Turkish Online Journal of Qualitative Inquiry (TOJQI)
Volume 11, Issue 3, October 2020: 449-454

Real Time Crowd Monitoring and Counting

Navin Singhaniya, Manmeet Kaur, Swastika Patil, Varuni Sawant

Department of Electronics Engineering,D Y Patil, Deemed to be University, Ramroa Adik Institute of Technology, Navi-Mumbai

Abstract. During the COVID-19 pandemic, social distancing has become a standard public health intervention around the world. Social distancing is proven to one of the most effective way to control spreading of corona virus and reduce its outbreak. An effective and efficient crowd management and control system should be able to manage the rapid spreading threat of corona virus disease(COVID-19) and help in crowd controlling and social distancing to avoid physical contact between people. In this paper, we proposed a framework of a crowd management system specially designed to keep in check the total number of people in a particular area to help encourage social distancing by using Open-CV and CCTVs or any other source of video input. The proposed method is novel and very fast to detect and count number of people in real time. The Euclidean distance between the centroids of two objects is used to detect and track the movement of an object through out the frame. Thus it helps to check whether the object enters or exits the frame and calculates the total number of humans in a particular area.

Keywords: real time crowd control, crowd management, human tracking, COVID-19

1 Introduction

As there is increase in urban populations, crowd is rising day by day, with new and emerging threats, the crowd control is taking place on a large scale. Managing the number of visitors in public areas such as shopping malls, banks, retailer shops, government offices, stadiums are challenging. Corona virus has changed the requirements of public security and crowd management. Because of corona virus technologies to monitor social distancing and crowd capacities came under review. Monitoring the number of people coming into the venue was helpful using different entry and exit points. Different Technology needed that can count the people coming in and going out of the venue [2].

We propose a monitoring system to know if the capacity reached at any venue is more than certain per cent and accordingly close the entry venue until the crowd inside clears. Commercial sites use people monitoring to measure the use of different parts of the building at different times. This information obtained can be used to optimize the use of energy in these commercial areas. Also in case of fire hazards, the system can be used to approximate the number of people still stuck inside the office. Crowd management solutions have become more and more popular amid user demand to keep their venues from becoming overcrowded.

An object detector is also normally very computationally expensive, and therefore slower, than an

object tracking algorithm. Few examples of object detection algorithms are HOG + Linear SVM, Haar cascades, and deep learning-based object detectors such as YOLO, Faster R- CNNs [3]. In a video there are several frames at their respective times we have to track the object with each changing frame. Few examples of object tracking algorithms are kernalized correlation filters, MedianFlow, GOTURN, discriminative correlation filters, MOSSE [4]. This paper proposes a method to monitor social distancing at public places by the use of the installed CCTV cameras to keep a track of the human population. This tracking system will help in preventing people from having massive gatherings in a place, which can make the pandemaic conditions worse.

2 Motivation

This work is useful for crowd management, number of people going into and coming out of a venue can be monitored and controlled. Counting of people in a particular area can help maintain social distancing. Acts as a measure towards footfall analysis and in a way to tackle COVID19. This crowd controlling system helps controls number of people inside any shop/ shopping mall/ Banks and give an audible Alarm and closed the doors when limit is crossed. Knowing the exact number

of people inside your establishment and can help send an alert to the staff if the people are way over the limit and thus manage the waiting time to enter the venue. Thus, this idea can also help the police to monitor the area where conditions are not favorable and help in reducing their efforts for equitable situations.

3 Techniques and Algorithms

In this paper we have used python and OpenCV module to create real time human detection. With the help of OpenCV, we will be counting the number of people heading "in" or "out" of a venue in real-time. Here we are using the techniques of object detection and object tracking.

In the object detection phase, we are using a tracker to detect new objects that have entered the tracker's view. For each object that is detected an object tracker create or update with the new bounding box coordinates. The second phase is the object tracking phase in which an object tracker is created to track the objects as it moves around the frame of the tracker. We apply object detection to find out where in the frame of the tracker an object is. Since a object detector is more computationally expensive, it makes it slower, than an object tracking algorithm. On the other hand, an object tracker will accept the input (x, y)-coordinates of where an object lies in an image and will assign a unique ID to that particular object being tracked. Based on various attributes of the frame we first predicting the new object location in the next frame then track the object as it moves around a video stream, Here, the concept of object detection and object tracking

3.1 *Phase 1:* - During this phase, we are running our computational object tracker to

1. detect the new objects when they enter the frame of view.

