NOVATEUR PUBLICATIONS
INTERNATIONAL JOURNAL OF INNOVATIONS IN ENGINEERING RESEARCH AND TECHNOLOGY
[IJIERT] ISSN: 2394-3696 Website: ijiert.org
VOLUME 8, ISSUE 6, June. -2021

SOCIAL DISTANCING DETECTOR USING DEEP LEARNING

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ABSTRACT
This paper presents a methodology for detecting social distance using deep learning and computer vision between people to control the spread of covid-19. This application is developed to give alerts to people for maintaining social distance in crowded places. By using pre-recorded video as input and the open-source object detection pretrained model using the YOLOv3 algorithm We can tell if people are following social distancing or not and based on that we are creating red or green bounding boxes over it. It is also working on web cameras, CCTV, etc, and can detect people in real-time. This may help authorities to redesign the layout of public places or to take precautionary actions to mitigate high-risk zones.it can be used in other fields also like autonomous vehicles, human action recognition, crowd analysis.

Keywords: Social distancing. Object detection. Crowd analysis, covid-19

Introduction

In December 2019 there was a cluster of pneumonia cases found in the city of Wuhan. Some of the early cases had reported visiting or working in seafood and live animal markets there. An investigation found that the disease was caused by a newly discovered coronavirus. The disease was subsequently named covid-19. It quickly spread to the whole world. On 11th March 2020 WHO carried out a virtual press conference and declared covid - 19 as pandemic [1]. The public health bodies such as the Centres for Disease Control and Prevention (CDC) had to make it clear that the most effective way to slow down the spread of Covid-19 is by avoiding close contact with other people [2]. Some countries have developed vaccines but people can contract the virus even after inoculation. So it's better to have precautions like wearing a face mask, maintaining social distance, etc in public places. Hence this work aims to detect the people who are not following 6 feet distance in workplaces and public areas by providing an automated detection system using deep learning and computer vision.

Literature Review

Various research work has been carried out on social distancing using different techniques. Yadav et al.[3] suggested in which raspberry pi4 was used to detect public places in real-time to prevent the spread of Covid-19. The trained model with the custom data set was used in the raspberry pi4 and the camera was taking input for processing. The camera is fed with real-time video of public places to the model in the raspberry pi4, which continuously and automatically monitors public places and detects whether people keep safe social distances, and also checks whether or not those people wear masks. This method operates in two stages: first, when any person is identified without wearing a mask his photo was taken and being sent to a control center at the police Headquarters, and second, when the system detects the violation of social distancing by any person in a threshold time there rings an alarm to alert people for maintaining social distance and a critical alert is sent to the control center of state Police Headquarters for further action. They achieved an accuracy of 91%.

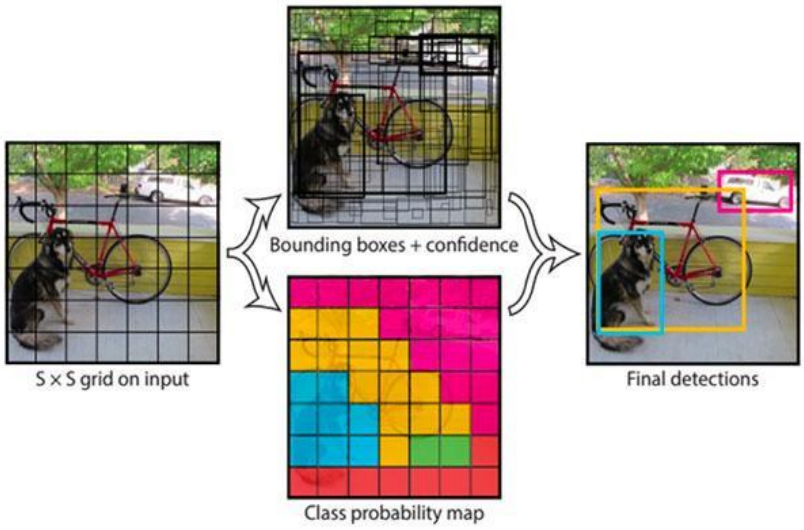

Figure 1. The illustration of YOLO model for object detector pipeline [4]

METHODOLOGY

This Social distancing detection tool was developed to detect the safety distance between two people. This particular project is based on three other projects

(1) Is object detection (2) is object tracking and (3) is distance measurement between the detected objects. In object detection, we are using YOLO (You only look once) transfer learning process. There are other transfer learning methods for detecting objects like mobile net SSD etc but Here we are using Yolo. Yolo can detect 9000 classes. We are using the coco dataset here which is trained on 80 layers but we are using person class here so from 80 layers we are using only person class. After that, we will move onto object tracking. After the detection of the person class, we need to track them So we will assign a new id to every detected person and draw a box over them which is the centroid of the box.

