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A SMART FACE MASK DETECTION SYSTEM FOR PUBLIC SAFETY AND HEALTH

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ABSTRACT

The COVID-19 epidemic is impacting our daily lives and has caused a sharp surge in health concerns worldwide. Wearing a protective facemask and avoiding coronavirus transmission are two reasons for survival advice. Wearing a facemask is the best way to ensure that COVID-19 is prevented. It might be challenging to physically check if people are appropriately using face masks and to alert the sufferer in crowded and public places. This study takes a more straightforward method to facemask identification and alerting the wearer if they are not wearing one. The suggested system/model is trained and analysed using Kaggle datasets. The real-time system determines if a person's face is covered by a facemask; if not, it sends a text message to the person in question. Real-time public faces are used to extract the mask, which is then fed into a convolutional neural network (CNN).

I. INTRODUCTION

Face mask detection is a challenging task. It has been receiving more and more attention in this era due to the spreading of corona virus disease. Hence many countries following the rule like “No entry without mask”. Face mask detection is very important issue in security purpose and Covid-19 prevention. In the case of medical field, mask reduces potential exposure risk from an infected person whether they have symptoms or not. Face mask detection is used in Airports, Hospitals, Offices and Educational Departments etc.

So face mask detection is become a very critical and challenging issue. The face recognition without mask is easier but face recognition with mask is critical one because feature extraction of masked face is very complicated than normal face. That is so many face features such as nose, mouth and chin are absent in the masked face. In medical field, mask reduces potential exposures risk from an infected person whether they have symptoms or not. So many face mask detection can be concentrated in two steps. 1) Face Recognition 2) Feature Extraction

Face recognition is the first step; here we need to detect the face from an image. Mainly there is a problem such as detecting the multiple mask and unmasked faces in an image. It can be solved by using a traditional object detection method. The traditional face detection algorithms are used Viola-Jones Algorithm, Adaptive Boost Algorithm and HOG (Histogram of Gradient). Here the object detection method is classified as multi-stage detectors and single short detectors (SSD). Faster RCNN is included in multi-stage detectors and YOLO (You Only Look Once) and Single-Short Detection (SSD) included in Single Stage Detectors.

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Here so many papers are studied about face mask detection. Several techniques are used for mask detection such as video analytic, image semantic segmentation, from finger prints, DWT (Discreet Wavelet transform) and LBP (Local Binary Pattern). All of these techniques are analyzed for checking a person wear mask or not and also identify the face recognition of a person. The section II in this work explains different methods used for face mask detection.

The main goal of agricultural planning is to achieve maximum yield rate of crops by using limited number of land resources. Many machine learning algorithms can help in improving the production of crop yield rate. Whenever there is loss in unfavourable conditions we can apply crop selecting method and reduce the losses. And it can be used to gain crop yield rate in favourable conditions. This maximising of yield rate helps in improving countries economy. We have some of the factors that influence the crop yield rate. They are seed quality and crop selection. We need test the quality of the seeds before sowing. As we know that good quality of seeds helps in getting more yield rate. And selection of crops depends upon two things that is favourable and unfavourable conditions. This can also be improved by using hybridization methods. Many researches are carried out to improve agricultural planning. The goal is to get the maximum yield of crops. Many classification methods are also applied to get maximum yield of crops. Machine learning techniques can be used to improve the yield rate of crops. The method of crop selection is applied to improve crop production. The production of crops may depend on geographical conditions of the region like river ground, hill areas or the depth areas. Weather conditions like humidity, rainfall, temperature, cloud. Soil type may be clay, sandy, saline or peaty. Soil composition can be copper, potassium, phosphate, nitrogen, manganese, iron, calcium, ph value or carbon and different methods of harvesting. Many parameters are used for different crops to do different predictions. These prediction models can be studied by using researches. These predictions are classified as two types. One is traditional statistic method and other is machine learning techniques. Traditional method helps in predicting single sample spaces. And machine learning methods helps in predicting multiple predictions. We need not to consider the structure of data models in traditional method where as we need to consider the structure of data models in machine learning methods.

