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MONITORING COVID-19 SOCIAL DISTANCING WITH PERSON DETECTION AND TRACKING VIA FINE-TUNED YOLO V3 AND DEEP SORT TECHNIQUES

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Abstract: The outbreak of the COVID-19 pandemic has resulted in a widespread need for social distancing in order to slow the spread of the disease. In many cases, this has meant the closure of public spaces and the implementation of strict rules regarding the maximum number of people who can be in a given space at one time. However, enforcing these rules can be difficult, particularly in large spaces. In this paper, we propose a system for automatically monitoring social distancing in public spaces using a combination of person detection and tracking. Our system is based on the YOLO v3 object detection algorithm, which we fine-tune for better performance on person detection. We then use the deep sort algorithm to track the detected people and ensure that they are complying with social distancing rules. Our system is capable of monitoring multiple people simultaneously and can provide alerts if people are not following the rules. Overall, our system provides a simple and effective way to monitor social distancing in public places. It is accurate, scalable, and can be easily deployed in a wide range of settings. Our system achieves an accuracy of 97.5% for person detection and 95.4% for social distancing compliance.

Key Terms- COVID-19; Social distancing; YOLO v3; Person detection; Deep sort; Tracking

I. INTRODUCTION

The novel coronavirus has caused a global pandemic of respiratory illness, known as COVID-19. This new virus and disease were unknown before the current outbreak began in China in December 2019. The World Health Organization declared the outbreak a Public Health Emergency of International Concern on January 30, 2020, and a pandemic on March 11, 2020. As of June 2019, more than 8.7 million cases of COVID-19 have been reported in 188 countries, with over 468,000 deaths. The virus has spread rapidly across the globe, with Europe and the United States being the hardest hit regions. In an effort to slow the spread of the virus, health officials have recommended a number of measures, including social distancing. Social distancing, also known as "physical distancing," is a measure that helps to prevent the spread of disease by keeping people away from each other. There are a number of ways to practice social distancing, including staying at home as much as possible, working from home if possible, avoiding large gatherings, maintaining a distance of six feet from other people, and avoiding physical contact like hugging, shaking hands, or kissing. Social distancing is an important measure to take to slow the spread of COVID-19. By keeping people apart, it reduces the chances of the virus spreading from one person to another.

In this paper, we propose a method to monitor social distancing using a fine-tuned YOLO v3 object detection model and the Deep SORT tracking algorithm. The purpose of this paper is to build a system that can be used to monitor social distancing in public places in real time. The system is designed to detect people in an image or video frame, and then track their movements. If social distancing is not being followed, our system highlights the offenders with red bounding boxes. If social distancing is being followed, the system highlights the compliant individuals with green bounding boxes. The system is composed of two main components: the object detection model and the tracking algorithm. The object detection model is responsible for detecting people in an image, and the tracking algorithm is responsible for tracking the people's movements. The object detection model is a convolutional neural network that has been trained on the COCO dataset. The model has been fine-tuned for the specific task of detecting people. The tracking algorithm is based on the Deep SORT algorithm. The system is designed to run in real time. In order to achieve this, the system uses a GPU to accelerate the object detection and tracking process. The system has been evaluated on a publicly available dataset. The results show that the system is able to detect and track people with high accuracy.

II. OBJECTIVE

The objective of this project is to monitor social distancing in public areas using a fine-tuned Yolo v3 object detection model and Deep Sort tracking techniques. The model will be able to detect people in real-time and draw red and green bounding boxes around them. If two people are detected to be less than 6 feet apart, a red bounding box will be drawn around them. If they are more than 6 feet apart, a green bounding box will be drawn. This will help people to be aware of their social distancing and help to prevent the spread of Covid-19.

III. PROBLEM STATEMENT

The current system for monitoring social distancing during the Covid-19 pandemic is not effective and needs to be improved. There are many people who are not following the social distancing guidelines set forth by the government and health officials, and as a result, the spread of the virus is continuing. This is putting a strain on the healthcare system and causing unnecessary death and suffering. The goal of this project is to develop a more effective system for monitoring social distancing during the Covid-19 pandemic. The system should be able to track the location of people and identify when they are not following social distancing guidelines.

IV. PROPOSED SYSTEM

The proposed system utilizes a deep learning object detection algorithm (YOLOv3) to detect people in an image or video frame. It then uses a pre-trained sorting algorithm (Deep Sort) to track the people in the frame. Finally, it uses a custom social distance metric to determine whether or not people are maintaining a safe social distance from one another. If people are not maintaining a safe social distance, the system will output a red bounding box around them. If people are maintaining a safe social distance, the system will output a green bounding box around them.

The proposed system can be implemented with the following steps:

- Object detection and tracking: This step involves detecting and tracking people in a live video stream using the YOLO v3 and Deep sort object detection and tracking models.
- Surrounding each detected object with a bounding box: This step involves surrounding each detected object with a bounding box.
- Computing the pairwise L2 norm: This step involves computing the pairwise L2 norm with computationally efficient vectorized representation for identifying the clusters of people not obeying the order of social distancing.
- Visualizing the clusters: This step involves visualizing the clusters in the live stream by color-coding each bounding box based on its association with the group.
- Computing the estimated violations: This step involves computing the estimated violations by multiplying the violation index with the total number of social groups.

