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Mask Detection and Tracing System

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ABSTRACT

Covid19 has given a new identity for wearing a mask. It is meaningful when these masked faces are detected accurately and efficiently. As a unique face detection task, face mask detection is much more difficult because of extreme occlusions which leads to the loss of face details. Besides, there is almost no existing large-scale accurately labelled masked face dataset, which increase the difficulty of face mask detection. The system encourages to use CNN-based deep learning algorithms which has done vast progress towards researches in face detection In this paper, we propose novel CNN-based method which is formed of three convolutional neural networks to detect face mask. Besides, because of the shortage of face masked training samples, we propose a new dataset called" face mask dataset" to finetune our CNN models. We evaluate our proposed face mask detection algorithm on the face mask testing set, and it achieves satisfactory performance.

Keywords : Face mask, CNN, Face detection, Deep learning

I. INTRODUCTION

At the end of this decade, face has got a new identification due to rise in COVID-19 cases. COVID-19 is a virus which gets inflicted when infected person comes in contact with any other person. Infected person can leave traces of virus on things around him. His spit or touch is observed to be most infectious medium to carry this virus. Hence as way of precaution people all around need to wear face mask to prevent them and everyone around them to get infected by the VIRUS. This discipline has been made compulsory which is helping in curbing the COVID-19 cases. Government have utilized strict law for wearing mask when in public area. People are fined for not wearing mask or not wearing it properly. Keeping the need of time in mind we have proposed a method for detecting the mask on face. The paper proposes a step wise method to detect the block of face in images and surveillance videos. The next step involves detection of mask on this block. Further steps involve whether the mask is worn properly or not. The first step of face detection is one of the longest-researched computer vision problem, which can be traced back about half a century ago. However, most of the early face detection algorithms cannot meet the practical need. The Viola Jones as a first researcher for face detection has face detector that consists of a series of classifiers ranging from simple to complex ones. Later researchers continued to study

based on it, and many of them apply more complex and descriptive features to make the detector more powerful. In recent years, deep learning has made great breakthroughs in many computer vision areas, such as general object detection, object classification, object segmentation and of course, face detection. Deep learning does not need to manually design features, as the CNN (Convolutional Neural Networks) can automatically take learning useful features from the training images. The proposed system involves use of CNN for face detection and detection of mask at later stage with K-means. The system will help detect the people wearing mask as well people not wearing mask or people who have not worn mask properly. This in course will help to bring discipline to public as well precaution through which they can easily roam around with mask in public place and help curb the COVID-19 infection.

II. LITERATURE RIVIEW

A. Multi-scale feature extraction for single face recognition

The Single sample face recognition has always been a hot but difficult issue in face recognition. By considering selecting robust features and generating virtual samples simultaneously, the paper proposes a multi-scale support vector transformation (MSSVT) based method to generate multi-scale virtual samples for single image recognition. The methods to solve problem are divided into two categories. One is to look for and select features that are robust to the number of samples, from the point of view of feature selection, such as PCA and 2DPCA. But when each person has only one face to be trained, the feature information extracted from the feature extraction algorithm will also be very limited, resulting in a bad recognition performance. The other is to generate multiple virtual samples from the point of view of the extended sample, thus reducing the impact of the sample size.[3]

B. Face recognition method based on sparse representation and feature fusion

This The authors propose a multi-feature fusion face recognition method based on sparse representation. The core idea is to find the sparseness through training, and then use the sparse coefficient and training samples to represent the test samples, and then the optimal sparse solution is obtained by solving the l1-norm problem. The recognition results of feature fusion method are better than any single feature algorithm under the condition of non-occlusion or occlusion. When there are less than 10 pictures of each category of people in the training sample and the occlusion type is not controllable, our algorithm can still obtain a high recognition rate. [5]