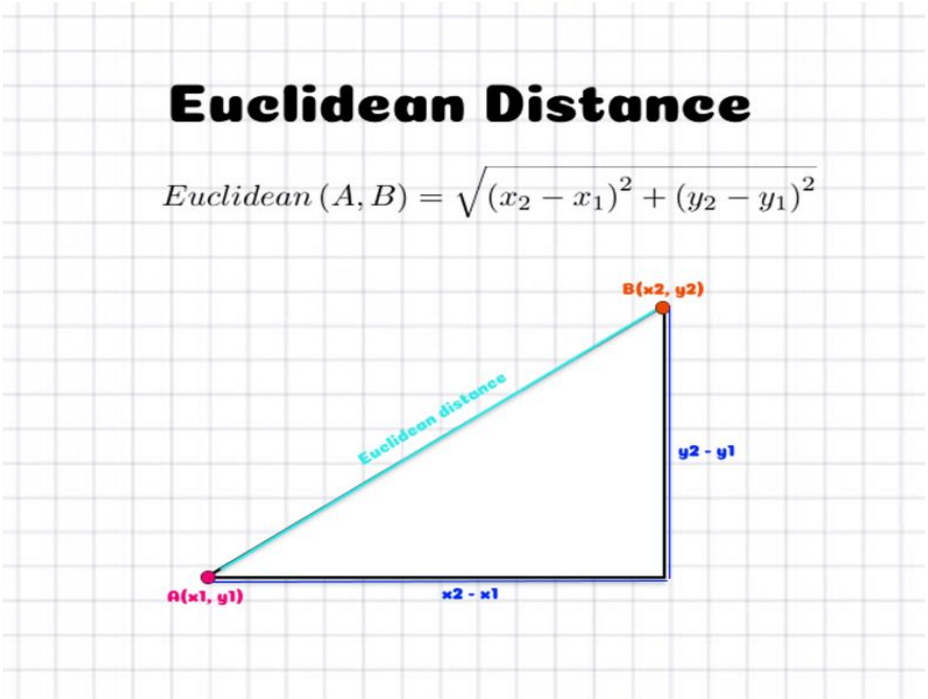

Figure 2. The formula of euclidean distance

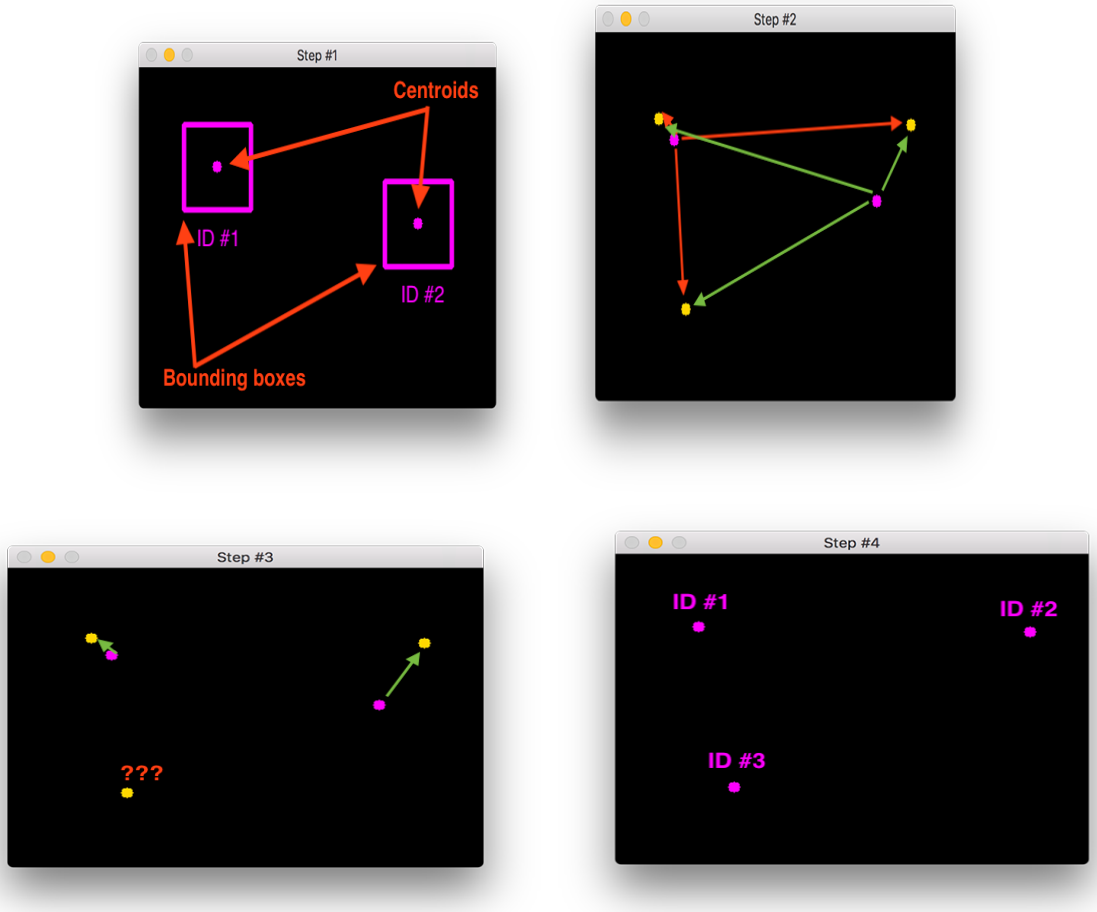

Figure 3. image of moving people from one place to another [5]

We have detected two persons over here .we have drawn boxes over them and measured the centroid of the box and in the second frame purple one is the old centroid and yellow is the new centroid same in the third frame and there is a new person detected over here so how can we know that the person has moved from one point to another for this we will calculate euclidean distance from old centroids and new centroids and the close pairs will be detected as the same person. After we have tracked the person we need to measure the distance between the two.

