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SOCIAL DISTANCE DETECTOR USING OPENCV YOLO, CNN ALGORITHM IN DEEP LEARNING

D.GANGA[1],V. BHARATH[2], P. NAVYA SRI[3], T. TULASI[4], SK. SHAROOK[5].

[1]Assistant Professor, CSE,Chalapathi Institute of Technology,Guntur, India
[2]UG Student,CSE,Chalapathi Institute of Technology,Guntur, India
[3]UG Student,CSE,Chalapathi Institute of Technology,Guntur, India
[4]UG Student,CSE,Chalapathi Institute of Technology,Guntur, India
[5]UG Student, CSE, Chalapathi Institute of Technology, Guntur, India

ABSTRACT: In the face of the global Covid-19 scenario, the process of softening the curve of the corona virus will be difficult if citizens do not take steps to prevent the spread of the virus. With no vaccine available, social distancing is the only possible way to combat the epidemic. The proposed framework uses the YOLO v4 object detection model to identify people in the background and in-depth tracking of identified people with the help of binding boxes and assigned IDs. The model results of YOLO v4 are compared to other popular modern models, e.g. CNN-based regional speed (convolution neural network) and singleshot detector (SSD) in terms of average accuracy (map), frames per second (FPS) and loss values are defined by object classification and location. Later, the L2 line shown in pair wise is calculated based on the three-dimensional feature space obtained using links and the size of the binding box. The name of the infringement index is proposed to reduce the inconsistency of the public deviation process. From the experimental analysis, it is evident that YOLO v4 with an in-depth tracking scheme shows good results with moderate map and FPS score to monitor community deviations in real time. We are using the YOLO v4 object acquisition model and the OpenCV image processing library to run this project. The project will play an important role in an area where large numbers of people can be expected such as a shopping mall or movie theatre or airport. With the help of this project we can ensure that people follow the process of socialization. Keywords: YOLO v4, Covid-19, Social Distancing, Pertained Model, Webcam, CNN, deep learning

1. INTRODUCTION

COVID-19 belongs to the family of coronavirus caused diseases, initially reported at Wuhan, China, during late December 2020. On March 11, it spread over 114 countries with 118,000 active cases and 4000 deaths, WHO declared this a pandemic . On May 4, 2020, over 3,519,901 cases and 247,630 deaths had been reported worldwide. Several healthcare organizations, medical experts and scientists are trying to develop proper medicines and vaccines for this deadly virus, but till date, no success is reported. 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 coronavirus pandemic along with minimum loss of economic endeavoursFig. 1: An outcome of social distancing as the reduced peak of the epidemic and matching with available healthcare capacity. and propose a solution to detect the social distancing among people gathered at any public place.

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The word social distancing is best practice in the direction of efforts through a variety of means, aiming to minimize or interrupt the transmission of COVID-19. It aims at reducing the physical contact between possibly infected individuals and healthy persons. 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. A recent study indicates that social distancing is an important containment measure and essential to prevent virus, because people with mild or no symptoms may fortuitously carry corona infection and can infect others.

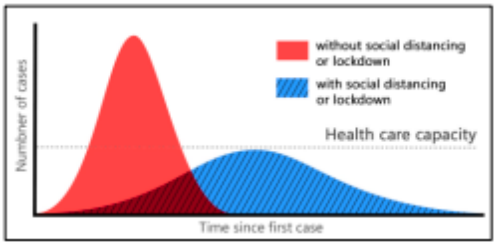

Fig-1 Use of Proper Social distance Fig. indicates that proper social distancing is the best way to reduce infectious physical contact, hence reduces the infection rate. This reduced peak may surely match with the available healthcare infrastructure and help to offer better facilities to the patients battling against the coronavirus pandemic. Epidemiology is the study of factors and reasons for the spread of infectious diseases. To study epidemiological phenomena, mathematical models are always the most preferred choice. Almost all models descend from the classical SIR model of Kermack and McKendrick established in 1927. Various research works have been done on the SIR model and its extensions by the deterministic system, and consequently, many researchers studied stochastic biological systems and epidemic models. Respiratory diseases are infectious where the rate and mode of transmission of the causing virus are the most critical factors to be considered for the treatment or ways to stop the spread of the virus in the community. Several medicine organizations and pandemic researchers are trying to develop vaccines for COVID-19, but still, there is no well-known medicine available for treatment