C. Spatial pyramid pooling in deep convolutional networks for visual recognition

For Visual Recognition, Scales, Sizes and Aspect Ratio are considered as important factor. SPP (Spatial Pyramid Pooling) is a flexible solution for handling these factors. In context of deep networks, these factors have received less consideration ,thus the system is trained with deep layer networks considering SPP layer. SPP-net shows outstanding accuracy in classification/detection tasks and greatly accelerates DNN-based detection. Their studies also show that many time-proven techniques/insights in computer vision can still play important roles in deep-networks-based recognition.[1]

D. Face and Gender Recognition System Based on Convolutional Neural networks

The proposed Face and Gender Recognition System realizes the combination of image face recognition and gender recognition module, which enables not only face recognition but also gender recognition in complex background. Based on the ResNet50 neural networks, we use the global average pool (GAP) instead of the fully connected layer before final output, followed by the softmax layer, which reduced the size of the networks. By constructing such a

simple structure, the accuracy of the system recognition has been improved.[6]

E. Dynamic Feature Matching on Partial Face Recognition

In The partial face recognition is having application in a broad spectrum of different fields. The different approaches used for the partial face recognition are the key point-based approach, region-based approach, and CNN-based approach. In key point-based, the popular method was MKD-SRC. In region-based partial face recognition approach, the prominent model is MR-CNN. In the midst of different approaches in partial face recognition, it is concluded that the CNN-based approaches are the comparatively best approach. The current novel approach proposed for partial face recognition. in CNN– based is called Dynamic Feature Matching (DFM). The dynamic feature dictionary correlating to the probe is achieved. DFM is able to yield the advantages of the properties of FCN and generate identifying features more precisely. DFM is having a promising application in various video recognition approaches in the future. [2]

F. Implementation of Principal Component Analysis on Masked and Non-masked Face Recognition

The paper analyses non-masked face recognition and masked face recognition accuracy using Principal Component Analysis (PCA) to recognize a person. It proved that, a face without mask gives better recognition rate in PCA based face recognition system. But when a person is wearing mask, facial recognition gives poor recognition rate. It is found that extracting feature from a masked face is less than non-masked face. Because of missing features for wearing mask which decrease the recognition rate. Finally, it is concluded that traditional statistical algorithm Principal Component Analysis (PCA) is better for normal face recognition but not for masked face recognition. So, in the future, concern to improve the accuracy of masked face recognition using other sophisticated machine learning methods.[7]

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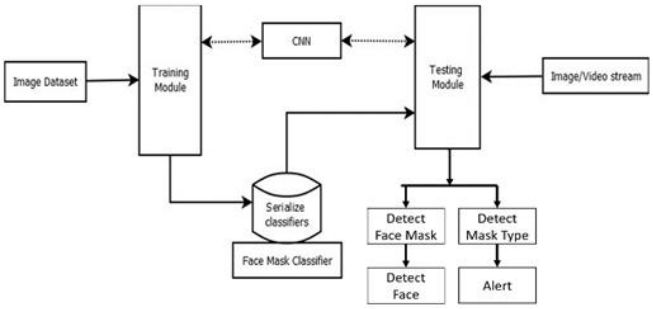
III. IMPLEMENTATION

A) System Architecture



B) Methodology

The diagram shows the major components of the system, which are:

• Image Data-set: Image data set is input to the system. This data set carries number of persons face with different angles. A single face image of person had 32 variation to categorize it different features.

• Training Module- The Data set is trained with given images to form base for the testing module. 70% of image data set is trained.

• Serializing Classifier - The classifier classifies the image for face detection and then mask detection • CNN Algorithm - The algorithm helps for face alignment and detection with combination with serialize classifier.

• Testing Module - The testing Module takes input from the live video or image stream .

• Detecting Face Mask - Mask is detected. The experimental results for face mask gives mask detection on face and mask type. it also detects face and alerts the individual if not wearing the mask.

C) Modules :

1) Image Capture

• Image is Captured through Image itself or Video Input. These Images takes in inputs, which are then processed in hidden layers of network using weights that are adjusted during training

• Then the model spits out a prediction. The weights are adjusted to find patterns in order to make better predictions

2) Face Detection

• Face Detection. Locate one or more faces in the image and mark with abounding box.

