Monitoring Covid-19 Social Distancing with Person Detection and Tracking Via Fine-Tuned Yolo V3 And Deepsort Techniques

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Abstract— Recently, the outbreak of Coronavirus Disease (COVID-19) has spread rapidly across the world and thus social distancing has become one of mandatory preventive measures to avoid physical contact. This survey paper emphasizes on a surveillance method which uses Open-CV, Computer vision and Deep learning to keep a track on the pedestrians and avoid overcrowding. The implementation can be done using closed circuit television (CCTV) and Drones where the camera will detect the crowd with the help of object detection and compute the distance between them. The Euclidean distance between two people will be calculated in pixels and is compared with given standard distance and if it is observed to be less than the standard distance the local authorities or local police authorities will be notified. As the pandemic situation has taken over the world, social distancing is one of the major precautions which needs to be taken. As people come together in crowds, they are more likely to come into close contact with someone that has COVID-19 and hence World Health Organization has proposed a strict law for maintaining physical distance of 1 meter (3 feet) in every pair. Thus, to keep a track of the social distancing among the public this idea of social distancing detector emerged.

Indexed Terms- COVID-19, OpenCV, Social distancing, Deep learning, Computer vision, CCTV, Drones.

I. INTRODUCTION

The pandemic situation has taken over the world and has made the conditions worst, as of now there is no vaccination developed for the contagious disease and hence social distancing has emerged as one of the best methods to prevent the spread of COVID-19. As the name suggests, social distancing implies that people should physically distance themselves from one another. The cases have been escalating at a very fast rate all over the world and thus social distancing is important. To monitor social distancing at public places, this survey paper provides a pinpointing solution. In this pandemic period using CCTV and drones we can keep a track on human activities at public places and henceforth we can compute and summarize distances between people and monitor the social distancing violations across the city. This proposed survey will also there and then restrict people from coming together and prevent social gatherings. People who gather in massive amounts at religious places can make conditions worse. Recently all countries in the world were and mostly are in the lockdown period and this has imposed the citizens to be at home but as time passes people will tend to visit more and more public places, religious places and tourist destinations, so in those circumstances this system of monitoring social distancing will be beneficial all around the world. With the help of computer vision and deep learning and the installed CCTV we can keep a track on humans and compute the distance between them in pixels by using computer distance algorithms and set the standard-maintained distance to be followed and get an

overview of people violating the law and concerned authorities can take the actions accordingly [6].

