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Implementing People Detection and Social Distancing Measuring System for Covid-19

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ABSTRACT: Covid-19 is a severe repository syndrome coronavirus-related disease that first occurred in China in December 2019. This pandemic has spread to 188 nations and claimed the lives of many people. When humans are in close proximity, the Corona virus spreads. According to the World Health Organization, maintaining a distance of at least one meter between one person and another is the greatest way to prevent the transmission of covid-19. The purpose of this study is to determine which objects (i.e., people) adhere to social distance norms and which do not. The proponents offer a deep neural network-based approach for spotting people. The upgraded network structure of YOLOv3 (you look at once) is an object detection system designed for real-time processing. An algorithm is also used to measure and classify the distance between people, as well as to automatically evaluate whether or not social distance regulations are being followed. As a result, the goal of this research is to reduce the spread of covid-19**.**

I. INTRODUCTION

COVID-19 is a coronavirus-related disease that was first discovered in Wuhan, China, in late December 2020. WHO labelled it a pandemic on March 11 after it spread to 114 countries, with 118,000 active cases and 4000 deaths. Over 3,519,901 cases and 247,630 deaths had been documented worldwide as of May 4, 2020. Several healthcare organisations, medical specialists, and scientists are working to produce effective medications and vaccines to combat this deadly virus, but no progress has been reported to date. This predicament pushes the international community to consider other options for halting the spread of the contagious virus. In the current situation, social distance is touted as the best spread stopper, and all afflicted countries have agreed to use it. This study aims to help support and prevent the coronavirus pandemic while minimizing economic losses, as well as provide a method for detecting social distance among people gathered in public places.

The term "social distancing" refers to best practices in the direction of measures aimed at minimizing or interrupting COVID-19 transmission through a variety of techniques. Its goal is to reduce physical contact between potentially infected people and healthy people. According to WHO guidelines, persons should keep a space of at least 6 feet between them in order to practice social distancing. According to a recent study, social distance is a critical containment mechanism and is required to avoid SARSCoV-2 since people with moderate or no symptoms may carry corona virus and infect others by chance. This lower peak may be compatible with existing hospital infrastructure, allowing patients fighting the coronavirus pandemic to receive better care. Epidemiology is the study of the factors that cause infectious illnesses to spread. Mathematical models are always the best choice for studying epidemiological phenomena. Almost all models are descended from Kermack and McKendrick's original SIR model, which was first published in 1927.

Many academics explored stochastic biological systems and epidemic models as a result of various research efforts on the SIR model and its extensions by the deterministic system. Respiratory infections are infectious, and the pace and mechanism of transmission of the causative virus are the most important aspects to consider while treating or preventing the virus from spreading in the population. Several medical organizations and pandemic researchers are working to create COVID-19 vaccinations, however there is currently no well-known cure available. As a result, the entire world takes preventative measures to prevent the spread of infection. Eksin et al. have developed a modified SIR model with the addition of a social distance parameter, a(I, R), that can be calculated using the number of infected and recovered people, represented as I and R, respectively.

II. RELATED WORK

The most crucial step in the software development process is conducting a literature review. After determining the time factor, economics, and firm Traffic Redundancy Elimination, the following stage is to select which operating system

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and language may be utilized to construct the tool. Once the programmers begin working on the instrument, they will require a great deal of outside assistance.

Senior programmers, books, and websites can all provide this assistance. Before we can start building the system, we need to understand the following ideas. With the notion that social distance is the most reliable approach for preventing the spread of infectious disease, it was chosen as an unprecedented measure on January 23, 2020, against the backdrop of December 2019, when COVID-19 arose in Wuhan, China. The outbreak in China reached a climax in the first week of February, with 2,000 to 4,000 new confirmed cases each day, in less than a month. For the first time since the outbreak began, there was a sign of relief when no new confirmed cases were reported for five days in a row, from March 23 to March 23, 2020. This is seen in the use of social distancing tactics in China, which were eventually used globally to regulate COVID-19. Prem et al. wanted to see how social distancing strategies affected the propagation of the COVID-19 virus.