• Face Alignment. Normalize the face to be consistent with the database, such as geometry and photometrics.

• Feature Extraction. Extract features from the face that can be used for the recognition task.

• Face Recognition. Perform matching of the face against one or more known faces in a prepared database.

3) Mask Detection

• Training: Here we'll focus on loading our face mask detection dataset from disk, training a model 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

D) Algorithm CNN

Convolutions Neural Network (CNN) is comprised of one or more convolutions layers (often with a sub sampling step) and then followed by one or more fully connected layers as in a standard multi layer neural network. The architecture of a CNN is designed to take advantage of the 2D structure of an input image (or other 2D input such as a speech signal). This is achieved with local connections and tied weights followed by some form of pooling which results in translation in variant features. Another benefit of CNN's is that they are easier to train and have many fewer parameters than fully connected networks with the same number of hidden units

Step 1: Dataset containing images along with reference caption is fed into the system

Step 2: The convolutional neural network is used a encoder which extracts image features 'f' pixel by pixel.

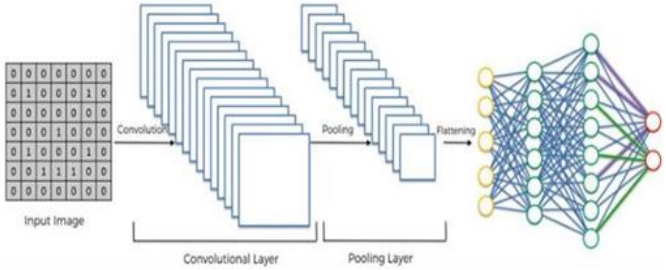
Step 3: Matrix factorization is performed on the extracted pixels. The matrix is of m x n.

Step 4: Max pooling is performed on this matrix where maximum value is selected and again fixed into matrix.

Step 5: Normalization is performed where the every negative value is con-verted to zero.

Step 6: To convert values to zero rectified linear units are used where each value is filtered and negative value is set to zero.

Step 7: The hidden layers take the input values from the visible layers and assign the weights after calculating maximum probability.

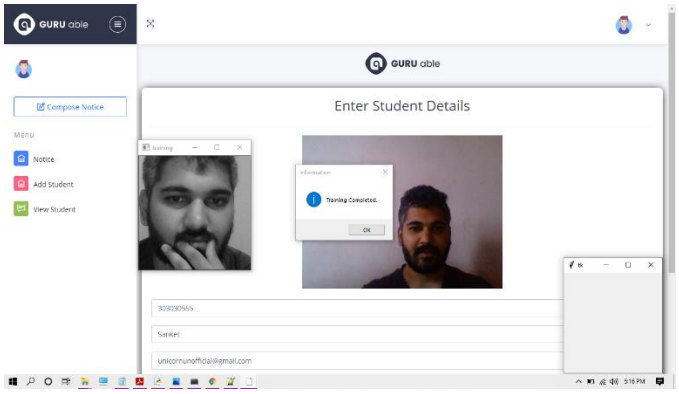


E) Tools & Technologies Used Python

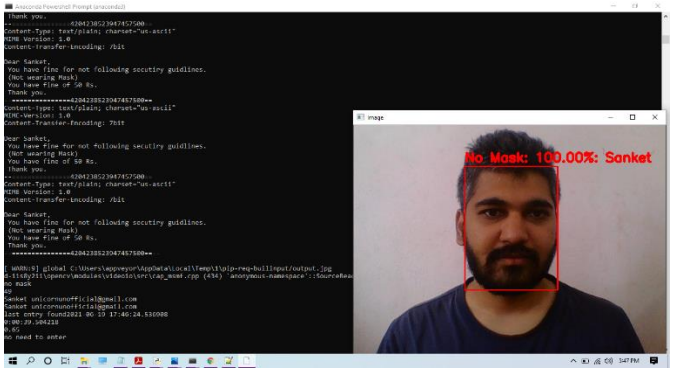
Python is an interpreted high-level programming language for general-purpose programming. Created by Guido van Rossum and first released in 1991,Python has a design philosophy that emphasizes code readability, notably using significant whites-pace. Python wrapper for it so that it can be used as Python mod-ules. This gives two advantages: First, the code is as fast as original C/C++ code - since it isthe actual C++ code working in background and Second, it is very easy to codein Python.3. Python-OpenCV binding is an appropriate tool for fast prototyping of com-puter vision problem

