As per UGC guidelines an electronic bar code is provided to seure your paper

International Journal for Modern Trends in Science and Technology, 8(06): 472-476, 2022

ISSN: 2455-3778 online
DOI: https://doi.org/10.46501/IJMTST0806081
Available online at: http://www.ijmtst.com/vol8issue06.html

Social Distancing Detection with Deep Learning Model

Dr.Sarangam Kodati[1*], Mohammed Shariq Saaduddin Ahmed[2], Vade Sushmitha Reddy[2], Jujjuri Shanmukh Goud[2]

Professor, Department of CSE, Teegala Krishna Reddy Engineering College, Hyderabad, Telangana, India.
Department of CSE, Teegala Krishna Reddy Engineering College, Hyderabad, Telangana, India.
*Corresponding Author : k.sarangam@gmail.com

To Cite this Article
Dr.Sarangam Kodati, Mohammed Shariq Saaduddin Ahmed, Vade Sushmitha Reddy and Jujjuri Shanmukh Goud. Social Distancing Detection with Deep Learning Model. International Journal for Modern Trends in Science and Technology 2022, 8(06), pp. 472-476. https://doi.org/10.46501/IJMTST0806081

Article Info
Received: 20 May 2022; Accepted: 20 June 2022; Published: 22 June 2022.

ABSTRACT

COVID-19 originated from Wuhan, China, has affected many countries worldwide since December 2019. On March 11, 2020, the World Health Organization (WHO) announced it a pandemic diseases as the virus spread through 114 countries, caused 4000 deaths and 118,000 active cases On October 7, 2020, they reported more than 35,537,491 confirmed COVID-19 cases, including 1,042,798 deaths. The latest number of infected people due to pandemic is shown in. Many healthcare organizations, scientists, and medical professionals are searching for proper vaccines and medicines to overcome this deadly virus, although no progress is reported to-date. To stop the virus spread, the global community is looking for alternate ways. The virus mainly spreads in those people; who are in close contact with each other (within 6 feet) for a long period. The virus spreads when an infected person sneezes, coughs, or talks, the droplets from their nose or mouth disperse through the air and affect nearby peoples. The droplets also transfer into the lungs through the respiratory system, where it starts killing lung cells. Recent studies show that individuals with no symptoms but are infected with the virus also play a part in the virus spread .Therefore, it is necessary to maintain at least 6 feet distance from others, even if people do not have any symptoms.

KEYWORD: Deep Learning, COVID-19, YOLOv3.

1. INTRODUCTION

Social distancing is not a new concept. Social distancing is a method used to control the spread of contagious diseases. As the name suggests, social distancing implies that people should physically distance themselves from one another, reducing close contact, and thereby reducing the spread of a contagious disease (such as corona virus). COVID-19 belongs to the family of corona virus caused diseases, initially reported at Wuhan, China, during late December 2019. Several health care organizations, medical experts and scientists are trying to develop proper medicines and vaccines for this deadly virus, but till date, no success is reported [1]. The rampant Corona virus disease has brought a global crisis with it's deadly spread to more than 180 countries. It is found that the lack of immunity against Covid-19 increases the vulnerability to the population. This is the reason that social distancing is being encouraged even after the development of vaccines, because it is the only feasible approach to stay completely safe. This situation forces the global community to look for alternate ways to stop the spread of this infectious virus. Social distancing is claimed as the best spread stopper in the present scenario, and all affected countries are locked-down to implement social distancing. This research is aimed to support and mitigate the corona virus pandemic along with minimum loss of economic endeavors, and propose a solution to detect the social distancing among people gathered at any public place. Social distancing aims at reducing the physical contact between possibly infected individuals and healthy persons [2], [3]. As per the WHO norms it is prescribed that people should maintain at least 6 feet of distance among each other in order to follow social distancing. Proper social distancing is the best way to reduce infectious physical contact, hence reduces the infection rate. This reduced peak may surely match with the available health care infrastructure and help to offer better facilities to the patients battling against the corona virus pandemic. To study epidemiological phenomena, mathematical models are always the most preferred choice. Emerging technologies like Convolutional Neural Networks, Deep learning, and AI can enable us to enforce social distancing. YOLOv3 and Deepsort are being proposed to detect and track pedestrians followed by calculating a violation index for non-social distancing behavior. Furthermore, if the violation index crosses a set parameter, the system is to show a notification on the screen to the authorized personnel, following which they can use protocols to alert the people in such public places. No audio alarms are to be used, keeping in mind the panic situations that could be caused by such warning alarms[4]. The paper deals with the problem statement, objectives and implementation of such a system in detail. It was difficult for the machine to determine who is maintaining social distancing and the real-world applications were limited. People are not detected from all angles by the current technology. A physical person should be there to observe whether or not the individuals are practicing social distancing. Sometimes human errors also occurs so results are not accurate.