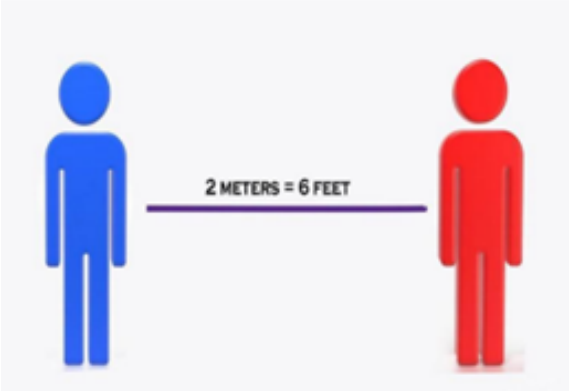


Figure 1 Distance Measurement

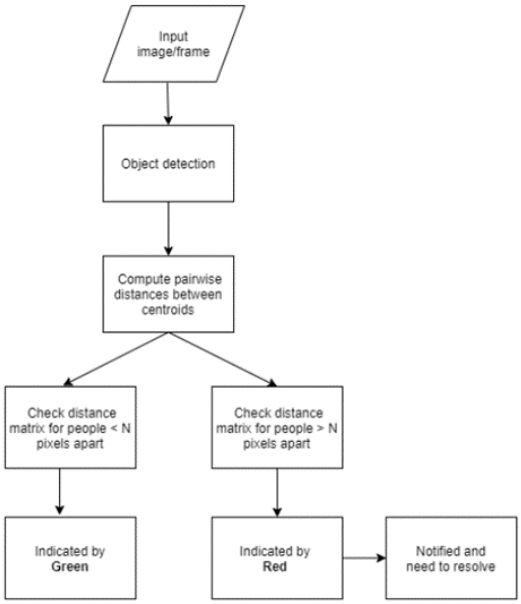
II. LITERATURE SURVEY

In 2017, Dr. S Syed Ameer Abbas and his co-authors proposed a system for human tracking and crowd management using raspberry pi and Open-CV. A cascade classifier was trained for head detection from the scene is trained using Haar features through OpenCV. The whole concept of their idea was to record the crowded scene using a camera and Raspberry pi3 that has a quad core ARMv8 central processing unit which processes the video frame by frame. The head count is measured and the crowd is managed by comparing the value with the threshold and if it surpasses the threshold the prevention can be done accordingly [4]. In 2018, Joel Joseph Joy and his co-authors proposed a system of traffic density identification which was based on image processing. The queue length and the traffic densities were recorded from the images taken from the camera. The video input was taken and fuzzy logic was applied to handle the concept of partial truth. The outcome of partial truth concept could range anywhere between completely true and completely false [2]. In 2020, Adrian Rosebrock published an article on social distancing detector which is based on OpenCV, Computer Vision and Deep Learning concept. The article throws a light on social distancing during the pandemic period and it focuses on social distance monitoring through CCTV cameras installed across streets. The camera records the distance between people in pixels and compares it with the standard measurement and thus behave as a social distancing detector. This social distance detector application logic resides in the file.py script and this file is responsible for looping over frame of a video stream and ensuring that people are maintaining a healthy distance from one another. It is compatible with both video files and webcam streams [6]. In 2019, Neel Bhave and his co-authors proposed a system which is a complete working model which comprised of Reinforcement model and Object detection algorithms. In this they used YOLO (You Only Look Once) Real Time Object Detection which has less shortcomings, is much faster, provides accurate results and can be trained for more than 200 classes. Reinforcement learning is an area of machine learning which is responsible for providing the green phase timing according to the current state of traffic and learn from the actions taken [3]

III. PROPOSED SYSTEM

WHO Officials in a press conference held in march 2020, stated that "Since people can spread the virus before they know they are sick, it is important to stay away from others when possible, even if you—or they—have no symptoms. "Since social distancing is essential to prevent the spread of Covid-19, but it was observed that social distancing was being violated at public places and hence the concept of "social distancing detector" is introduced. In this research we are using object detection to monitor safe distance between people [3]. CCTVs and Drones can be used for human detection. Closed Circuit television (CCTV) are being used as a means of surveillance from a long time but due to its limitations it is not completely reliable. The drone thus has a better communication with the rest of the swarm in a particular area to follow the human while also dividing the areas between the drones dynamically so as to not lose track of the human. OpenCV, computer vision and deep learning are used to monitor social distancing across the region. Initially, object detection is applied to detect pedestrians in a video stream. In the next step, the pairwise distances between all detected people are calculated and finally these distances are compared with the standard distance that should be maintained (6 feet or 2 meters) and are represented by red frame if they are violated and green frame otherwise. So, if 5-6 people gather around in a particular area, the local authorities or the local police stations will be

immediately notified. Recently, after the outbreak of this virus, the police Authorities need to patrol across the city and are bound to invest time unnecessarily. Using this concept of social distancing detection, the police will be able to monitor and reach the exact location and control the scenario immediately. Thus, social distancing can be controlled and indirectly the spread of COVID-19 be prevented [5]. The below figure shows the steps for implementation of a social distancing detector.



Advantages of Proposed System

- The proposed framework utilizes the YOLO v3 object detection model to segregate humans from the background and Deepsort approach to track the identified people with the help of bounding boxes and assigned IDs.
- The results of the YOLO v3 model are further compared with other popular state-of-the-art models, e.g. faster region-based CNN (convolution neural network) and single shot detector (SSD) in terms of mean average precision (mAP), frames per second (FPS) and loss values defined by object classification and localization.
- Later, the pairwise vectorized L2 norm is computed based on the three-dimensional feature space obtained by using the centroid coordinates and dimensions of the bounding box.
- The violation index term is proposed to quantize the non-adoption of social distancing protocol.
- From the experimental analysis, it is observed that the YOLO v3 with Deepsort tracking scheme displayed best results with balanced mAP and FPS score to monitor the social distancing in real-time.
- It focused on crowd detection and person count by proposing multiple height homographies for head top detection and solved the occlusions problem associated with video surveillance related applications.