2. Check for the objects that were lost during the tracking phase. For each detected object, the update has been made in the counter and the new bounding box coordinates is created around the object.

3.2 Phase 2:- The tracking phase is active when the detecting phase is inactive. For each detected object, we create an object tracker which moves along with the object in the frame. The object tracker should be faster and more efficient than the object detector. This process is continued and repeated until we've tracked all theobjects in the frame of view and then re-run the object tracker.

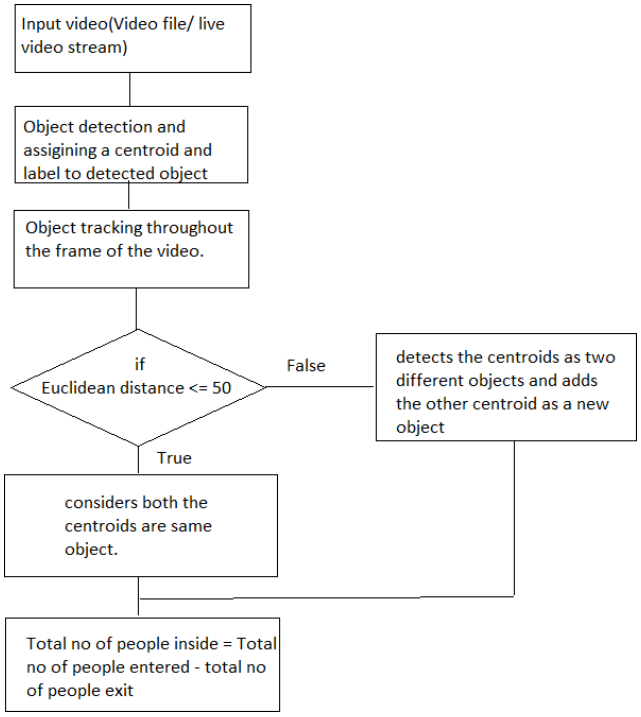

Fig 1: Flow Chart

We have implemented such a tracking system for building our people counter by applying highly accurate object detection methods without using computing applications. Because of using combine approach we can use object detection method without much computation overload. The accuracy of this system is dependent on colour and ambient light condition it varies for shadows and different lighting conditions.

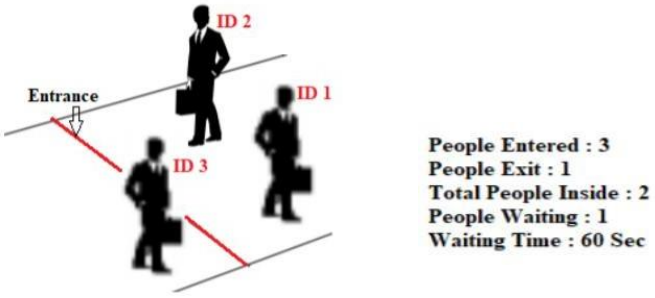

Fig. 2: Proposed system outline

4 Applications

Efficient Crowd management, number of people going into and coming out of a venue can be monitored and controlled. Crowd control solution enables effective management of crowds and

helps to implement social distancing especially during the need of COVID-19 pandemic. High Accuracy – Manual counting of traffic done by appointing security staff or part time employees leads to a less accurate and less satisfactory results. This system provides precise tracking and monitoring without human intervention. The real time analysis of video data gathered by combining AI with deep-learning can help staffs to promptly respond to any change or problematic situation. The real time crowd data gathered from this program can be helpful to sustainably utilize energy in the entire building (e.g. air conditioning needs, etc.), Also in case of any hazardous situations the system can be used to count the number of people still stuck in the building.