2. IMPLEMENTATION OF SOCIAL DISTANCING DETECTION WITH DEEP LEARNING MODEL:

Real-Time alert: If selected, we send an email alert in real-time. Threading: Threading removes OpenCV's internal buffer (which basically stores the new frames yet to be processed until your system processes the old frames) and thus reduces the lag/increases fps. People counter: If enabled, we simply count the total number of people: set People Counter = True in the config. Desired violations limits: You can also set your desired minimum and maximum violations limits.

This social distancing detection tool was developed to detect the safety distance between people in public spaces. The deep CNN method and computer vision techniques are employed in this work. Initially, an open-source object detection network based on the YOLOv3 algorithm was used to detect the pedestrian in the video frame. From the detection result, only pedestrian class was used and other object classes are ignored in this application. Hence, the bounding box best fits for each detected pedestrian can be drawn in the image, and these data of detected pedestrians will be used for the distance measurement. For camera setup, the camera is captured at fixed angle as the video frame, and the video frame was treated as perspective view are transformed into a two-dimensional top-down view for more accurate estimation of distance measurement. In this methodology, it is assumed that the pedestrians in the video frame are walking on the same flat plane. Four filmed plane points are selected from frame and then transformed into the top-down view[5]. The location for each pedestrian can be estimated based on the top-down view. The distance between pedestrians can be measured and scaled. Depending on the preset minimum distance, any distance less than the acceptable distance between any two individuals will be indicated with red lines that serve as precautionary warnings. The work was implemented using the Python programming language. The pipeline of the methodology for the social distancing detection tool.

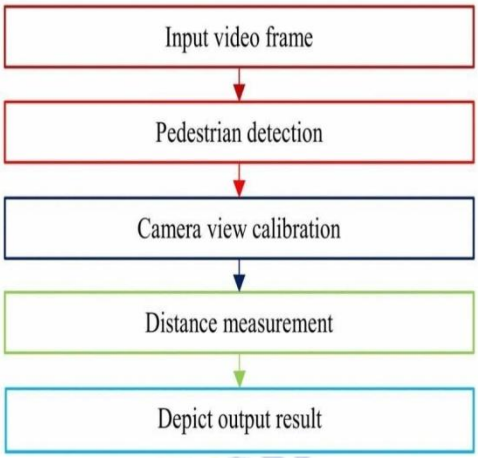

Fig1:Pipeline for social distancing detection.

3. PEDESTRIAN DETECTION

Deep CNN model was the object detection approach was proposed that mitigated the computational complexity issues by formulating the detection with a single regression problem. When it comes to deep learning-based object detection, the YOLO model is considered one of the state-of-the art object detectors which can be demonstrated to provide significant speed advantages will suitable for real-time application. In this work, the YOLO model was adopted for pedestrian detection is shown in Figure 3. The YOLO algorithm was considered as an object detection taking a given input image and simultaneously learning bounding box coordinates (tx, ty, tw, th), object confidence and corresponding class label probabilities (P1, P2, …, Pc). The YOLO trained on the COCO dataset which consists of 80 labels including human or pedestrian class. In this work, the only box coordinates, object confidence and pedestrian object class from detection result in the YOLO model were used for pedestrian detection.

