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Survey towards Mask Detection and Tracing

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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. EXISTING SYSTEM

The very earlier systems designed have taken statistical methods for facial recognition. Later system surveyed has used feature extraction as a technique for facial recognition. In papers such as [3] and [5], multiple feature extraction is used with sparse representation. The papers [1] [6] make use of CNN as a latest framework for facial recognition. We put

forth study CNN as a basic framework which will be used in proposed system.

The traditional neural network is not capable of dealing with images. Consider in case of the regular network, imagine each pixel is connected to one neuron and there will be thousands of neurons which will be computationally expensive. Convolutional Neural Network (CNN) handles images in different ways, but still, it follows the general concept of Neural Network. In constructing the CNN, it mainly consists of three parts – Convolution, Polling, Flattening. The fundamental purpose of convolution is to select characteristics from the input image. It conserves the spatial relationship between pixels by learning image characteristics using small squares of input data. The output obtained is a matrix known as the feature map. A further operation called ReLU is used after every convolution operation. The next step is of Pooling which is also known as sub-sampling or down-sampling. Pooling reduces the length of each feature map but maintains the most important information. In Max Pooling, it defines a spatial neighbourhood and takes the biggest element from the rectified feature map within that window. The other method is to take the average of all elements in that window. After pooling, next stage comes is flattening. In this step, the matrix is converted into a linear array so that to input it into the nodes of the neural network. The full connection is connecting a convolutional network to a neural network and then compiling network. The usage of CNN helps in minimizing the number of parameters needed for images. It also helps to do the parameter sharing as it can possess translation invariance.

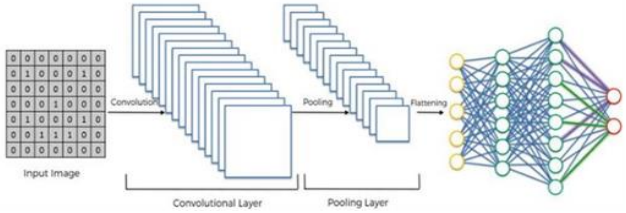

Fig 2: CNN (Source: Medium)

COVID-19 situation has given rise to determination of face wearing mask. The Papers [2][7][8] let us study the partial or masked face recognition with use of CNN.

IV. CONCLUSION

The survey shows that these systems are most useful utility in recent times to detect the mask on face. The model studies for face detection and further to identify the individual who are not wearing can be utilized to stop the spread of virus. As a social cause this system can be implemented at malls as well at public places to curb spread of virus. For future work, the same system can be utilized for identity of face with face mask in which more features can be considered from facial region.

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