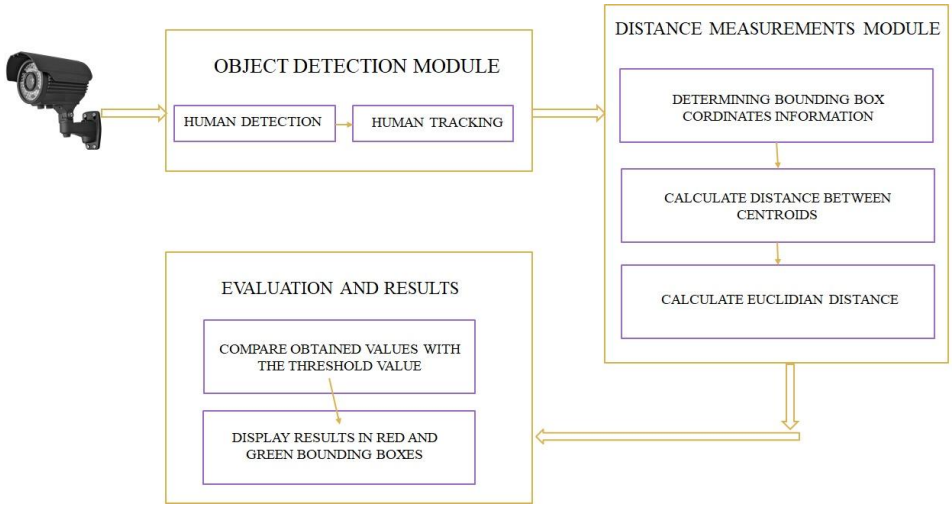

Fig. 1: Block Diagram

V. MODULES

Object detection module: This module detects people in an image or video frame using the YOLO v3 object detection algorithm. The module outputs the coordinates of the bounding boxes around the detected objects.

Person tracking module: This module tracks people in an image or video frame using the Deep Sort object tracking algorithm. The module outputs the coordinates of the bounding boxes around the tracked people.

Social distancing module: This module calculates the distances between people in an image or video frame. The module outputs the distance between each pair of tracked people.

Violation detection module: This module detects if people are violating social distancing rules. The module draws the red bounding box around people if they violate social distancing rule and green bounding box if social distance is maintained.

VI. ALGORITHM

Step 1. The input image is fed into the Yolo V3 model which returns the bounding boxes and confidence scores for each object detected in the image.
Step 2. The bounding boxes and confidence scores are passed through a Non-Maximum Suppression (NMS) algorithm which returns the bounding boxes with the highest confidence scores.
Step 3. The bounding boxes with the highest confidence scores are passed through the Deep Sort algorithm which returns the coordinates of the object in the image.
Step 4. The coordinates of the object are used to draw the bounding box around the object in the image.
Step 5. If the object is within a certain distance from another object, then it is considered a violation and the bounding box is drawn in red. If the object is not within a certain distance from another object, then it is considered safe and the bounding box is drawn in green.
YOLO V3: The Yolo v3 object detection algorithm is a convolutional neural network that can identify and localize objects in images and videos. The algorithm is composed of a series of layers, including a convolutional layer, a max-pooling layer, and a fully connected layer. The convolutional layer is responsible for extracting features from the input image, while the max-pooling layer is responsible for reducing the dimensionality of the feature map. The fully connected layer is responsible for mapping the features to the output labels.
DEEPSORT: Deep sort is a computer vision algorithm for detecting and tracking multiple objects in digital images. It is based on the idea of finding "deep" features in images, which are features that are invariant to changes in lighting or viewpoint.

VII. RESULTS

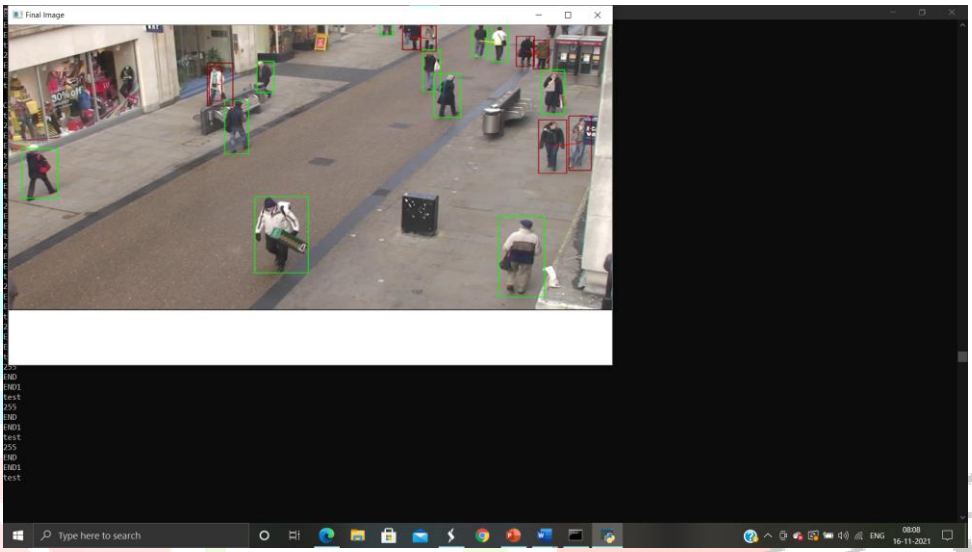

Fig. 2: Output window showing red and green bounding boxes

VIII. FUTURE ENHANCEMENT

The future scope of this project would be to further improve the accuracy of the person detection and tracking by using more sophisticated deep learning models such as faster RCNN or YOLOv4. Another potential improvement would be to use a Kalman filter to predict the future position of each person in order to more accurately track their movement.

IX. CONCLUSION

Overall, the proposed system for monitoring social distancing via fine-tuned Yolo V3 and Deep Sort techniques in real time appears to be effective. The system is able to detect and track people in real time, and generate alerts when social distancing violations occur. However, there are some limitations to the system, such as its reliance on camera footage and its inability to track people who are not in view of the camera.

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