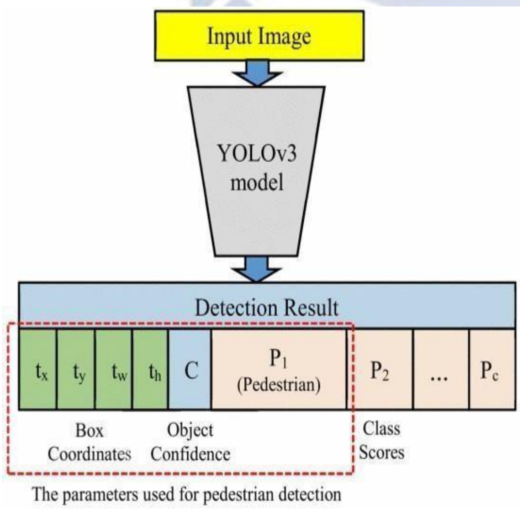

Fig 2:YOLO model applied for pedestrian detection.

3.1 Camera View Calibration

The region of interest (ROI) of an image focuses on the pedestrian walking street was transformed into a top-down 2D view that contains 480×480 pixels as shown in Figure 4. Camera view calibration is applied which works by computing the transformation of the perspective view into a top-down view. In OpenCV, the perspective transformation is a simple camera calibration method which involves selecting four points in the perspective view and mapping them to the corners of a rectangle in the 2D image view. Hence, every person is assumed to be standing on the same level flat plane. The actual distance between pedestrians corresponds to the number of pixels in the top-down view can be estimated [7].

3.2 Distance Measurement:

In this step of the pipeline, the location of the bounding box for each person (x, y, w, h) in the perspective view is detected and transformed into a top-down view. For each pedestrian, the position in the top-down view is estimated based on the bottom-center point of the bounding box[6]. The distance between every pedestrian pair can be computed from the top-down view and the distances is scaled by the scaling factor estimated from camera view calibration. Given the position of two pedestrians in an image as (x1, y1) and (x2,y2) respectively, the distance between the two pedestrians, d., can be computed as:

$$d= \sqrt{(x2-x1)2+(y2-y1)2} \qquad (1)$$

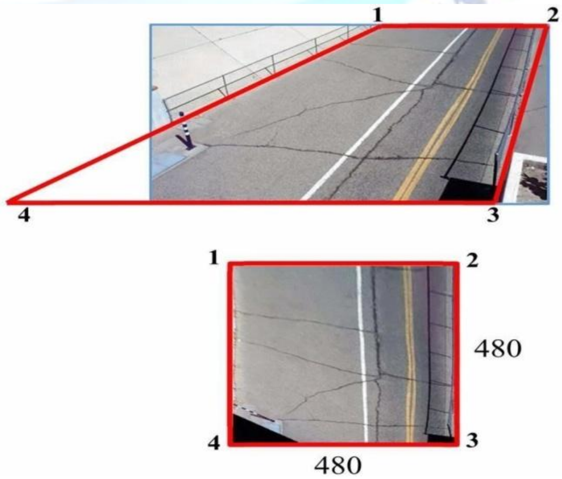

Fig 3: Sample of original perspective view (top) and top down view after calibration (bottom).

The pair of pedestrians whose distance is below the minimum acceptable distance, t., is marked in red, and the rest is marked in green. A red line is also drawn between the pair of individuals whose distance is below the pre-defined threshold. The bounding box's color threshold operation, c, can be defined as: c={redgreend<td≥t(2)

4. RESULT AND DISCUSSION

Below are some of the snapshots of the output of the working program model. It is categorized into two stages, stage one is where the pedestrians are detected from the inputted video and the total count is displayed in the right bottom corner, In stage two we have added the warning notification which can be seen in the right bottom corner of the screen.