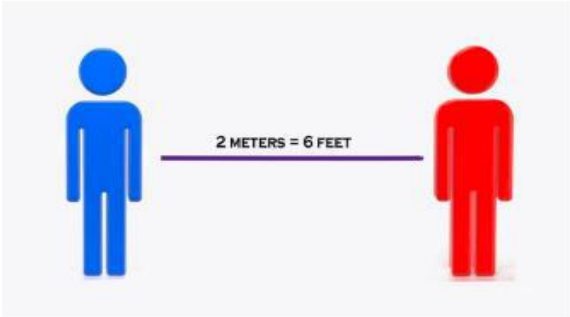

Fig-2 Social Distance

2. LITERATURE SURVEY

"SOCIAL DISTANCE DETECTOR BY USING RASPBERRY **AND OPENCV TO FIND THE HUMAN TRACKING AND** CROWD MANAGEMENT". by **DR.SYED AMEER ABBAS,JOSEPH JOY -YEAR - 2017**

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 .

In 2018, Joel Joseph Joy and his co-authors proposed a system of traffic density

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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 .

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 .

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. PROPOSED SYSTEM

The proposed system, the social distancing analyser tool was developed using computer vision, deep learning, and python to detect the interval between people to maintain safety. The YOLOv4 model based on convolution neural networks, computer vision, and deep learning algorithms is employed in the development of this work.

Initially, for detection of the people in the image or frame YOLOv4 is used an object detection network based on the YOLOv4 algorithm was used . From the result obtained, only the “People” class is filtered by ignoring objects of classes. The bounding boxes are mapped in the frame. The distance is measured using the result obtained by this process.

Our proposed system is a four-level module that focuses on things like human identification, their tracking and then after their distance detection (mainly humans using YOLO object detection algorithm) and calculation using computer vision and deep learning by using OpenCV. We will follow the following criteria given below: -

1. Pass the input which will be image or video and we will pass it frame by frame.
2. Detect the human object in the image or video frame using YOLO object detection.
3. Compute the pairwise distances between centroids of boxes drawn on the people.
4. Check if the distance between any two persons is ‘x’ pixels and check whether it is above or below the given threshold.
5. Generate the output in the output stream.

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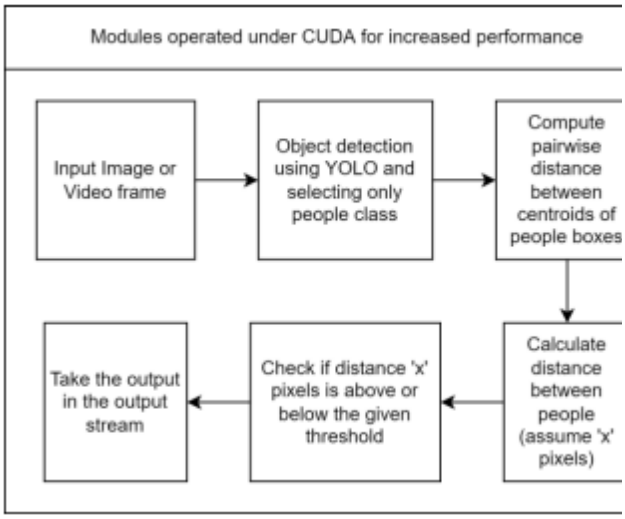


Fig-3 Workflow of our Proposed System

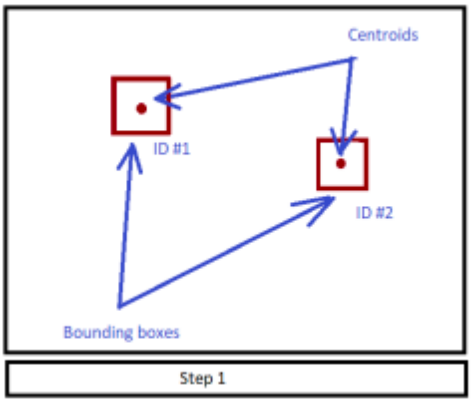
4. IMPLEMENTATION

Module 1: Object detection using YOLO V4 algorithm

Here object refers to the person from the COCO dataset which is used with YOLO weights for training. From the objects of COCO dataset we consider only person object. If the object is person then only the object will be detected other objects will not be detected.

Module 2: Object Tracking using Open CV

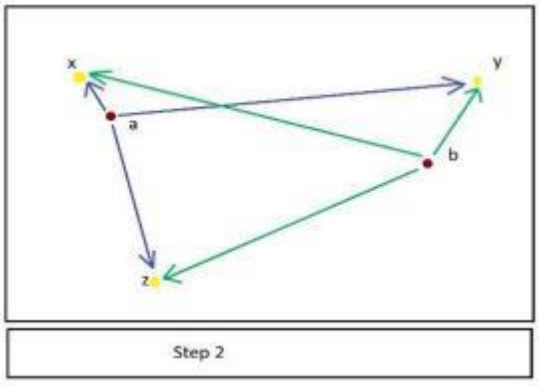
Step 1: Accepting the bounding boxes and computing the corresponding centroids which means the center of bounding boxes.



