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DETECTION OF SOCIAL DISTANCE

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ABSTRACT

A deep learning-based system for detecting social distance between pedestrians in order to reduce the spread of the Novel Covid-19 virus has been developed. By analysing a real-time video clip, the discovery tool was designed to make users aware of social alienation. The object that has been previously trained. As input, video frames from the camera were fed into a detection model using the YOLO V3 algorithm, which then Social distancing was detected using this method. The video frame is then converted to a hierarchical 2-dimensional format. Distance estimation among persons using a three-dimensional perspective. The distance between people is measured, and any disobedient groups of people inside the exhibit are marked with a coloured barrier. The proposed technique is tested on real-time camera views or live footage of people wandering through the city. In a crowded environment, this framework provides for the effective execution of social separation rules between different persons.

Keywords*: Deep Learning, Computer Vision, OpenCV, Tensorflow, Keras.*

1. INTRODUCTION

This study is being presented to promote the mitigation of Covid19 dissemination. It offers a method for identifying crowds in public spaces such as banks, shopping malls, and clinics. Person detection algorithms are used to reliably detect a person's existence in areas of interest, and then the distance between the discovered persons is measured.

We've got two basic approaches to object detection algorithms or models: region-based and unified-based methods. The region-based technique has two steps: first, propose a few locations in the image, and then search into those regions for human detection [21]. The method is RCNN, which is significantly slower because it requires running the procedure for the same number of areas as the selective region technique [50]. Fast-RCNN speeds up the process by allowing it to execute the model on all regions at once [50]. It also speeds up the process by switching from selective search to regional proposal network (RPN).

The Faster-RCNN provides excellent detection and recognition precision [49]. The only issue is that high computational costs are undesirable for devices such as cameras and cell phones. In such cases, a unified-based strategy that is also less complex is a speedier answer in human detection. This method uses a large number of anchors in the image (pixel mapping in a bounding box grid) and then uses the probability of an object in each anchor or box to eliminate overlapped bounding boxes to detect humans or objects in real-time. You Only Look Once (YOLO) is a strategy utilised in a unified approach that is employed in real-time detection and helps in the detection of small objects faster with a high accuracy rate [34]. The authors of [1] proposed a speedier solution called Single Shot Multibook Detector (SSD). This method first calculates a feature map from an image using a CNN, then uses that feature map to identify or detect objects in the image.

As if it were possible to integrate social distancing on top of object detection models. Faster-RCNN object detection model customization may be found in research [19]. On top of object detection, the researchers tweak the models to anticipate social separation. The correctness of the work is 93 percent. The problem with this method is that it is computationally expensive when compared to other detection methods like SSD and YOLOv5. The second issue is that physical variations in surroundings such as camera elevation, heights, and floor irregularity require each camera to be retrained.

2. RELATED WORKS

This section showcases some of the related deep learning-based human detection research. Deep learning is used in a large number of recent works on object classification and detection, which is also explored. Since the outbreak of the COVID-19 pandemic, numerous countries have been looking for technological answers. COVID-19 has been combated by Asian countries using a variety of technology. The most widely utilized technology is phone location tracking, which saves COVID-19 positive people's data and allows them to be tracked depending on their proximity to healthy people. Germany and Italy are monitoring lockdown using anonymized location data. C9 corona symptom tracker [19] is a new software from the United Kingdom that allows individuals to register their symptoms. Similarly, South Korea created Corona 100m [19], an app that stores the location of

infected persons and sends out alerts to healthy people when they are within 100 meters of corona sufferers. India has created an app that allows users to keep a certain distance from someone who has tested positive for corona.

Deep learning is a type of artificial intelligence (AI) that mimics the human brain's data processing and object detection capabilities. It's a sophisticated neural network with a smart algorithm.

We describe a computer vision system for recognizing humans via a camera set at the highway or at a workplace, based on the idea from the work. The camera's field of view encompasses all people walking in a given area. These existing deep CNN approaches can determine the number of persons in an image or video with bounding boxes, while the YOLO method was used to detect the video stream taken by the camera. The application will emphasize whether there is sufficient social distance between persons in the video by measuring the Euclidean distance between them.