5 Results

In this paper we are detecting and tracking the humans in real time. Entrance in the venue is considered as a prediction boundary if any person is coming in the venue, then people entered count and total people inside count is increased as the person crosses the boundary. Similarly, when a person exits from the venue people exit and Total people inside count is updated in real time. This work also keeps track of number of people waiting to enter the venue and also shows the approximate waiting time required to enter the venue. An audible Alarm is given when limit of people inside the venue is crossed to the set value. After this system will close the door and make audio announcement at the entrance asking people to wait for some time. Once some people make exits from the venue then again system will allow person to enter the venue. System will also monitor the social distancing between two persons and when the social distancing norms are not followed alert audio message is given.

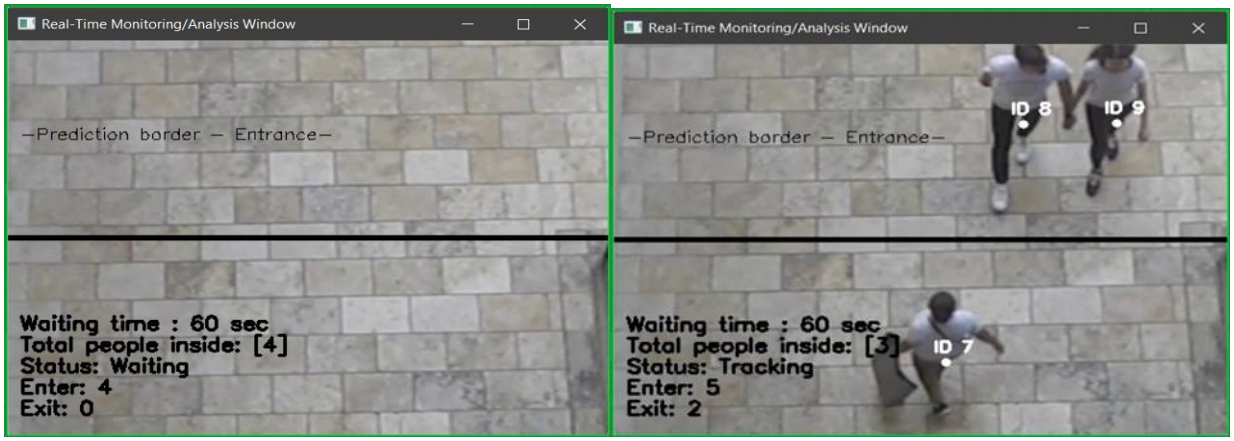

Fig 3: Output

6 Conclusion

In this paper, we propose a method of efficient crowd management by tracking and counting people entered and exit from a particular venue. The human detector and tracking algorithm used can detect human in every frame with a high accuracy. We have used Euclidean distance between the centroids of two objects to detect and track the movement of an object through out the frame. Thus keeping track of moment of each object throughout the frame. It also indicate approzimate waiting time to enter into the venue. Expriment on real time video shows the proposed method is accurate and efficient in real time applications.

7 Future Scope

The human counting solution can be modified to detect people in crowded places. This can be really helpful in finding lost people through surveillance cameras. We can also upgrade the system to make it track people and identify them. This can be helpful for security surveillance. We can upgrade it for person recognition which can detect the facial expressions that can be used to screen visitors at entrance of the venue. In many events or shopping centres by analysing videos system can detect the staff based on particular dress code. Also using this method, the staff can be easily recognised and one can understand the ratio within the store in order to minimize the issues. Different queue management algorithms provide the time can help calculate the delay in service for a particular queue based on the time and length of the queue. This will help detect any issues, and optimize the total number of queues available by reshuffling the customers between the queues. We can also solve the crowd overlap problem, and furthure increase the accuracy of our algorithm.