Due to a multitude of constraints such as low-resolution video, varying articulated position, clothes, lighting and background complications, and limited machine vision capabilities, human detection is an ambitious aim. However, prior awareness of these obstacles can increase detection effectiveness. Detecting a moving object consists of two stages: object detection and object classification. Background subtraction, optical flow, and spatiotemporal filtering approaches could be used to achieve the primary step of object detection. The difference between the current frame and a background frame (first frame) is determined at the pixel or block level in the background subtraction method. Background subtraction techniques include adaptive Gaussian mixture, temporal differencing, hierarchical background models, warping background, and non-parametric background.

Flow vectors associated with object motion are quantified over time in order to identify regions in motion for a given sequence of images in an optical flow-based object recognition technique. Optical flow based approaches have computational overheads and are susceptible to numerous motion-related anomalies such as noise, colour, and lighting, according to the researchers. Aslani et al. suggested a spatio-temporal filter-based methodology for motion identification, in which the motion parameters are identified using three-dimensional (3D) spatio-temporal aspects of the person in motion in the image stream. These approaches are favourable since they are simple and have a low computational complexity, but their performance is limited due to noise and uncertainties in moving patterns.

Advanced strategies that have lately been developed have proven to be effective in solving object detecting challenges. Prior to classification, convolutional neural networks (CNN), region-based CNN, and faster region-based CNN used region proposal techniques to generate the objectness score, which was then used to generate the bounding boxes around the object of interest for visualisation and other statistical analysis. Although these strategies are effective, they do necessitate a longer training period. Because all of these CNN-based systems rely on classification, YOLO proposes a regression-based method for dimensionally separating the bounding boxes and interpreting their class probabilities. The developed architecture separates the image into numerous pieces that represent bounding boxes, coupled with the class likelihood scores for each portion to consider as an object, in this manner. This method provides tremendous increases in terms of speed while sacrificing efficiency. The detector module has strong generalization abilities, allowing it to represent a complete image

IV. PROPOSED SYSTEM

This paper provides a deep learning-based system for automating the task of social distancing surveillance video monitoring. The suggested framework employs the YOLO v3 object detection model to distinguish humans from the background, as well as the Deepsort technique to track recognised people using bounding boxes and assigned IDs. In terms of mean average precision (mAP), frames per second (FPS), and loss values defined by object classification and localization, the results of the YOLO v3 model are compared to those of other popular state-of-the-art models, such as faster region-based CNN (convolution neural network) and single shot detector (SSD). The pairwise vectorized L2 norm is then computed using the three-dimensional feature space generated by employing the bounding box's centroid coordinates and dimensions.

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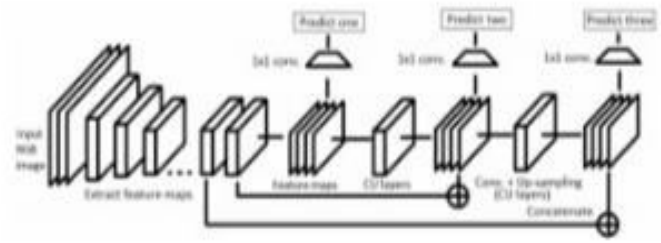

Figure: 1 Schematic representation of YOLOv3 architecture

OBJECT DETECTION: YOLO

Object detection is a computer vision problem that entails both the localization and classification of one or more items inside an image. It's a difficult computer vision problem that necessitates both successful object localization (finding and drawing a bounding box around each object in an image) and object classification (predicting the correct class of localised object).

The "You Only Look Once," or YOLO, family of models is a set of end-to-end deep learning models for fast object recognition developed by Joseph Redmon et al. and first detailed in the paper "You Only Look Once: Unified, Real-Time Object Detection" published in 2015.

A single deep convolutional neural network (initially a version of GoogLeNet, then modified and named DarkNet based on VGG) separates the input into a grid of cells, each of which predicts a bounding box and object classification immediately. After a post-processing step, a large number of potential bounding boxes are combined into a final forecast.