3. METHODOLOGY

This social distancing detection programme was created to identify people's safety distance in public areas. In this study, the deep CNN approach and computer vision techniques are used. Initially, the pedestrian in the video frame was detected using an open-source object detection network based on the YOLOv3 [13] method. Only the pedestrian class was used as a result of the detection, and other object types were ignored in this application. As a result, the bounding box that best fits each identified pedestrian can be drawn in the image, and this data will be utilized to calculate distance.

Detection of pedestrians:

The Deep CNN model was suggested as an object detection strategy that reduced computer complexity by defining detection as a single regression problem [11]. When it comes to deep learning-based object identification, the YOLO model is one of the state-of-the-art models that has been shown to provide considerable speed improvements and is suited for real-time applications. The YOLO model was used for pedestrian identification in this study, as illustrated in Figure 3. The YOLO algorithm was viewed as an object detection algorithm that learned bounding box coordinates (tx, ty, tw, th), object confidence, and related class label probabilities (P1, P2,..., Pc) from a given input image. The YOLO was trained on the COCO dataset, which contains 80 classifications ranging from human to pedestrian. Only box coordinates, object confidence, and pedestrian object class from the YOLO model were used in this study for pedestrian detection.

Calibration of the camera view:

Figure 4 shows how an image's region of interest (ROI) focusing on a pedestrian strolling along a street was turned into a top-down 2D display of 480480 pixels. Calibration of the camera view is done by computing the transition of the perspective view into a top-down view. The perspective transformation in OpenCV is a straightforward camera calibration approach that involves selecting four points in the perspective view and mapping them to the corners of a rectangle in the 2D image view. As a result, everyone is considered to be standing on a level, flat plane. The actual distance between pedestrians can be calculated based on the number of pixels in the top-down image.

Measuring Distance:

The location of the bounding box for each person (x, y, w, h) in the perspective view is identified and turned into a top-down view in this step of the pipeline. The bottom-centre point of the bounding box is used to estimate each pedestrian's position in top-down view. From the top-down view, the distance between each pedestrian pair may be calculated, and the distances are scaled by the scaling factor obtained from camera view calibration. Given the positions of two pedestrians in an image as (x1, y1) and (x2,y2), the distance between them, d., can be calculated as follows:

The pedestrian couple whose distance is less than the minimum allowable distance, t., is highlighted in red, while the rest is highlighted in green. A red line is drawn between the pair of people whose distance is less than the pre-determined threshold.

4. RESULT AND DISCUSSION

This project's system development was performed using Python 3, OpenCV for image processing techniques, and the Caffe object detection model framework. Some analysis has been done to test the effectiveness of this constructed system, and findings have been acquired. In this study, the MobileNet SSD Caffe model was employed as the main algorithm for person detection. The main video footage from the full scene set in the living room, where the camera is positioned high to acquire an overhead view, is taken for programme tweaking.

This programme is intended to be utilized in a real-time context, precision and accuracy are essential to achieving the goal.

5. CONCLUSION AND FUTURE WORK

A deep learning model is used to suggest a way for detecting social separation. The distance between persons can be assessed using computer vision, and any noncompliant pair of people will be marked with a red frame and a red line. A video of pedestrians going down a street was used to validate the suggested method. The proposed method can be further improved for usage in various environments such as the office, restaurant, and school based on the visualization findings. Furthermore, the work can be enhanced by optimizing the pedestrian detection method, integrating other detection techniques such as mask detection and human body temperature detection, increasing the hardware computing capacity, and calibrating the camera perspective view.

One of the most significant precautions in avoiding physical contact that could contribute to the spread of coronavirus is social separation. Viral transmission rates will be increased as a result of non-compliance with these rules. To achieve two desired functionalities, a system was created using Python and the OpenCV library.

Based on thermal pictures, this study offered an intelligent surveillance system for individuals monitoring and social distancing classification. In comparison to existing deep learning models, the proposed technique produced good results for persons detection in terms of evaluating the detector's accuracy and precision. A special algorithm was applied to bounding boxes to discriminate between safe and unsafe settings, designating the bounding box for observed people as green or red, respectively.

In the future, we will use this technology on mobile cameras in the future, such as those placed on an autonomous drone system, making drones easier to control and more successful at capturing fast actions of recognised objects from various angles. We will expand our research to include and test people identification using 3-D dimensions with three parameters (x, y, and z), allowing us to sense equal distribution distance throughout the entire image while removing the perspective effect. In addition, the recently announced YOLOv4 detector will be taken into account.

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