IV. RESULTS

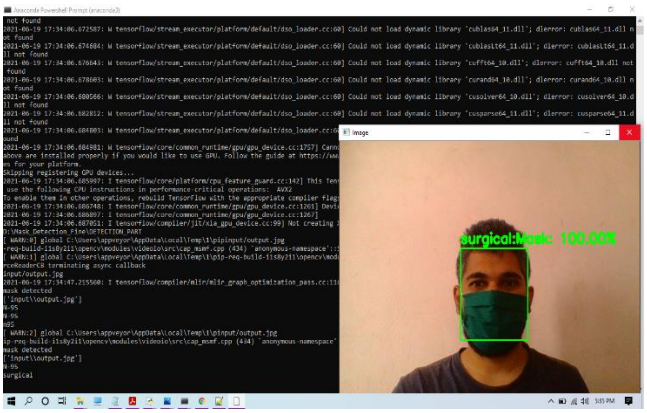
A) Training Dataset



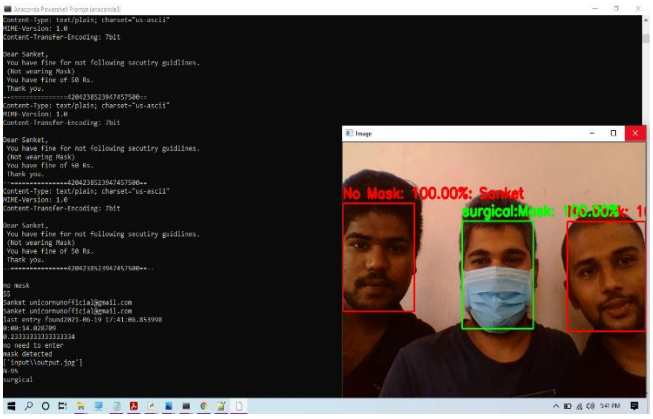
B) No Mask



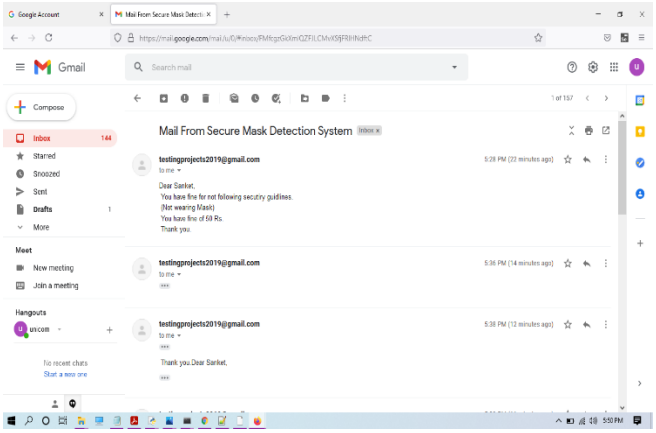
C) With Mask



D) Analysis



E) Fine Mail



V. CONCLUSION

The system is designed as most useful utility in recent times to detect the mask on face. The cascade model study for face detection and further to identify the individual who are not wearing or who are not properly wearing the mask so that proper precaution and discipline can be utilized to stop the spread of virus. The individuals not wearing mask are notified

while face detection is also implemented to know the individual. As a social cause this system can be implemented at malls as well at public places to curb spread of virus.

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