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Face Mask Recognition Using Convolutional Neural Networks

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ABSTRACT: The COVID-19 is an emergency prompting a lot of setbacks and security issues. All together to lessen the spread of COVID, people wear masks to secure themselves, yet some people will not wear masks because of specific reasons putting every other person in danger. One main goal of scientists during the progressing COVID pandemic is to make ways to handle this issue through quick and proficient methods. In our proposed project a reliable method is used based on deep learning-based features in order to address the problem of masked face recognition process. We apply a Convolutional Neural Network (CNN) to extract the features from the obtained regions. We then find out who is not wearing a mask and alert the necessary authorities. This system can then be used in security cameras in schools, offices and other public areas to make sure everyone wears a mask and manage people who don't.

KEYWORDS: Machine Learning, Convolutional Neural Networks, MobileNetV2, Face Detection.

I. INTRODUCTION

The COVID-19 virus can be spread through contact and polluted surfaces, therefore, the classical biometric frameworks based on passwords or fingerprints are not any longer protected. Face acknowledgment are safer with no compelling reason to contact any device or gadgets. Recent studies on coronavirus have proven that wearing a face mask by healthy and infected population reduces considerably the transmission of this virus, yet a couple of others won't wear masks because of specific reasons putting every other person in danger. With the assistance of Convolution neural network which can without much of a stretch handle enormous measure of information and give high characterization exactness, we can make a program which detects whether people are wearing masks or not.

Training of CNN for image classification can be done mainly in 2 ways: training the CNN from the scratch or using the concept of transfer learning. Masked face recognition, aims to recognize a face with mask basing on the eyes and the forehead regions. We handle the second task using deep learning-based method. We use pre- trained deep learning-based model in order to extract features from the unmasked face regions (out of the mask region). With this data we can determine who is wearing a mask and who isn't. By integrating this in surveillance cameras we can check whether individuals wear masks either in a large public area or even an office hallway. We can even attempt to make a framework which denies an individual passage in the event that he/she isn't wearing a mask.

II. LITERATURE SURVEY

Sabbir Ejaz, and RabiulIslamIn MASKED FACE RECOGNITION USING CONVOLUTIONAL NEURAL NETWORK uses the FaceNet pre-trained model for improving masked face recognition. This paper, has benchmarked this approach with two well-known datasets and a new dataset. The FaceNet model trained on masked and non-masked images gives better accuracy for simple masked face recognition. In later work, it is our importance to enhance and enlarge our work to address different extreme masks condition of face recognition.[1]

Ankan Bansal, Rajeev Ranjan, Carlos D. Castillo and Rama Chellappa Deep Features for Recognizing Disguised Faces in the Wild. This paper first evaluates the approach on the relatively simple Disguised and Makeup Faces Database. The aim of this is to recognize disguised faces as belonging to the subject under consideration and reject the impersonators. Recognizing disguised faces is an important practical problem for law enforcement and identity protection.[2]

Rafiuazzaman Bhuiyan, SharunAkterKhushb, Sanzidul Islam A Deep Learning Based Assistive System to Classify COVID-19 Face Mask for Human Safety with YOLOv3 this study introduces an approach for detecting a person is wearing a mask or no mask using state of art YOLOv3 architecture. The model is trained by the face mask image and non-face mask image. This piece of research mainly focuses on building a custom object detection model using YOLOv3 not to make the whole architecture.[3]

ToshnallMeenpal,AshutoshBalakrishnan,Amit Verma "Facial Mask Detection using Semantic Segmentation". This paper presents facial mask detection using the concepts of semantic segmentation. Semantic segmentation. Semantic segmentation is the process of assigning a label to each pixel of the image. This paper proposes a model for face detection using semantic segmentation in an image by classifying each pixel as face and non-face i.e., effectively creating a binary classifier and then detecting the segmented area.[4]

Matthew A. Turk and Alex P. Pentland Face Recognition Using Eigenfaces". This approach treats face recognition as a two-dimensional recognition problem, taking advantage of the fact that faces are normally upright and thus may be described by a small set of 2-D characteristic views. The approach transforms face images into a small set of characteristic feature images, called eigenfaces, which are the principal components of the initial training set of face images.[5]

Shuang Li, Xin Ning, Lina Yu, Liping Zhang, Xiaoli Dong Yuan Shi, Wei He “Multi-angle Head Pose Classification when Wearing the Mask for Face Recognition under the COVID-19 Coronavirus Epidemic” Facial modeling and analysis have always been an important research in the field of biometrics. But for different research, the input of high-quality pictures is absolutely necessary. Therefore, facial images with small head deflection tend to be more popular. The work of this paper is to study the head pose classification problem which can help improve the performance of many algorithms related to faces. [6]

