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Real Time Face Mask Detection and Crowd Monitoring

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ABSTRACT: Covid 19 is a virus-borne infectious disease that was first discovered in Wuhan, China, in December 2019. Infected persons exhale small airborne particles containing the virus, which is how Covid 19 is spread. Wearing a face mask is one of the most efficient ways to combat this infection. However, most people do not wear face masks in public areas, allowing infections to spread more easily. In this project, we offer a method for detecting face masks that uses Tensor flow, open CV, and the Caffe model. The test is carried out using a real-time programme. According to the findings of the experiments, the device can accurately recognise people who wear or do not wear the facemask, even if they move to different positions.

KEYWORDS: CNN, Euclidan distance, RestNet50

I. INTRODUCTION

COVID-19 has affected day to day life and is slowing down the global economy. This pandemic has affected thousands of peoples, who are either sick or are being killed due to the spread of this disease. The most common symptoms of this viral infection are fever, cold, cough, bone pain and breathing problems, and ultimately leading to pneumonia. As a result, the focus is on taking extreme precautions such as following a strict hygiene routine (e.g., regularly washing hands, avoiding face-to-face encounter, etc.), social separation, and wearing masks, among other things. This virus is rapidly spreading around the globe. COVID-19 has had a rapid impact on our daily lives, enterprises, and global trade and travel. Because the virus spreads quickly from person to person, early detection of the sickness is critical for controlling its spread. The majority of countries have slowed their goods manufacturing. The pharmaceuticals business, solar power industry, tourism, information and technology industry, and other industries and sectors are all affected by the disease's cause. This infection has far-reaching consequences for citizens' everyday lives as well as the global economy. It has also played a big part in our daily lives, people are getting stressed in fear of coming in contact with the virus like they always have to be very careful when interacting with others. we are now forced to wear masks and maintain social distancing to slow down the spread of the virus.

II. RELATED WORK

Md. Shahriar Islam et al [1] discussed a method to detect face masks on people. Face detection and mask detection are the operations that are done here. Feature extraction and a Convolutional Neural Network model is used here as they are helpful for image classification and detection of objects. Pre-processing of the image, cropping of the image and classification of objects in the image are the steps that are being carried out here. The system will give a security alert if a person is not wearing a face mask. A surveillance camera is used to monitor whether people are wearing a mask here. Arjya Das et al [2] proposed a method to detect face masks. It detects masked people from images. Sequential Convolutional Neural Network model has been employed here. They have got an accuracy of 95.77% and 94.58% on two datasets. It can classify people who are covering their face's with their hands instead of a mask. Data pre-processing and training of the model are the steps used here for face mask detection.

Suresh K et al [3] proposed a method to detect masks using a Optimistic Convolutional Neural Network. The objects are detected from real time input image/video from the public. The people who are not wearing masks are alerted that they are not following covid protocols. The dataset is from Kaggle, it has 3918 images and they are cropped. The dataset includes masked and non masked images of people. People detection and mask detection are possible by OpenCV and MobileNet.

Samuel Ady Sanjaya et al [4] suggested a method for the detection of masked faces using MobileNet V2. The model has an accuracy of 96.85%. Two datasets are used here for training and testing, one is from Kaggle and other one is Real-World Masked Face Dataset. Data collecting, Pre-processing, splitting the data, building the model, implementation are the different steps carried out here.

Harish Adusumalli et al [5] proposed a method for face mask detection using OpenCV. A video stream is given as input to the model. The proposed model uses TensorFlow and OpenCV to detect face masks on individuals. If the detected person is found in the database the name is displayed as well, while detection and an alert is sent to their email if the individual is not wearing a mask. The model is trained with 75% of the dataset and 25% of it is used for testing. Dataset collection, training the model to detect face masks and people and sending the email are the different operations here. Dr R Senthilkumar et al [6] proposed a method to detect face masks using AI and IOT. They have used image processing and AI methods to identify whether people are wearing masks or not. They have used YOLOV3 is used here for training and testing the model and IOT is used to send alert messages. The count of people with and without masks are also counted here.

Susanto et al [7] proposed a method to detect face masks to avoid the spread of the covid virus. The proposed model uses YOLO V4 algorithm to detect masks on individuals. The model identifies different types of face masks and can detect multiple people. It can also work very well at different brightness levels.

Yogesh Gowari et al [8] proposed a method to detect face masks with a real time video input. Convolutional Neural Network and MobileNet SSD have been used for image classification. People counting, mask detection, alarm alert and scan id are the main features of the system. Mukul Shende et al [9] proposed a face mask and crowd detection technique that uses Pytorch and Multi task cascade convolutional neural network. The model is built with a pre-trained model using computer vision libraries in python. The data set used here is Real-world Masked Face Recognition Data set.

Gagandeep Kaur et al [10] proposed a model to recognize face masks using CNN. The dataset used here is from Kaggle.com and contains 3832 images. They have used python script, tensor flow and CNN. The system can be used to recognize face masks at any angle and with great accuracy.

III. CROWD MONITORING AND FACE MASK DETECTION

This section details how the proposed system will function automatically to detect face masks and also check social distancing of people to minimize the impact of covid and keep society safe. This part also details the architecture of the proposed model.

The proposed system uses a deep learning algorithm and computer vision with a transfer learning approach to optimize the performance. This is to be used in a camera in real life scenario to detect people who are wearing masks and also people not wearing masks. Fine tuning is also used which is also a form of transfer learning. It is much more than just feature extraction. Here the camera video feeds from the Network Video Recorder are converted to gray scale to improve its efficiency and speed and is sent for further processing to the model. The ResNet50 architecture is used as the core model for detection as it has a big cost advantage in comparison with normal 2D CNN model. YOLOV3 is also used here for detection that which has been trained on a large dataset of images for high accuracy classification of objects.

