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Social Distance Monitoring System for Covid-19 based on Deep Learning

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***Abstract*— Social distancing is a mandatory safety measure taken in order to have more control over the breakout of spreading diseases such as COVID-19. The coronavirus disease 2019 has brought global crisis with its deadly spread. Many scientists, healthcare organisations are working for proper medicines to cure this virus. For now, social distancing is the feasible approach to fight against this pandemic. The risks of virus spread can be reduced by avoiding physical contact among humans. It will focus on reducing the physical contact between possibly infected individuals and healthy persons, it can perform a very important role in overcoming the virus spread. The proposed system will be an efficient deep learning-based system to ease the process of monitoring the social distancing via human detection and distance finding approaches, where each individual is identified in video with the help of bounding boxes. For human detection, the CNN will be used to detect people and geometric difference is used to find the distance between two persons. In the proposed system if social distancing norms are not followed then indication will be given by changing the colour of the bounding box.**

***Keywords*— Deep Learning, Covid 19, Social-distancing, public-safety, YOLO v3, Geometric difference.**

I. INTRODUCTION

COVID-19 is a disease caused by a new coronavirus which appeared in China in December 2019. The uncertainty and complexity of the coronavirus have made it difficult to predict the duration and spread of this pandemic. Prevention involves wearing masks and washing hands frequently. The basic objective is to reduce the physical contact between the infected and the healthy people. As prescribed by WHO, people should maintain at least 1 meter (m) distance from each other to control the spread of this disease. This project aims to reduce the effects of coronavirus disease along with minimum loss of resources; this disease has badly impacted the global economy. Secondly, to provide a highly accurate solution for the detection of people to help out in monitoring social distancing. The purpose of this work is to provide a deep learning platform for social distance tracking. By decreasing the risk of virus transmission from an infected person to a healthy one, the virus' spread and disease severity can be significantly reduced. If social distancing is implemented at the initial stages, it can perform a crucial role in overcoming the virus spread and preventing the pandemic disease's peak.

II. LITERATURE SURVEY

[1] An effective real time deep learning -based system for automating the process of social distancing monitoring using object detection and tracking techniques, where each person was identified in real time using boundary boxes. The bounding boxes that were generated assist in locating clusters or groups of persons who satisfy the pairwise closeness property by using mahala Nobis distance they find the distance between two people. The experiments included popular state of object identification model such as Faster RCNN, SSD and YOLO v3, with YOLO v3 demonstrating efficient performance with balanced FPS and map score.

[2] Deep learning based human detection technique to monitor social distancing using CNN. Video stream/frame sequence received from CCTV cameras were fed to the object detection and tracking model i.e., CNN. This paper introduced two CNN based sequential models to detect the presence of an individual within an image. The CNN architecture was adapted for object detection. The CNN was used with the social distancing algorithm to measure the distance criteria among people. The distance between two objects was detected by using Euclidean distance. If distance is less, a red frame was placed next to a noncompliant pair of people and if distance was large green frame was placed.

[3] Analysis of public monitoring activities and that was done using existing CCTVs with artificial intelligence to optimize surveillance. In the process of detection, python packages such as OpenCV and Pandas were used. YOLO (You Only Look Once) was used to detect violations of Large-scale social restriction. By using Pseudocode algorithm, the system first detected objects while also giving an ID to every detected object. Then track their movement using the centroid tracking algorithm. Using tracking, they find out whether the object was tracked past the yellow line and using Euclidean distance the distance

between two people measured. If distance was less the red bounding box was shown and distance was maintained the green bounding box placed.

[4] The Mobile Net Single Shot Multibox Detector for object tracking and OpenCV library for image processing was used to detect people. The distance between the humans detected in video footage will be calculated and compared to a set of predetermined pixel values. The distance between the central points and the overlapping boundary between persons was measured. When harmful distances between persons were detected, notification was sent out to maintain the distance safe. Two planned functionalities were implemented using Python and the OpenCV package. The first component detected social distancing and other detected violation of entering restricted locations.

[5] The effects of coronavirus disease along with minimum loss of resources. It tuned up the object detection model for human detection under low light conditions a recently released EXDARK dataset was considered. This dataset contains different indoor and outdoor low light images, furthermore, the data was subdivided for low light environments into 10 classes. A deep learning -based solution was proposed that used an object detection model for automating the task of social distance monitoring at fixed camera distance under various low light environments. To monitor social distance at motionless TOF camera was utilized along with the YOLO v4 algorithm to maintain speed-accuracy trade-off.

III. BLOCK DIAGRAM

1. **Video Capture Module for Social Distancing**: Firstly, the video capture module gets a video on the application to monitor social distancing. The application then extracts frames from the video. Frames are usually 640x480 formats.
2. **Detection Engine Human Detection**: The human detection is done by the 2D CNN itself. In 2 D CNN there are 2 Phases namely, Training Phase and Recognition Phase. Humans are detected using this 2D CNN recognition phase respectively. 2D CNN is important as CNN we are analysing the videos
3. **Distance Finder**: We can simply apply a geometric difference approach on the trained dataset to find approximate distance between the humans.
4. **Indicator:** In the captured video, if social distancing norms are not followed then such cases will be indicated by changing the colour of the bounding box to red.