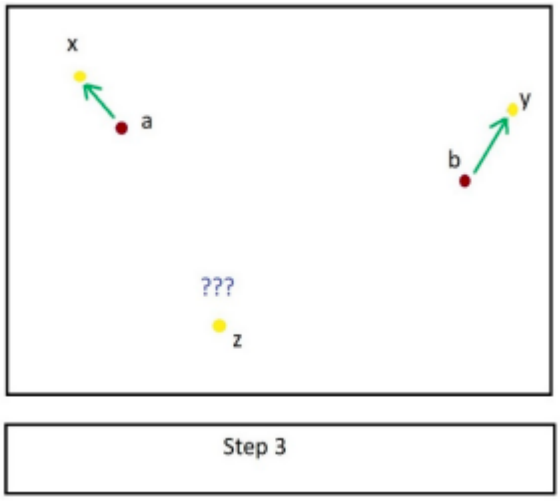
Step 2: Computing Euclidean distance between new centroids (yellow) represented by x, y, z and old centroids (brown) represented by a, b.

• Centroid tracking works on an assumption that the pair of centroids with minimum Euclidean distance or the closest pair is must be the same person. So, unique ID will be generated to that pair i.e., person.

• In the above image there are two existing centroids and three new centroids from the previous frame which describes a new person has been detected in this frame.



Step 3: Association of ID's as we know Euclidean distances.



Step 4: New ID's will be registered by storing co-ordinates of bounding boxes of new object i.e., person.

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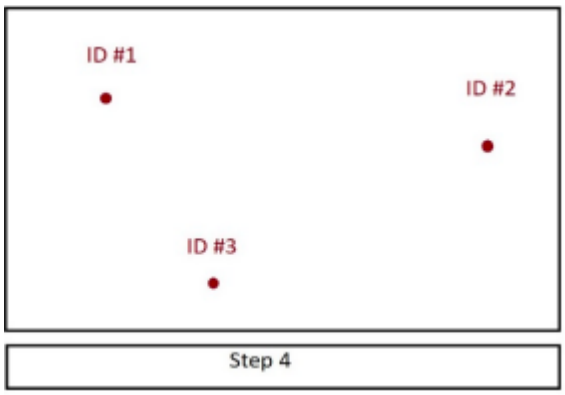
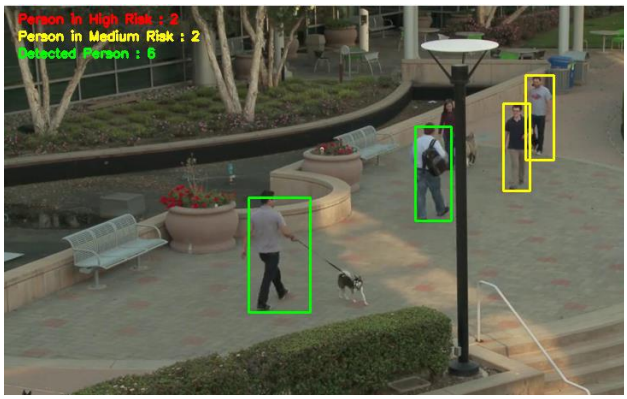


Step 5: The object which leaves our frame area then we will just deregister the object.
Module 3: Distance computation using Euclidean distance as metric Computation of distance between the pairs of detected persons using Euclidean distance as metric.
Module 4: Adding violations and displaying number of violations. The persons who are less than M pixels (M represents minimum distance set by us in the project) distance apart from each other will be considered as violation pair.
They will be highlighted with red color bounding boxes and the number of violations at that particular frame will be displayed. The persons who are maintaining more than M pixels of distance will be considered as non-violation pair and they will be highlighted with green color bounding boxes.

5. SCREEN SHORT



6. CONCLUSION

The computer vision, deep learning algorithms like YOLO and OpenCV to reduce the impact of covid-19 by accessing distance between people and if any pair fails to follow the social distance norm then we will indicate it with red line and this all will be done in real-time and because we are using CUDA, we will get faster results than traditional methods. Our proposed method demonstrated this by using a pre-recorded video of people walking on a road. This model can be used in other places like hospitals, offices, public areas etc. Also, some improvements can be done in the model to get more functionalities and improve performance.

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