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Review of Human Face Mask Identification using Deep learning with Open CV Techniques

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Abstract- The 2019 coronavirus illness outbreak has become a significant threat to public health. Because of the way it behaves when in touch with other substances, it is rapidly disseminating. Therefore, the World Health Organization recommended that people in crowded settings use masks as a form of preventive. In some of these regions, the illnesses have grown quite widespread as a direct result of the incorrect use of face masks. Therefore, in order to solve this issue, we needed a mask monitoring system that was effective. By means of the development of machine learning and analytical techniques using image processing, present methods for mask detection. Image processing analysis and the approach of machine learning are both used in the process of finding out mask detection. There are a few different approaches that may be used to identify face masks. The convolutional neural network approach is the one that is utilised most often nowadays. In comparison to other organisations, CNN has a very high level of both accuracy and decision making. In this article, we will talk about a variety of deep learning approaches that may be used to recognise face masks.

Key Words- Corona virus disease 2019, Face mask detection, CNN, Machine learning.

I. INTRODUCTION

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. 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.

II. VARIOUS FACE MASK DETECTION TECHNIQUES

There are many techniques are used for face mask detection. Some of them are explained below.

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.
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, hereunknown 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 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. The detection network includes a backbone, a neck and head modules. As a result the ResNet accuracy is very much higher than the Mobile Net.

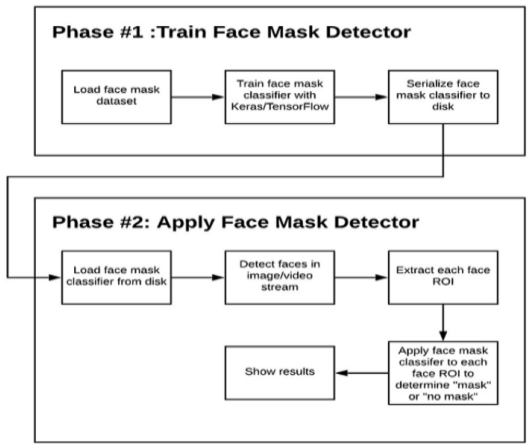

Fig. 1. Process flow

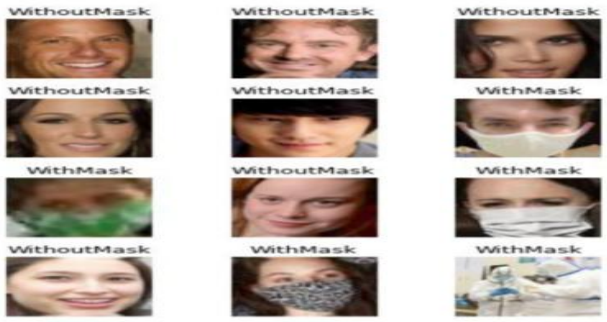

Fig. 2. Face Mask Dataset 1 (with and without mask), M. N. Islam et al. .

Fig. 3. Face Mask Dataset 2 (with and without mask), M. N. Islam et al..

III. COMPARISON

So many papers are studied about the face recognition without mask. But a few papers are concentrated about face with mask [8] discussed about the recognition accuracy of masked face and non-masked using PCA (Principal Analysis Component). It gives face without mask provide better recognition rate. The recognition accuracy drops to less than 70% when face is masked. In [12] the authors developed a new face mask wearing condition including correct face mask wearing, incorrect face mask wearing, and no face mask wearing. It achieved 98.70% accuracy in the face detection phase. In [13] the authors developed a system for detecting the presence or absence of medical mask in the operating room. In this approach to trigger an alert only for medical staff who do not wear a surgical mask, by minimizing false positive face detection.

IV. CONCLUSIONS

The artificial intelligent (AI) and machine learning (ML) are developed various models for face mask detection. In this article, discussed about various methods are used for facial mask detection. As we know nowadays mask detection is a very challenging task. The applications of Facial Mask Detection are used especially for the prevention of spreading Corona Virus, tracking & identifying criminals and anti-spoofing etc. By using a Deep Convolutional Neural Network Algorithm, we can easily detect the facial mask. But the facial mask detection and non-masked face detection accuracy provided high variations.

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