II. LITERATURE SURVEY

In 2012, Face Detection using Convolutional Networks and Gabor Filters [1] proposed by Bodan Kwolek used to detecting facial regions by composing a Gabor Filters and a convolutional neural network. Gabor Filter is concentrated on extract the intrinsic facial features. The main advantages of Gabor Filter are allows the signal analysis at different scales and resolution. The convolutional neural network layer consist one or more plane. Totally 6 convolutional neural networks used here. As a result it showed providing better recognition and high rate in face detection than the alone performance of CNN.

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In 2015 intelligent face mask detection system [2] proposed by N. Ozkaya, S. Sagiroglu used for the generation of face masks from its finger print. To develop an intelligent system for obtains masked face from fingerprints without having any knowledge about their faces. The multi model database contains 120 persons. The IFPSF contains 4 modules including Data Enrollment and MMDB module (Multi Model Biometric Data Base). The Face Reconstruction Module consists a pre processing and post processing steps. Here ANN (Artificial Neural Network) analyzes the existence of any relationship between face and fingerprint. As a result of achieve unknown biometric feature from unknown one, here unknown biometric is face mask and unknown one is fingerprint. In 2016, study of masked face detection approach in video analytics [3] proposed by Gayatri Deora and Ramakrishna, here video analytic approach is used for detection. When face detection can be triggered by calculating the distance between a person and camera. Viola Jones Algorithm used for facial part detection, such as detection of eyes, nose and mouth etc. This algorithm provides very high detection rates and low false positive rate. As a result poor image quality leads to high false detection rate.

In 2016, Face recognition and authentication using LBP and BSIF [4] proposed by Naveens, Dr. R.S Moni. Here introduce a face recognition and authentication method for the detection and elimination of masks. The local and global facial features are used to realize a real face and masked face. A 3D mask data based 3DMAD used here by the combination of LBP (Local Binary Pattern) and BSIF (Binarized Statistical Image Features) extract textures for face authentication. The steps are included here face detection, feature extraction, face recognition and face authentication. Feature extraction find out the global and local features for face region. The nose and eye region features are included in local features. By the classification of these features, finds the real or masked face through face recognition process.

In 2017, A Cascade Framework for masked face detection [5] proposed by Weibu Jiangejinn Xiao and Chuanhong Zhou used a simple system for mask detection. The architecture consists of cascaded 3 convolutional mask detectors are Mask–12, Mask–24-1 and Mask – 24-2. Here ResNet 5 model–7 layer convolutional layer followed by a pooling layer is used. Mask 1 is the first stage and Mask 3 is the last stage of masked face detector. A masked face dataset is used and it is contained 160 images for testing and 40 images for testing purpose. Training process includes Pre-train model and Fine tune models. Finally use PASCAL VOC for evacuation process. Testing on Masked Face achieved 86.6% accuracy.

In 2017, face detection and segmentation based on improved mask R-CNN [6] proposed by Kaihan Lin and Xiaoyong Liu, used a segmentation method is based on Mask R-CNN. The Convolutional Network Model ResNet101 architecture used for extracts feature. Popular face benchmark dataset, FDDB (Face Detection Data Set and Benchmark) and AFW datasets are used. A fully convolutional layer network followed

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by a max pooling layer is used for creating a mask. As a result it gives high G-mask accuracy than normal mask accuracy.

In 2018, Detection of 3D mask in 2D face recognition system by using DWT and LBP [7] proposed by Arti Mahore and Meenakshi Tripathi, here detection of 3Dmask is based on anti-spoofing. It follows the detection approaches categories such as hardware, software and user collaboration. In hardware method uses an external hardware for creating a mask. Software based method uses texture-base analysis. The input RGB image is covered luminance and chrominance parts, DWT is processed these channel efficiently. Feature extraction process is carried out by using a Local Binary Pattern (LBP). The SVM (Support Vector Machine) classifier is analyzed it is a real or fake image.

In 2019, Implementation of Principle Component Analysis on Masked and Non-Masked Face Recognition [8] proposed by Md. Sabbir Ejaz and Rabiul Islam, here analyzed a masked and non-masked face recognition accuracy by using a principle component analysis. The dataset used is Olivetti and Oracle Research Laboratory (ORL) face database. Here PCA is used for feature extraction. The steps are used in this work includes Facial Image Acquisition and Facial Feature Extraction using PCA and Eigen Vector Calculation. As a result it gives high recognition rate of face without mask.