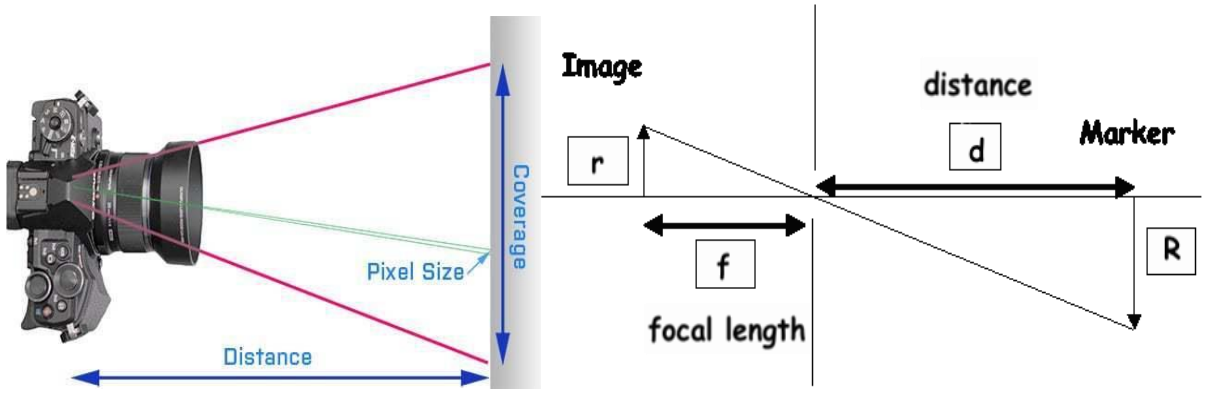

Figure 4 . image for distance calculation between two people

f=(P*d)/W where f = focal length , p = pixel of the object, d = distance from

d' =(W*F)/P the object, w= width

RESULTS AND DISCUSSION

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 perspective view of the video frame is transformed into a top-down view for a more accurate estimation of distance measurement. 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 some detection errors shown. 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 corresponding to the middle-point of the bottom line is estimated based on the bounding box will be 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. Hence, only the pedestrians walking within the specified space will be counted for people density measurement.

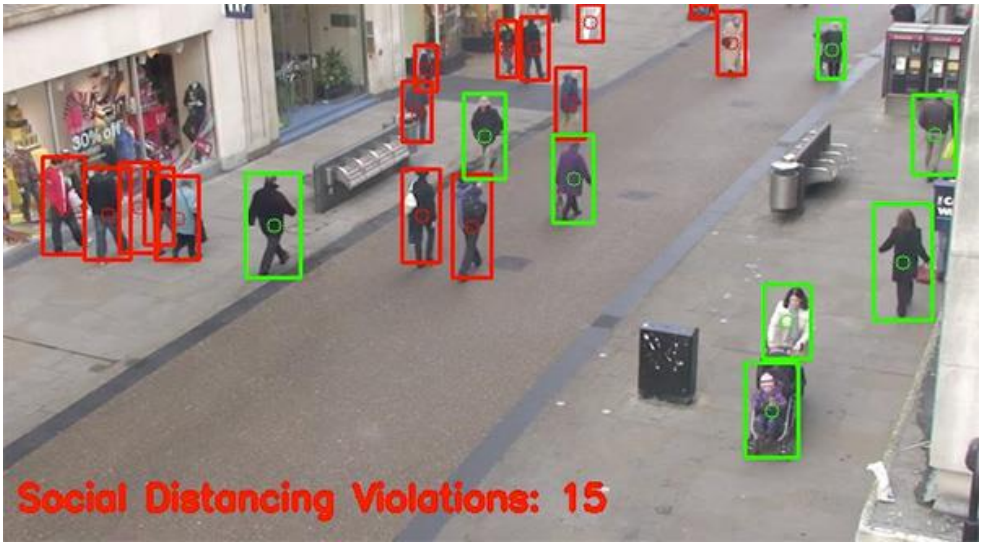

Figure 5. Here red boxes represent people who are too close (less than 6 feet) to one another

CONCLUSION AND FUTURE SCOPE

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 non-compliant pair of people will be indicated with a red frame and 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 of determining the social distancing measures between people. We can add on other algorithms such as face mask detection and human body temperature detection. In the future, we can use this methodology on mobile camera autonomous drones.

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