Shiming Ge¹, Jia Li², Qiting Ye^{1,3}, Zhao Luo^{1,3} Detecting Masked Faces in the Wild with LLE-CNNs with the rapid development of machine learning methods, the problem of face detection seems to be well addressed yet. For example, the face detector proposed achieves an average precision of 98.0% on the public image benchmark AFW by using the cascaded Convolutional Neural Networks, while the speed of some face detectors can reach up to 35 FPS or even 400 FPS.[7]

Edy Winarno,ImamHusni Al Amin, HernyFebruariyanti,Prajanto Wahyu Adi, WiwienHadikurniawati, Muchamad Taufiq Anwar Attendance System Based on Face Recognition System Using CNN-PCA Method and Real-time Camera In this research, the development of a face recognition model as a face attendance machine using a hybrid feature extraction method using CNN-PCA was built using a combination of face detection and face recognition framework model using real-time cameras that function as a face detection tool and human face identification.[8].

III. METHODOLOGY

A new user who wants to access the face mask detection system needs to at first register to the web application to use of its features. In the event that the user has effectively enlisted, user can straightforwardly login to the web application. If not, user has to register to the web application by filling the basic details like email and password.

The technologies that have been used are:

1) Flask

Flask is a web framework. It is a Python module that lets you develop web applications easily. Flask is based on the Werkzeug WSGI toolkit WSGI toolkit and the Jinja2 template.

2) Python

Python is an interpreted high-level language. Python has syntax that allows developers to write programs with fewer lines than some other programming languages. Python can be used on server to create web application.

3) MobileNetV2

MobileNetV2 is a cutting edge for mobile visual recognition including classification, object detection and semantic segmentation. This classifier uses Depth wise Separable Convolution which is introduced to dramatically reduce the complexity cost and model size of the network, and subsequently is appropriate to Mobile gadgets, or devices that have low

computational power.

IV. PROPOSED WORK

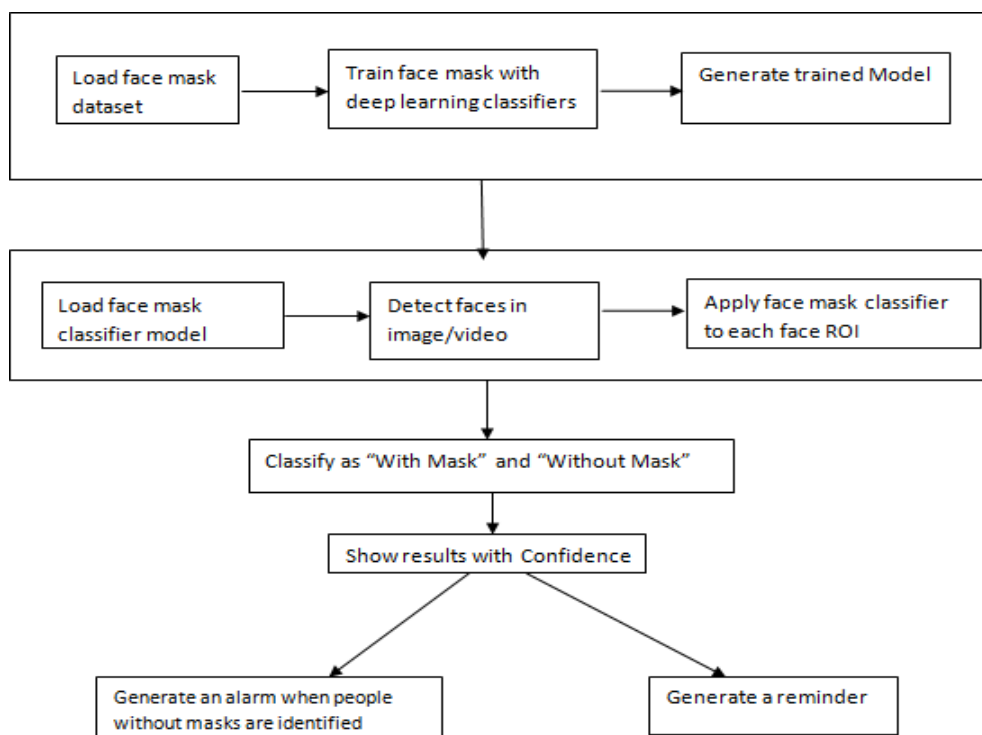


Figure 1: - Architectural Design

Figure 1 shows the architectural design of Face Mask Detection System.