In 2019, Facial Mask Detection using Semantic Segmentation [9] proposed by Toshanlal Meenpal, Ashuthosh Balakrishnan and Amit Verma used a facial mask detection based on semantic segmentation. Here the class labels are named as face or non-face. The convolutional neural network VGG-16 architecture followed by fully convolutional network is used for segmentation. As a result it recognizes multiple faces. This method is useful for frontal faces as well as non-frontal faces. As a result it is focused on removal of erroneous prediction.

In 2020, performance evaluation of intelligent face mask detection system with various deep learning classifiers [10] proposed by C. Jagadeeswari, M.Uday Theja. Here the performance of face maskdetection using different deep learning classifiers can be analyzed mobileNet V2, ResNet 50, VGG 16, ADAM, SGD. These are the classifiers used for it. For each classifier followed byu 3 optimizer and evaluate the performance. The optimizers are used here such as ADAM, ADAGRAD, SGD (Stochastic Gradient Descent). As a result ADAM optimizer perormance is very good and also observed that MobileNet V2 classifier has best result with high accuracy.

In 2020, Retinal Face Mask Detector [11] proposed by Mingjie Jiang, Xinqi fan and Hong, here introduces a Retinal Face Mask Detector. It is a One-stage object detector. The dataset contained 7959 images. The ResNet and mobile Net used as BACKBONE. But ResNet is considered as standard backbone.

III. SYSTEM ANALYSIS AND DESIGN

EXISTING SYSTEM

While caring for thousands of COVID-19 patients, hospital staff, nurses, physicians,

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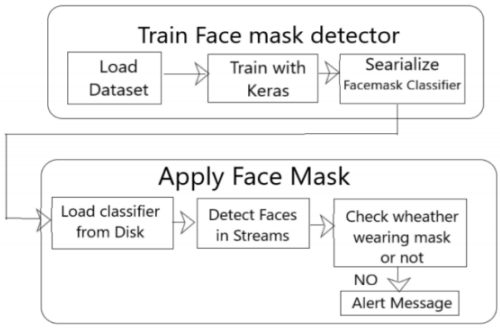
administrators, scientists, and engineers have also been pursuing ways to optimize care to face the onslaught of daily new cases. COVID-19 disease 2019 has large scale negative impact on health across the globe. One major form of defense against viruses is to wear face masks in public places. Retinaace Mask detector, a high accuracy facemask detector.This paper addresses building a hybrid deep and classical machine learning model to detect facemask. The model consists of two elements. The first element is designed using Resnet50 for feature extraction, and the second element is built using Support Vector Machine (SVM), decision tree, and ensemble algorithm for facemask classification process. An architecture is trained efficiently using deep learning on a dataset that has images of individual's faces with and without facemask. The system architecture prevents spreading of virus by finding out individuals who are not wearing facemask in smart cities by monitoring with public Closed-CircuitTelevision (CCTV) cameras. An individual is spotted if not wearing a facial mask and reported corresponding authority.

PROPOSED SYSTEM

We proposed to build a real-time facemask detection model using Convolution Neural Network (CNN) which is a class of Deep Neural Network (DNN), most commonly used in image classification and recognition. The proposed model can be implanted in surveillance cameras in organizations, schools, universities, shopping malls, multiplex etc. which helps to monitor individuals automatically whether they are wearing facemask, if not, spot them and report to higher authorities as well as notify them personally through text. This model helps to break the chain of spreading of virus when in close contact and reduces the positive cases which are rapidly increasing day-by-day and the rate of losing helpless lives can be controlled.

IV. SYSTEM ARCHITECTURE



V. SYSTEM IMPLEMENTATION

Modules Description

Convolutional neural network (CNN):

CNN has been extensively used in diverse computer vision applications, including FER. At the beginning of the 21st century, several studies in the FER literature found that the CNN is robust to face location changes and scale variations and behaves better than the multilayer perceptron (MLP) in the case of previously unseen face pose variations, employed the CNN to address the problems of subject independence as well as translation, rotation, and scale invariance in the recognition of facial expressions.