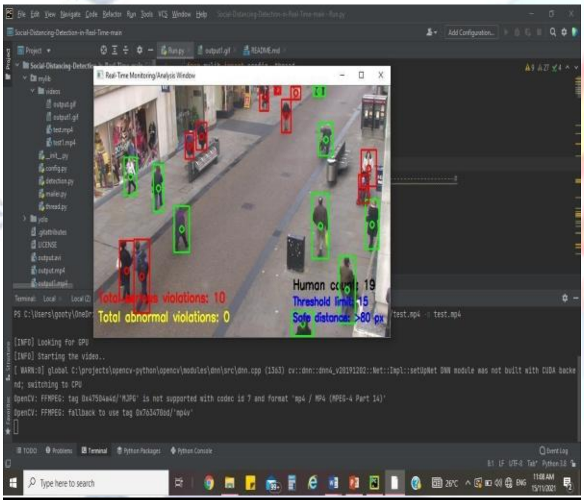

Fig 4: Showing a Persons Without Abnormal Violations

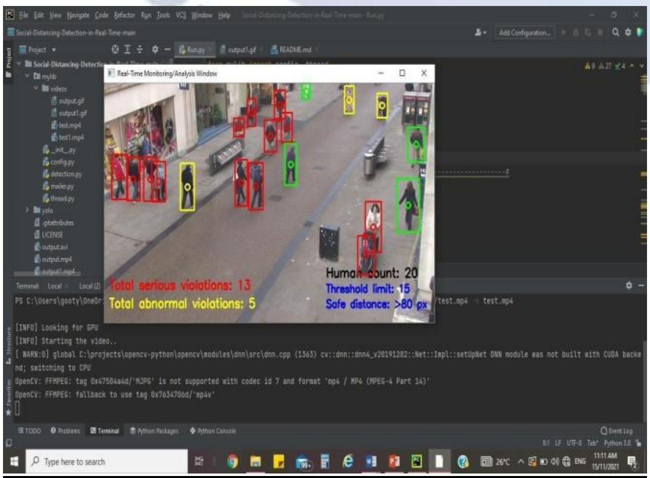

Fig 5: Showing a Persons with Abnormal Violations

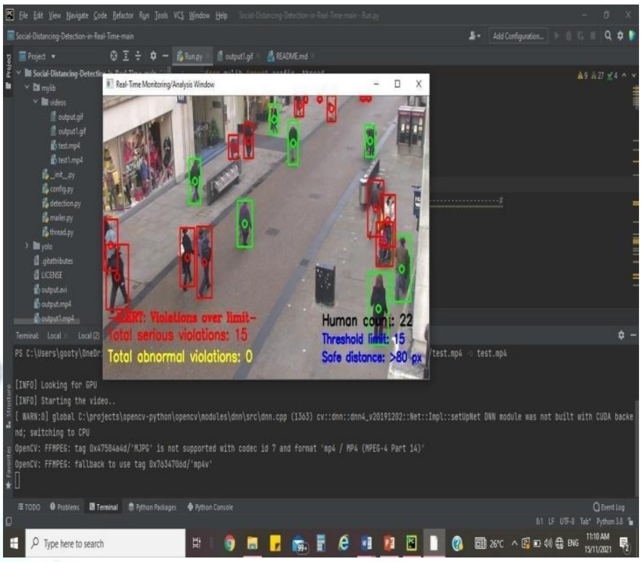

Fig 6: Showing a Alert Violations Over limit

The video shows the pedestrian walking on a public street. In this work, the video frame is fixed at a specified angle to the street. The perspectives view of the video frame is transformed into a top-down view for more accurate estimation of distance measurement. Figure 6 shows the social distancing detection in a video frame and the results of the top-down view. The sequences are depicted from top to bottom. The points represent each pedestrian for social distancing detection. The red points represent the pedestrians whose distance with another pedestrian is below the acceptable threshold and the green points represent the pedestrians who keep a safe distance from other pedestrians. However, there are also a number of detection errors are shown in Figure 7. These errors are possibly due to the pedestrians walking too near to another pedestrian until they are overlaid on the camera view. The precision of the distance measurement between pedestrians is also affected by the pedestrian detection algorithm. The YOLO algorithm is also able to detect the half body of the pedestrian as an object by showing the bounding box, the position of the pedestrian corresponds the middle point of bottom line is estimated based on the bounding box will less precise. To overcome the detection errors, the proposed methodology had been improved by adding a quadrilateral box to observe the appointed region in an image as shown in Figure 8. Hence, only the pedestrians walking within the specified space will be counted for people density measurement.