In this section, we discuss YOLO v4. shows a diagrammatic representation of YOLO v4 architecture.

Backbone: It employs CSPDarknet53 as a feature extractor with a graphics processing unit (GPU). Few backbones are more appropriate for classification than for detection. For example, CSPResNext50 is better than CSPDarknet53 for image classification; whereas, CSPDarknet53 is proved better in terms of object detection. For better detection of small objects, the backbone model needs a higher network size as an input and for higher receptive fields more layers are required.

Neck: For feature map extraction, it uses Path Aggregation Network (PAN) and Spatial Pyramid Pooling (SPP). PAN used in YOLO v4 is the modified version of the original PAN where addition is replaced with concatenation. This increases the neck receptive field with improvement in the model's accuracy and minimal rise of inference time.

Head: YOLO v4 utilizes the same head as YOLO v3 with the anchor-based detection steps.

Materials and methods
Training dataset

In this project , to tune up the object detection model for human detection under various low light conditions, a recently released ExDARK dataset is considered which specifically focuses on a low-light environment. In this dataset, 12 different classes of objects are labeled, out of which we fetched data of our desired class for training. This dataset contains

different indoor and outdoor low light images; furthermore, the data is subdivided for low light environment into 10 classes ambient, object, strong, twilight, low, weak, screen, window, shadow, and single. Sample images of various indoor-outdoor low-light environments from the datase

Testing dataset

A custom dataset is used for the evaluation of the proposed model. The dataset is collected from the market of Rawalpindi, Pakistan during the night in the days of COVID-19. Pakistan is one of the most urbanized countries in South Asia with a 3% yearly urban population growth rate. The large population and congested streets make it a riskier place in the growth of COVID-19 and it is very difficult to maintain safety distance in such narrow places. Hence, the monitoring system should need to have high accuracy in terms of the detection and location of the people. Evaluation of the proposed framework in such a highly-populated area will help us to better analyze the performance of the model. Test dataset is the collection of 346 RGB frames. Frames are collected with motionless ToF camera of Samsung galaxy note 10+ installed 4.5 feet above the ground where a 0° regular camera view calibration is adopted. Sample images of low-light conditions from the custom dataset

IV. RESULTS

CCTVs and Drones can be used for human detection. Closed Circuit television (CCTV) are being used as a means of surveillance from a long time but due to its limitations it is not completely reliable. The drone thus has a better communication with the rest of the swarm in a particular area to follow the human while also dividing the areas between the drones dynamically so as to not lose track of the human. OpenCV, computer vision and deep learning are used to monitor social distancing across the region. Initially, object detection is applied to detect pedestrians in a video stream. In the next step, the pairwise distances between all detected people are calculated and finally these distances are compared with the standard distance that should be maintained (6 feet or 2 meters) and are represented by red frame if they are violated and green frame otherwise. So, if 5- 6 people gather around in a particular area, the local authorities or the local police stations will be immediately notified. Recently, after the outbreak of this virus, the police Authorities need to patrol across the city and are bound to invest time unnecessarily. Using this concept of social distancing detection, the police will be able to monitor and reach the exact location and control the scenario immediately. Thus, social distancing can be controlled and indirectly the spread of COVID-19 be prevented. The below figure shows the steps for implementation of a social distancing detector.