This deep learning based social distance system is developed to detect the distance between people to avoid spread of covid-19 at public places. The CNN module and open-source object detection network based on the yolo v3 algorithm was used in this system. This yolo v3 algorithm was used to detect the people walking on the roads and on the social places to detect in the video frames. Bounding boxes will be created around the detected people. Bounding box is the best option to detect the distance between the two people. To check the distance between two bounding boxes we are using the Euclidean distance formula. If the distance between two bounding boxes is less than six feet then the colour of the bounding box will be red, and if the distance between the two boxes is more than six feet then it means people following social distance so the colour of the bounding box is green.

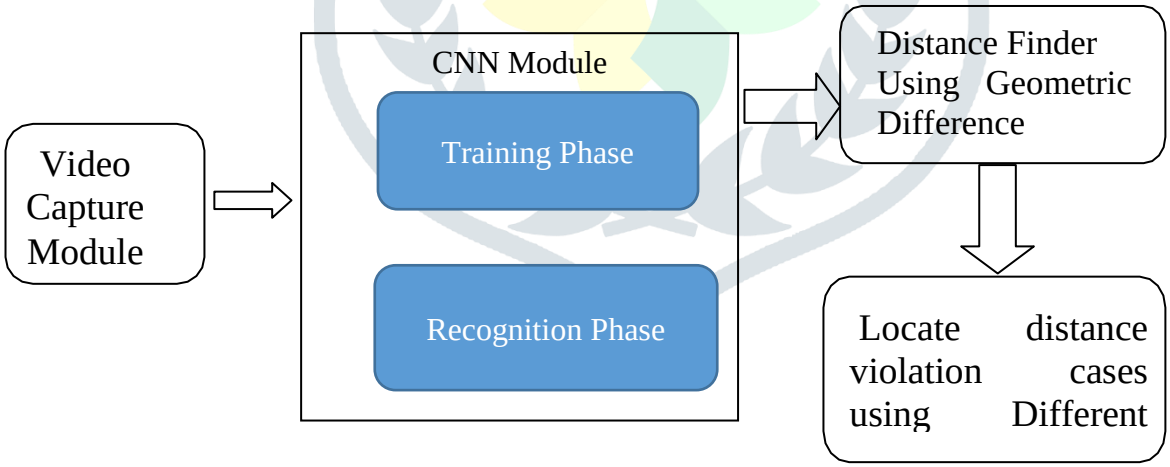

Fig. 1 Proposed system approach

IV. RESULTS

The result of the social distance framework is seen as shown in the given fig. The system is deep learning based that uses open cv, TensorFlow and NumPy to train models and the framework also uses YOLOv3 object detection algorithm. After human detection, the centroid distance formula is used to compute bounding box distance. With Euclidean distance and the calculated the distance between each detected bounding box of peoples. People in the above images are moving freely so the distance between them is varied constantly. When the people are in range of threshold distance then a green bounding box appears, it means social distance is followed and if it is not followed then a red bounding box appears. Hence Social distance is maintained.

Fig. 2 Social distancing 1

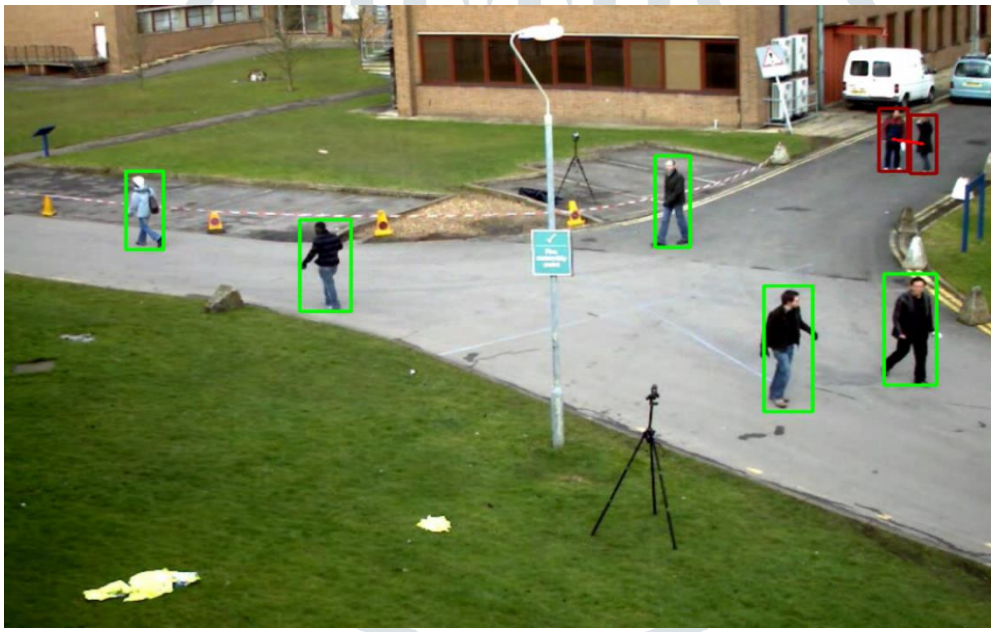

Fig. 3 Social distancing 2

V. CONCLUSIONS

In deep learning based social distance monitoring systems, pretrained YOLO v3 is used for human detection and for the distance measurement between two peoples geometric distance formulas. YOLO v3 based social distance monitoring solution is evaluated from coco detection. If the social distance is not maintained then the detection algorithm gives the red colour bounding box and if the social distance is maintained then green colour bounding box is given. This model is very beneficial as compared to physical monitoring which decreases human efforts and provides large coverage of areas for detection purposes. Thus, to maintain social distancing the proposed model is used.

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