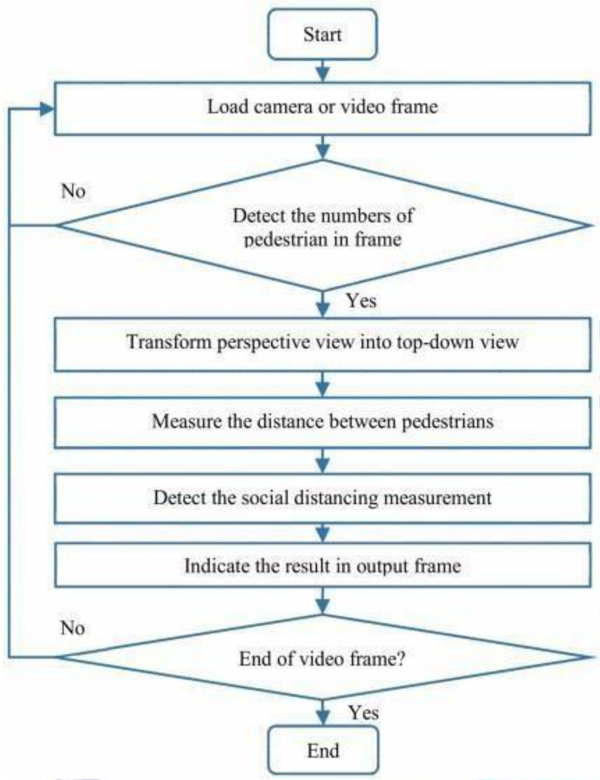

Fig 8:Program flowchart of social distancing detection for each video frame.

5. CONCLUSION

A methodology of social distancing detection tool using a deep learning model is proposed. By using computer vision, the distance between people can be estimated and any noncompliant pair of people will be indicated with a red frame and a red line. The proposed method was validated using a video showing pedestrians walking on a street. The visualization results showed that the proposed method is capable to determine the social distancing measures between people which can be further developed for use in other environment such as office, restaurant, and school. Furthermore, the work can be further improved by optimizing the pedestrian detection algorithm, integrating other detection algorithms such as mask detection and human body temperature detection, improving the computing power of the hardware, and calibrating the camera perspective view.

Conflict of interest statement

Authors declare that they do not have any conflict of interest.

REFERENCES

[1] Adolph C., Amano K., Bang-Jensen B., Fullman N., Wilkerson J. medRxiv. 2020 .

[2] Ahmad M., Ahmed I., Ullah K., Khan I., Adnan A. 2018 9th IEEE annual ubiquitous computing, electronics mobile communication conference (UEMCON) 2018. pp. 746–752.

[3] Implementation of Mitigation Strategies for Communities with Local COVID-19 [online] Available:https://www.who.int/emergencies/diseases/novel-coronavirus-2019.

[4] Talluri Sunil Kumar, Sarangam Kodati, Sagar Yeruva, Talluri Susan, A Novel CNN-Based Classification and Prediction of COVID-19 Disease Using Deep Learning, Proceedings of Second International Conference on Advances in Computer Engineering and Communication Systems.

[5] Ahmad M., Ahmed I., Khan F.A., Qayum F., Aljuaid H. International Journal of Distributed Sensor Networks. 2020;16 1550147720934738.

[6] Implementation of Mitigation Strategies for Communities with Local COVID-19 Transmission, [online] Available: https://www.cdc.gov/coronavirus/2019-ncov/downloads/community-mitigation-strategy.

[7] S. Yadav, Deep learning-based safe social distancing and face mask detection in public areas for covid-19 safety guidelines adherence