References

1. Pouw, Caspar AS, Federico Toschi, Frank van Schadewijk, and Alessandro Corbetta. "Monitoring physical distancing for crowd management: Real-time trajectory and group analysis." PloS one 15, no. 10 (2020): e0240963.
2. Davies, Anthony C., Jia Hong Yin, and Sergio A. Velastin. "Crowd monitoring using imageprocessing." Electronics & Communication Engineering Journal 7, no. 1 (1995): 37-47.
3. Abuarafah, Adnan Ghazi, Mohamed Osama Khozium, and Essam AbdRabou. "Real-time crowd monitoring using infrared thermal video sequences." Journal of American Science 8, no. 3 (2012): 133-140
4. Hsieh, Jun-Wei, Cheng-Shuang Peng, and Kao- Chin Fan. "Grid-based template matching for people counting." In 2007 IEEE 9th Workshop on Multimedia Signal Processing, pp. 316-319. IEEE, 2007.
5. Zini, Luca, Nicoletta Noceti, and Francesca Odone. "Precise people counting in real time." In 2013 IEEE International Conference on Image Processing, pp. 3592-3596. IEEE, 2013.
6. Seer, Stefan, Norbert Brandle, and Dietmar Bauer. "Design of decision rules for crowd controlling using macroscopic pedestrian flow simulation." In Pedestrian and Evacuation Dynamics 2008, pp. 577-583. Springer, Berlin, Heidelberg, 2010.
7. Gao, Liqing, Yanzhang Wang, Xin Ye, and Jian Wang. "Crowd counting considering network flow constraints in videos." IET ImageProcessing 12, no. 1 (2017): 11-19.
8. Paul Viola and Michael Jones, “Rapid Object Detection using a Boosted Cascade of Simple Features”, Mitsubishi Electric Research Labs, Cambridge, 2001, IEEE.
9. P.Papageorgiou, Micheal Oren and Tornaso Poggio, “A General Framework for Object Detection”, Center for Biological and Computational Learning Artificial Intelligence Laboratory, Cambridge.
10. Ashfin Dehghan, Haroon Idrees, Amir Roshan Zamir and Mubrarak Shah, “Automatic Detection and Tracking of Pedestrians in Videos with Various Crowd Densities”, Computer Vision Lab, University of Central Florida, Orlando,USA, 2014, SpringerInternational Publishing Switzerland.
11. Energetic, Electronic and Communication Engineering Vol:2, No:10, 2008.
12. Songyan Ma and Tiancang Du. “Improved Adoboost face detection,” International Conference on Measuring Technology andMechatronics Automation, Changsha, 2010.
13. kel Rodriguez, Ivan Laptev, Josef Sivic and Jean- Y ves Audibert, “Density-aware person detection and tracking in crowds,” Imagine, LIGM, Universite Paris-Est.
14. W. Liu, M. Salzmann, and P. Fua, Context- aware crowd counting, in Proc. IEEE/CVF Conf. Comput. Vis. Pattern Recognit. (CVPR), Jun. 2019, pp. 50995108.
15. V. A. Sindagi and V. M. Patel, HA-CCN: Hierarchical attention based crowd counting network, IEEE Trans. Image Process., vol. 29, pp. 323335, 2020.

16. Z. Shen, Y. Xu, B. Ni, M. Wang, J. Hu, and X. Yang, Crowd counting via adversarial cross- scale consistency pursuit, in Proc. IEEE/CVF Conf. Comput. Vis. Pattern Recognit., Jun. 2018, pp. 52455254
17. T. Zhao, R. Nevatia, and B. Wu, Segmentation and tracking of multiple humans in crowded environments, IEEE Trans. Pattern Anal. Mach. Intell., vol. 30, no. 7, pp. 11981211, Jul. 2008.
18. W. Ge and R. T. Collins, Marked point processes for crowd counting, in Proc. CVPR, Jun. 2009, pp. 29132920
19. M. Li, Z. Zhang, K. Huang, and T. Tan, Estimating the number of people in crowded scenes by MID based foreground segmentation and head shoulder detection, in Proc. 19th Int.
20. Shaoqing Ren, Kaiming He, Ross Girshick, and Jian Sun, Faster R-CNN: Towards Real-Time Object Detection with Region Proposal Networks, in arXiv:1506.01497v3 [cs.CV] 6 Jan 2016
21. Lingbo Liu, Zhilin Qiu, Guanbin Li, Shufan Liu, Wanli Ouyang and Liang Lin, Crowd Counting with Deep Structured Scale Integration Network, 2019 IEEE/CVF International Conference on Computer Vision (ICCV)
22. Diping Song, Yu Qiao and Alessandro Corbetta, Depth Driven People Counting Using Deep Region Proposal Network, Proceedings of the 2017 IEEE International Conference on Information and Automation (ICIA) Macau SAR, China, July 2017