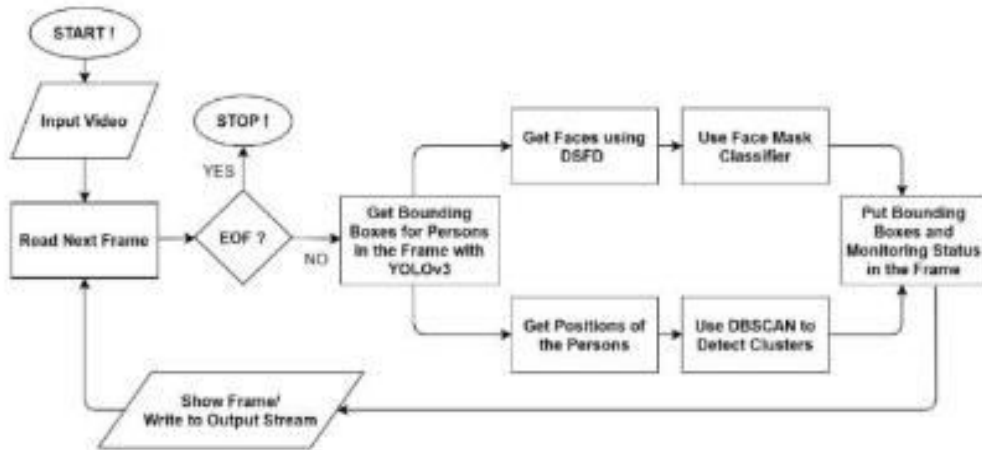


Fig 1: Working of model

The RestNet50 has been loaded with pre-trained ImageNet weights, a new FC head has been constructed leaving the network head off and the new FC head has been attached to the base of the old head. The base layers of the network has been froze as well. Only the weights of the head layer will be changed during fine tuning part of the back propagation, the weights of the base layer will remain unchanged. After the data has been prepared and the architecture has been made ready for fine tuning the model is compiled and trained. During the retraining of the architecture a small learning rate has been used to ensure that the convolutional filters do not deviate very much from what has been already learned and the experiments have been done with OpenCV, Keras using deep learning and computer vision to carry out face mask and social distancing classifications in real time video streams. The main parts of the proposed system are person detection, face mask detection and safe distance measurement between people. YOLOV3 with RestNet50 and Open CV has been used for real time person detection which achieves 91.2% mAP, outperforming the likes of faster R-CNN model. A bounding box will be displayed for every person that has been detected using the model. The triangle similarity technique is used to find the distance of the person from the camera which is in turn used to find the distance between two people. The perceived focal length of the camera can be calculated from person distance D from the camera and height of the person H. The pixel height P of the person is obtained from bounding box coordinates. The formula is represented as $F=(P*D)/H$

The distance from the camera can be found using the expression $D1=(H*F)/P$

After calculating the depth of the person we can calculate the distance between the people this is achieved by calculating the euclidian distance between the people. The Euclidian distance is measured from the center of the bounding box of each person that is detected. After this we get the x and y values and these pixel values are converted to centimeters. The x, y and z coordinates for each person is obtained in centimeters. If the euclidian distance between two people is less than 1.5 meters a red bounding box is shown on the display meaning a severe violation has occurred and if the distance is between 2 meters and 1.5 meters then a yellow bounding box is shown signaling an abnormal violation and if the distance is greater than 2 meters there is no violation and it shows a green bounding box over the person. In the proposed system a light weight model that is accurate and efficient has been implemented making it easier to deploy to a machine. Annotated images are used train the model to help classify the image as mask or no mask categories using output class confidence.

The proposed system uses a camera to automatically keep track of public areas to help minimise the spread of covid. The model that has been developed and trained using a dataset has been installed in the machine and a camera is connected on it. The camera gives real time video to the system and the system detects whether people are keeping social distancing rules as well as detects whether people are wearing masks or not.

Image inpainting is a method for repairing damaged pictures or removing unnecessary elements from pictures. It recovers the missing or corrupted parts of an image so that the reconstructed image looks natural. In real world, many people need a system to recover damaged photographs, designs, drawings, artworks etc. damage may be due to various reasons like scratches, overlaid text or graphics etc.

This system could enhance and return a good looking photograph using a technique called image inpainting. Image inpainting modify and fill the missing area in an image in an undetectable way, by an observer not familiar with the original image. The technique can be used to reconstruct image damage due to dirt, scratches, overlaid text etc.

Some images contain mixed text-picture-graphic regions in which text characters are printed in an image. Detecting and recognizing these characters can be very important, and removing these is important in the context of removing indirect advertisements, and for aesthetic reasons. There are many applications of image inpainting ranging from restoration of photographs, films, removal of occlusions such as text, subtitle, logos, stamps, scratches, red eye removal etc.

Paper is organized as follows. Section II describes automatic text detection using morphological operations, connected component analysis and set of selection or rejection criteria. The flow diagram represents the step of the algorithm. After detection of text, how text region is filled using an Inpainting technique that is given in Section III. Section IV presents experimental results showing results of images tested. Finally, Section V presents conclusion.

IV. CONCLUSION

The face mask detection and crowd monitoring model that is developed in which both parts provide very high accuracy for detection and classification with the face mask detector classifies the input into masked or unmasked where masked is subdivided into further three categories. In the case of crowd monitoring we can obtain better results by implementing it with an overhead camera which helps in better distance classification.

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