Fig: 2 Home page

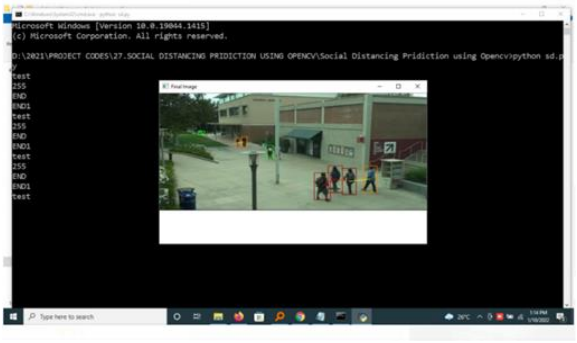


Fig: 3 Red Indication showing people not maintain distance

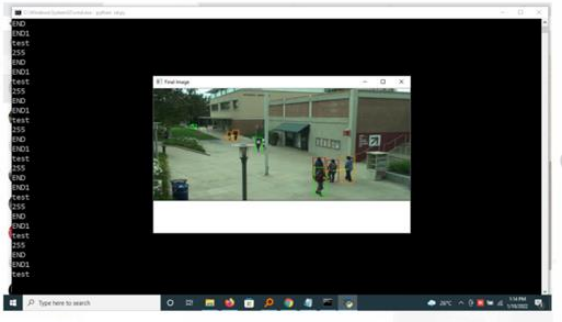


Fig:4 Green Indication showing People maintaining distance

CONCLUSION

As we envision the world post COVID-19 pandemic the need of self-responsibility emerges irrefutably. The scenario

would mostly focus on accepting and obeying the precautions and rules that WHO has imposed more precisely as responsibility of one will totally embark on themselves and not government. Social Distancing would undoubtedly be the most important factor as COVID 19 spreads through close contact with infected ones. In order to supervise large mobs, an effective solution is important and this survey paper focuses on that. Using installed CCTV and drones, authorities can keep a track of human activities and control large crowd to come together and prevent violating the law [2]. As far as people are maintaining a safe distance they would be indicated with green light, and as the CCTV captures more and more crowd gathering, red light would pop-up and the allocated police of that area will be notified and the situation can come under control immediately [6]. As controlling large mob is not an easy task, using this survey, conditions can be managed before situation goes out of control. Thus, implementing this idea can reduce the onground efforts of the police and they can entirely focus on supervising conditions exclusively on those areas where conditions are unfavorable and thus, they can utilize time wisely and save energy for equitable situations.

REFERENCES

[1] Dr. S. Syed Ameer Abbas, Dr. P. Oliver Jayaprakash, M. Anitha, X. Vinitha Jaini, “Crowd Detection and Management using Cascade classifier on ARMv8 and OpenCV-Python”, Mepco Schlenk Engineering College, Sivakasi, 2017 International Conference on Innovations in Information, Embedded and Communication systems (ICIIECS).

[2] Joel Joseph Joy, Manali Bhat, Namrata Verma, Milind Jani, “Traffic Management Through Image Processing and Fuzzy Logic”, D.J. Sanghvi College of Engineering, Mumbai, India, Proceedings of the Second International Conference on Intelligent Computing and Control Systems (ICICCS 2018), IEEE Xplore Compliant Part Number: CFP18K74-ART; ISBN: 978-1-5386-2842-3.

[3] Neel Bhave, Aniket Dhagavkar, Kalpesh Dhande, Monis Bana, Jyoti Joshi, “Smart Signal-Adaptive Traffic Signal Control using Reinforcement Learning and Object Detection”, Department of IT, RAIT, Nerul, Maharashtra, India, Proceedings of the Third International Conference on I-SMAC (IoT in Social, Mobile, Analytics and Cloud) (I-SMAC 2019), IEEE Xplore Part Number: CFP19OSV-ART; ISBN:978-1-7281-4365-1.

[4] Dr. S. Syed Ameer Abbas, M. Anitha, X. Vinitha Jaini, “Realization of Multiple Human Head Detection and Direction Movement Using Raspberry Pi”, Electronics and Communication Engineering”, Mepco Schlenk Engineering College, Sivakasi, This full-text paper was peer-reviewed and accepted to be presented at the IEEE WiSPNET 2017 conference.

[5] Gayathri Devi Ramaraj, Sriram Venkatakrishnan, Balasubramanian, Soorya Sridhar,” Aerial Surveillance of Public Areas with autonomous track and Follow using Image processing”, Department of Electrical and Electronics Sri Sairam Engineering College, Chennai, India.

[6] Article on OpenCV social distancing detector by Adrian Rosebrock on June 1, 2020, on www.pyimagesearch.com

[7] Article on Object detection with 10 lines of code by Moses Olafenwa on June 16, 2018 on https://towardsdatascience.com