At the time of writing, there are three main iterations of the approach: YOLOv1, YOLOv2, and YOLOv3. The first version suggested a broad architecture, while the second version refined the design and used predefined anchor boxes to improve bounding box proposal, and the third version improved the model architecture and training process even more.

Although the models' accuracy is similar to but not quite as excellent as Region-Based Convolutional Neural Networks (R-CNNs), they are popular for object detection due to their speed, which is frequently demonstrated in real time on video or using camera feed input.

In a single assessment, a single neural network predicts bounding boxes and class probabilities directly from entire images. Because the entire detection pipeline is a single network, it can be optimised directly on detection performance from beginning to end.

For the Keras Project, Experiencor YOLO3 was used. Each version of YOLO has its own source code, as well as pre-trained models.The source code for the YOLO versions referenced in thepublications can be found on the official DarkNet GitHub repository, which is written in C. A tutorial on how to use the code for object detection may be found in the repository.

It's a difficult model to build from the ground up, especially for beginners, because it necessitates the creation of numerous specific model elements for training and prediction. Even utilising a pre-trained model directly, for example, necessitates specialised programming to distil and interpret the model's projected bounding boxes.

We can use a third-party implementation instead of writing this code from scratch. There are a lot of third-party YOLO solutions for Keras, but none of them appear to be standardised or designed to be used as a library.

The YAD2K project established a de facto standard for YOLOv2 by providing scripts to convert pre-trained weights into Keras format, use the pre-trained model to produce predictions, and distil and interpret the predicted bounding boxes. Many other third-party developers have modified this codeto enable YOLOv3 using this code as a starting point.

Huynh Ngoc Anh's "keras-yolo3: Training and Detecting Objects with YOLO3" or experiencor is maybe the most extensively used project for employing pre-trained YOLO models. The project's code is released under the MIT open source licence, which is quite permissive. It includes scripts for loading and using pre-trained YOLO models, as well as transfer learning for generating YOLOv3 models on new datasets, similar to YAD2K.

He also maintains the keras-yolo2 project, which has identical code for YOLOv2 as well as thorough tutorials on how to utilise it. It appears that the keras-yolo3 project is an upgraded version of that project.

Experiencor has trained versions of the YOLOv3 on standard object detection issues such as a kangaroo dataset, racoon dataset, red blood cell detection, and others. He's compiled a list of model performance, made model weights available for download, and included YouTube videos of model behaviour.

