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Face Mask Detection using Convolutional Neural Network

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Abstract - *The corona virus COVID-19 pandemic is causing a worldwide health crisis therefore the effective protection methods is wearing a mask publicly areas consistent with the planet Health Organization (WHO). The COVID-19 pandemic forced governments across the planet to impose lockdowns to stop virus transmissions. Reports indicate that wearing face masks while at work clearly reduces the danger of transmission. An efficient and economic approach of using AI to make a secure environment during a manufacturing setup. A hybrid model using deep and classical machine learning for mask detection are going to be presented. A mask detection dataset consists of with mask and without mask images, we are getting to use OpenCV to try to to real-time face detection from a live stream via our webcam. We'll use the dataset to create a COVID-19 mask detector with computer vision using Python, OpenCV, and Tensor Flow and Keras. Our goal is to spot whether the person on image/video stream is wearing a mask or not with the assistance of computer vision and deep learning.*

Key Words*: *Corona virus disease 2019, Face mask detection, CNN, Machine learning

1. INTRODUCTION

Face mask detection may be a challenging task. It's been receiving more and more attention during this era thanks to the spreading of corona virus disease. Hence many countries following the rule like "No entry without mask". Face mask detection is extremely important issue in security purpose and Covid-19 prevention. Within the case of medical field, mask reduces potential exposure risk from an infected person whether they have symptoms or not. Mask detection is used in Airports, Hospitals, Offices and academic

Departments etc. So mask detection is become a really 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 extremely complicated than normal face. That's numerous face features like nose, mouth and chin are absent within the masked face. In medical field, mask reduces potential exposures risk from an infected person whether or not they have symptoms or not. Numerous mask detection are often concentrated in two steps.

1) Face Recognition

2) Feature Extraction

Face recognition is that the first step; here we'd like to detect the face from a picture. Mainly there's a drag like detecting the multiple mask and unmasked faces in an image. It are often solved by employing a traditional object detection method. The normal face detection algorithms are used Viola-Jones Algorithm, Adaptive Boost Algorithm and HOG (Histogram of Gradient). Here the object detection method is assessed 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 numerous papers are studied about mask detection. Several techniques are used for mask detection like video analytic, image semantic segmentation, from finger prints, DWT (Discreet Wavelet transform) and LBP (Local Binary Pattern). All of those techniques are analyzed for checking an individual wear mask or not and also identify the face recognition of an individual.

The section II during this work explains different methods used for mask detection.

2. Proposed System:-

The proposed system focuses on the way to identify the person on image/video stream wearing mask with the assistance of computer vision and deep learning algorithm by using the OpenCV, Tensor flow, Keras and PyTorch library.

Approach

1. Train Deep learning model

2. Apply mask detector over images / live video stream

Proposed System Architecture

3. LITERATURE REVIEW

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

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

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.

CONCLUSIONS

As the technology are blooming with emerging trends the supply so we've novel mask detector which may possibly contribute to public healthcare. The architecture consists of Mobile Net because the backbone it are often used for top and low computation scenarios. so as to extract more robust features, we utilize transfer learning to adopt weights from an identical task face detection, which is trained on a really large datase

We used OpenCV, tensor flow, keras , Pytorch and CNN to detect whether people were wearing face masks or not. The models were tested with images and real-time video streams. The accuracy of the model is achieved and, the optimization of the model may be a continuous process and that we are building a highly accurate solution by tuning the hyper parameters. This specific model might be used as a use case for edge analytics. Furthermore, the proposed method achieves state-of-the-art results on a public mask

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