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Face Mask Detection using Viola Jones Algorithm the Real Time Screening System

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ABSTRACT
CORONA VIRUS pandemic caused by novel coronavirus is continuously spreading until now all over the world. The impact of COVID-19 has been fallen on almost all sectors of development. The healthcare system is going through a crisis. Many precautionary measures have been taken to reduce the spread of this disease where wearing a mask is one of them. In this paper, we propose a system that restrict the growth of COVID-19 by finding out people who are not wearing any facial mask in international airports where all the public places are monitored with Closed-Circuit Television (CCTV) cameras. While a person without a mask is detected, the corresponding authority is informed through the city network. A viola johns architecture is trained on a dataset that consists of images of people with and without masks collected from various sources.. It is hoped that our study would be a useful tool to reduce the spread of this communicable disease for many countries in the world.
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I. INTRODUCTION

A face mask detection is a technique to find out whether someone is wearing a mask or not. It is similar to detect an object from a scene. Many systems have been introduced for object detection. Aims at designing a system to find out whether a person is using a mask or not and informing the corresponding authority in a Airports. Firstly, CCTV cameras are used to capture real-time video footage of different public places in the international transports. From that video footage, facial images are extracted and these images are used to identify the mask on the face.

We believe that a more reasonable way is to enable the CNN to discriminate the occluded parts from the nonoccluded parts adaptively. However, it is difficult for the conventional deep CNN to have this ability. For a convolutional layer, the convolution operation is local and the kernel is shared at every spatial location. While for the fully connected layer, the effective receptive field of its input may become very large when the CNN goes deeper. However, for face

Our main contributions are summarized as follows: (i) we propose the Voila Johns module for learning feature masks to improve the performance of face recognition with occlusion; (ii) we show that Viola Johns can be included in different CNNs and optimized with end-to-end training; (iii) we demonstrates the effectiveness of Viola Johns with real-life as well as synthetic occluded face image

II. RELATED WORK

BlueDot method was first used to mark the cluster of unusual pneumonia in Wuhan which finally detected the disease as a pandemic. It also predicted that the virus would spread from Wuhan to Bangkok, Taipei, Singapore, Tokyo and Hong Kong. HealthMap service, based on San Francisco, spotted the patients with a cough which is the initial sign of COVID-19, using Artificial Intelligence (AI) and big data. A study on using facemask to restrict the growth of COVID-19 is introduced in [1]. The study indicated that the masks that are adequately fit, effectively interrupt the spread of droplets expelled when coughing or sneezing. Masks that are not perfectly fitted, also capable of retaining airborne particles and viruses. Allam and Jones [2]proposed a framework on smart city networks focusing on how data sharing should be performed during the outbreak of COVID-19. The proposed system discussed the prospects of Urban Health Data regarding the safety issues of the economy and national security. In the system, the data is collected from various points of the city using sensors, trackers, and from laboratories. A face mask detecting model named Viola johns combining with a cross-class object removal algorithm is proposed by Jiang et al. [3]The developed model includes one stage detector consisting feature pyramid network that results in slightly higher precision and recall than the baseline result. For reducing the shortage of datasets, they have applied transfer learning, a well-known deep learning technique. Gupta et al. [4]proposed a model to enforce the social distance using smart city and Intelligent Transportation System (ITS) during COVID-19 pandemic. Their model described the deploying sensors in different places of the city to monitor the real-time movement of objects and offered a data-sharing platform. A noticeable contribution of a smart city in controlling the spread of coronavirus in South Korea is explained by Won Sonn and Lee [5]. A time-space cartographer speeded up the contact tracking in the city including patient movement, purchase history, cell phone usages, and cell phone location. Real-time monitoring has been carried out on CCTV cameras in the hallways of residential buildings. Singh et al. [6] put their focus on how IoT can fight against COVID-19. The developed system emphasizes on inter-connected devices or operations to track the patients along with wary cases. A well-informed group using interconnected devices is formed to identify the clusters significantly. A remarkable pandemic control model without lockdown in a smart city has been outlined by Sonn et al. The patients have been interviewed and their past movement has been monitored. They have claimed that some patients tried to conceal about their past mobility but real-time tracking system found the exact information. Jaiswal et al. [7]proposed a way to minimize the risk during COVID-19.