The classification of the images is done by model in 2 phases:

Phase 1: - Face mask dataset is loaded into the system - Different classifiers like MobileNetV2, ResNet50, and VGG16 are used to generate a trained mode.

Phase 2: - Load the face mask classifier model. The choice of a system must be based on the best performance. Hence the above performance metrics may be considered for coming out with the best system so that it can be implemented at large scale

Datasets:

The collection of images used for training and testing the model was collected from the web. The image size resolution of the dataset ranges from 800 up to 1200 pixels. All images were formatted in a JPEG formatting.

Training:

Here we'll focus on loading our face mask detection dataset from disk, training a model (using Keras/TensorFlow) on this dataset, and then serializing the face mask detector to disk.

Deployment:

Once the face mask detector is trained, we can then move on to loading the mask detector, performing face detection, and then classifying each face as with mask or without mask.

Classification:

Classification is done with the training of the model that will recognize and classify the trained images with the learned

visual patterns. The authors implemented the development of a program using open-source software using Python and OpenCV. Along with the TensorFlow and Keras module to create a CNN model using the VGG16 network model.

V. RESULT AND ANALYSIS

The final project will result in detecting whether the individuals are wearing the mask or not. As the technology are blooming with emerging trends, we have novel face mask detector which can possibly contribute to public healthcare. The engineering comprises of Mobile Net as the backbone it can be used for high and low computation scenarios. In order to extract more robust features, we utilize transfer learning to adopt weights from a similar task face detection, which is trained on a very large dataset. We utilized Open CV, tensor flow, keras, CNN and state of art YOLOv3 architecture to detect whether people were wearing face masks or not. The models were tested with images and real-time video streams.

Figure 2 and Figure 3 displays the accuracy chart and Face Mask detection interface of Face Mask Detection System.

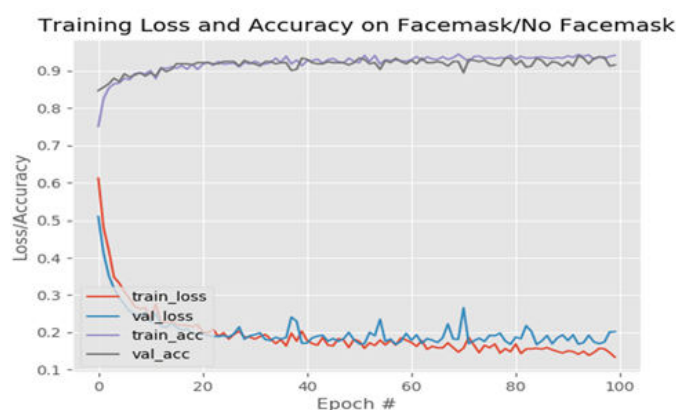


Figure 2:- Accuracy Matrix

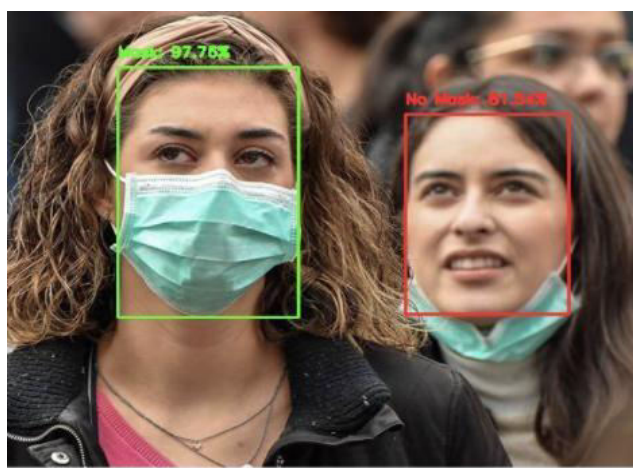


Figure 3: - Output Frame



Figure 4: - Home Page

Figure 4 displays the Front-End interface for users of Face Mask Detection System.

VI. CONCLUSION

We used OpenCV, tensor flow, keras, CNN and state of art YOLOv3 architecture 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 is a continuous process and we are building a highly accurate solution by tuning the hyper parameters. The same work can further be improved by employing large volumes of data and can also be extended to classify the type of mask, and implement a facial recognition system, deployed at various workplaces to support person identification while wearing the mask

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