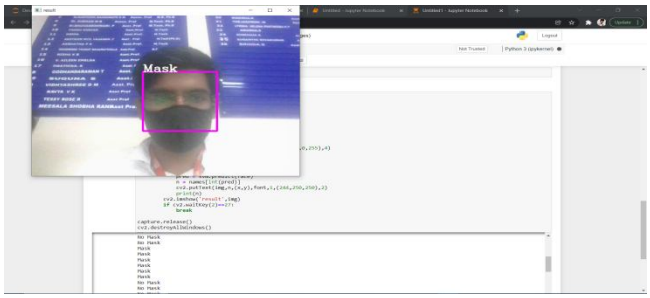

Fig. 5 The System perfectly detecting the presence of mask on human face

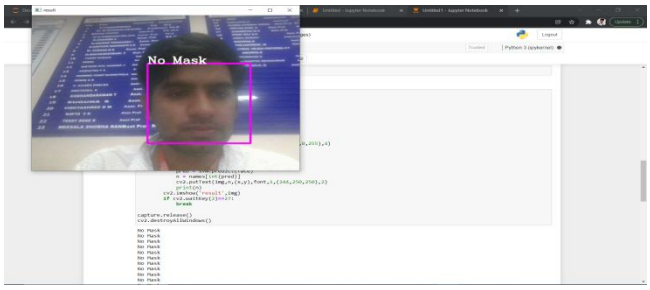

Fig. 6 The System perfectly detecting the absence of mask on human face

B. Merits

The system helps in:

1) Cost Efficient
2) High Detection Rate
3) Increased Accuracy
4) Less Processing Tim

V. CONCLUSIONS

The proposed system is an approach that uses image detection techniques to help maintain a secure environment and ensure individual protection by automatically monitoring public places to prevent the spread of the COVID-19 virus, as well as assisting the police by reducing their physical surveillance work in containment zones and public areas where real-time surveillance is required.

As a result, in the current circumstances, when the lockout is being lifted, this proposed system will be effective in tracking public locations in an automatic manner. We've gone over the tracking of identification of face masks that aid human health in great detail. This solution was successfully implemented and tested in real-time.

Because real-time actions have the potential to drastically minimize violations, the suggested system would promote public safety by saving time and assisting tin the reduction of corona virus spread. This method can be employed in temples, shopping malls, metro stations, and airports, among other places.

The system shows out to be approx. 99.34% Accurate

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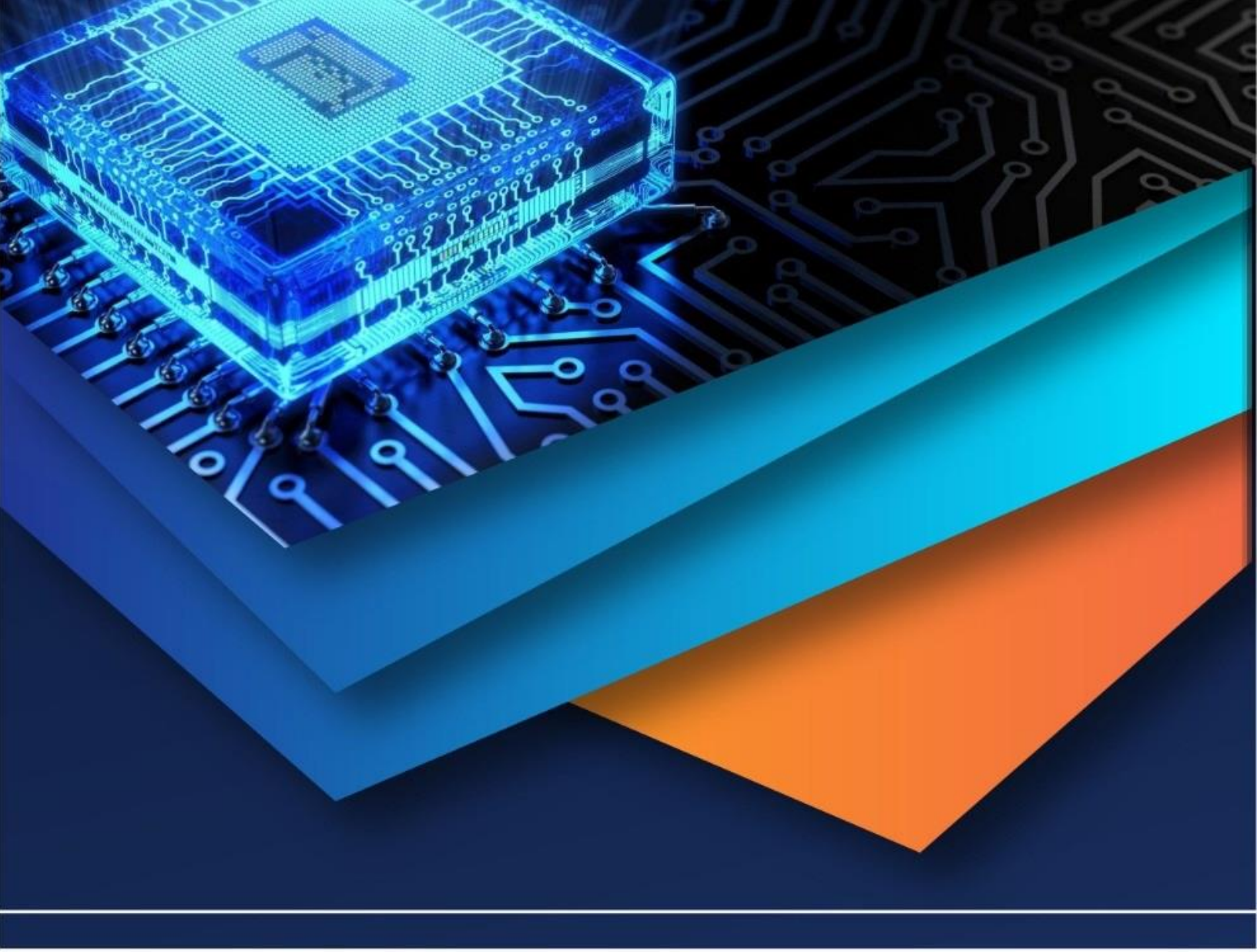

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