III. METHODOLOGY

We proposed an automated smart framework for screening persons who are not using a face mask in this paper. In the smart city, all public places are monitored by CCTV cameras. The cameras are used to capture images from public places; then these images are feed into a system that identifies if any person without face mask appears in the image[8]. If any person without a face mask is detected then this information is sent to the proper authority to take necessary actions. The block diagram of the developed framework is depicted All the blocks of the developed system are described as follows. A. Image Preprocessing The images captured by the CCTV cameras required preprocessing before going to the next step. In the preprocessing step, the image is transformed into a grayscale image because the RGB color image contains so much redundant information that is not necessary for face mask detection. [9]RGB color image stored 24 bit for each pixel of the image. On the other hand, the grayscale image stored 8 bit for each pixel and it contained sufficient information for classification. Then, we reshaped the images into (64×64) shape to maintain uniformity of the input images to the architecture. Then, the images are normalized and after normalization, the value of a pixel resides in the range from 0 to 1. Normalization helped the learning algorithm to learn faster and captured necessary features from the images.

B. Deep Learning Architecture The deep learning architecture learns various important nonlinear features from the given samples. Then, this learned architecture is used to predict previously unseen samples[10]. To train our deep learning architecture, we collected images from different sources. The architecture of the learning technique highly depends on CNN. All the aspects of deep learning architecture are described below.

i) Dataset Collection: Data from two different sources are collected for training and testing the model. We collected a total of 858 images of people with masks and 681 images of people without a mask. For training purposes, 80% images of each class are used and the rest of the images are utilized for testing purposes. shows some of the images of two different classes.

ii) Architecture Development: The learning model is based on CNN which is very useful for pattern recognition from images. The network comprises an input layer, several hidden layers and an output layer. The hidden layers consist of multiple convolution layers that learn suitable filters for important feature extraction from the given samples. The features extracted by CNN are used by multiple dense neural networks for classification purposes. They would come to the locality where the person without a face mask was detected and took necessary actions. If proper actions are taken, then people might not come in public places without a facial mask

IV. CONCLUSION

This paper presents a system for a smart city to reduce the spread of coronavirus by informing the authority about the person who is not wearing a facial mask that is a precautionary measure of COVID-19. The motive of the work comes from

V. RESULT ANALYSIS

The testing loss is lower than training loss for about 30 epochs but after that, it started increasing w means the confidence of prediction started decreasing. The testing loss fluctuates between an acceptable range and it falls about at 98th epoch. This means the model has a decent generalization ability for previously unseen data and it does not cause overfitting of the training data.

The decision of the classification network is transferred to the corresponding authority. The system proposed in this study will act as a valuable tool to strictly impose the use of a facial mask in public places for all people.

VI. LIMITATIONS AND FUTURE WORKS

The proposed system faces difficulties in classifying faces covered by their hands since it almost looks like the person wearing a mask. While any person without a face mask is traveling on any vehicle, the system cannot locate that person correctly.

Since we can overcome this by allowing a single person through entry point. For a very densely populated area, distinguishing the face of each person is very difficult. For this type of scenario, identifying people without face mask would be very difficult for our proposed system. In order to get the best result out of this system, the city must have a large number of CCTV cameras to monitor the whole city as well as dedicated manpower to enforce proper laws on the violators. Since the information about the violator is sent via SMS, the system fails when there is a problem in the network. The proposed system mainly detects the face mask and informs the corresponding authority with the location of a person not wearing a mask. Based on this, the authority has to send their personnel to find out the person and take necessary actions. But this manual scenario can be automated by using drones and robot technology to take action instantly. Furthermore, people near to the person not wearing a mask may be alerted by an alarm signal on that location, and displaying the violators face in a LED screen to maintain a safe distance from the person would be a further study.

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