Face Detections

Face detection can be regarded as a specific case of object-class detection. In object-class detection, the task is to find the locations and sizes of all objects in an image that

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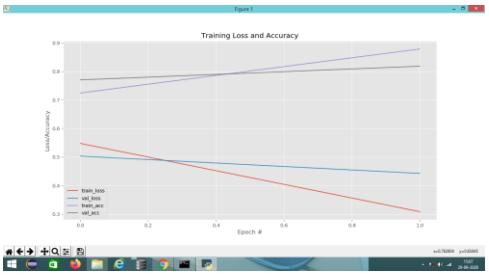
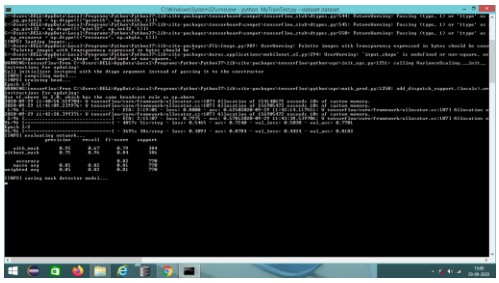
belong to a given class. Examples include upper torsos, pedestrians, and cars. Face detection simply answered two question, 1. is there any face in the collected images or video? 2. where it was located?

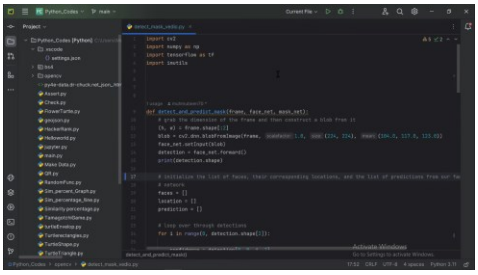
Face-detection algorithms focus on the detection of frontal human faces. It is analogous to image detection in which the image of a person is matched bit by bit. Image matches with the image stores in database. Any facial feature changes in the database will invalidate the matching process.[3] A reliable face-detection approach based on the genetic algorithm and the eigen-face[4] technique: Firstly, the possible human eye regions are detected by testing all the valley regions in the gray-level image. Then the genetic algorithm is used to generate all the possible face regions which include the eyebrows, the iris, the nostril and the mouth corners.[3]

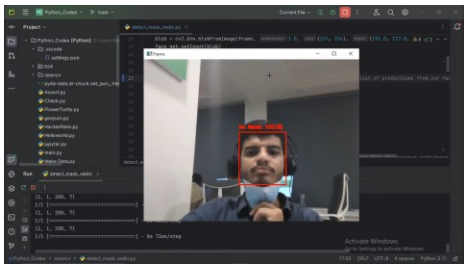
Each possible face candidate is normalized to reduce both the lighting effect, which is caused by uneven illumination; and the shirring effect, which is due to head movement.

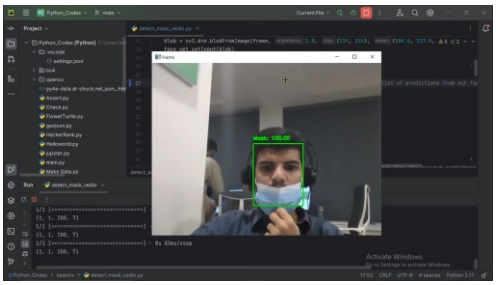
VI. SCREEN SHOTS











VII. CONCLUSION

According to our study, we have developed a system that can automatically determine if someone is wearing a face mask and alert higher authorities if they are not. To help the public make sure they are wearing face masks and to prevent the spread of the COVID-19 virus, this suggested solution makes use of computer vision and mobile

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networks. Police or higher authorities can more easily determine whether someone is wearing a mask thanks to our study; if not, they will also have the victim's photo so they may take further action. Locations such as airports, retail centres, workplaces, schools, and train stations may all use the suggested method.

This concept may be used to several other situations for public safety, including:

- Use a face mask to determine whether a person is committing a crime.
- Determine the kind of mask the individual is donning.
- The detection of coughing and sneezing.
- Temperature Inspection

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