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V. SIMULATION RESULTS

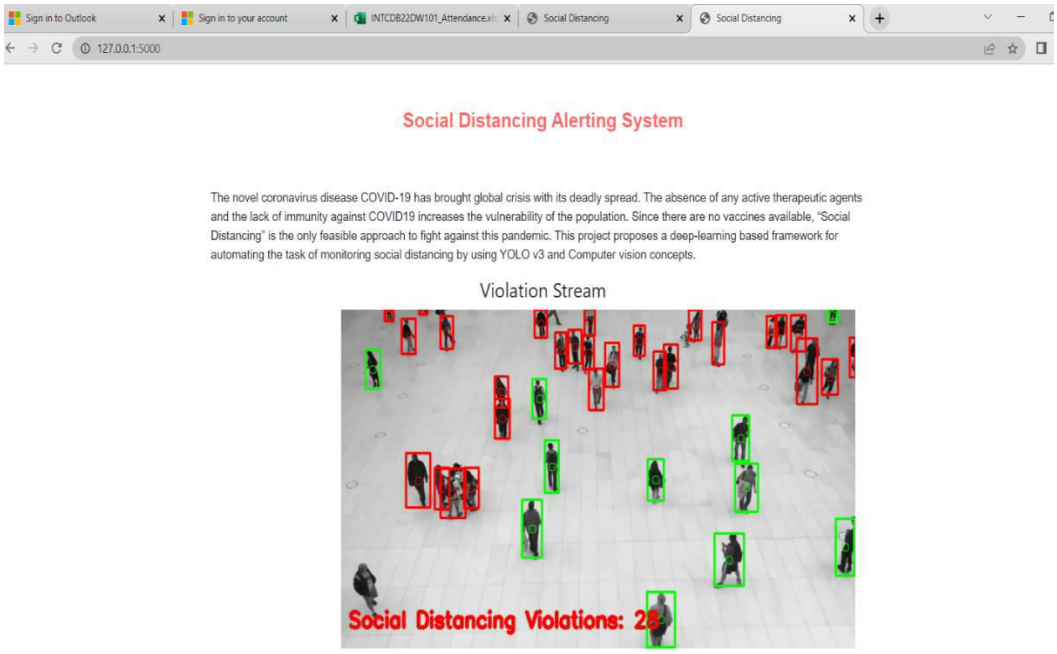

Figure:1 Output screenshot

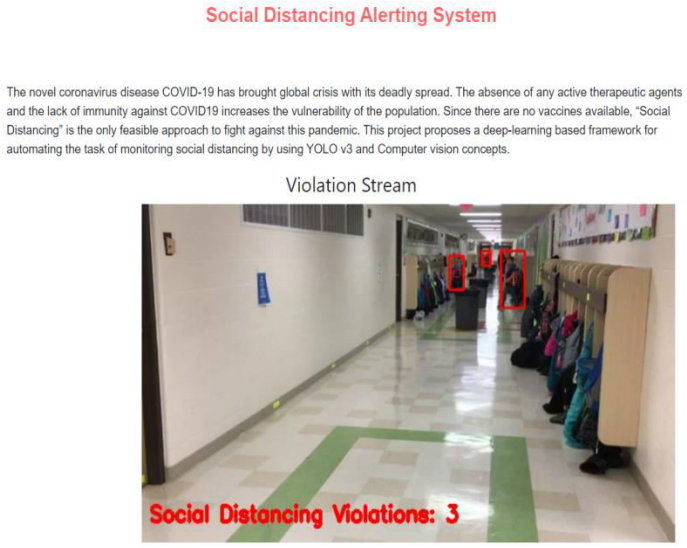

Figure:2 Output screenshot-2

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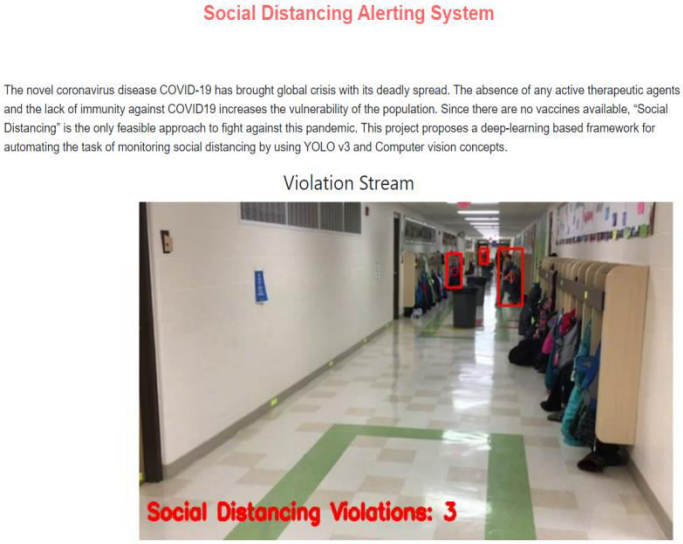

Figure:3 Output screenshot-3

Figure:4 Output screenshot-4

VI. CONCLUSION AND FUTURE WORK

The research presents a real-time deep learning-based system for automating the process of monitoring social distancing via object identification and tracking methodologies, in which each participant is detected in real-time using bounding boxes. The resulting bounding boxes assist in locating clusters or groups of persons that satisfy the pairwise vectorized approach's proximity property. The number of violations is determined by computing the number of groups established and the violation index term, which is calculated as the ratio of people to groups. The experiments included popular state-of-the-art object identification models such as Faster RCNN, SSD, and YOLO v3, with YOLO v3 demonstrating efficient performance with balanced FPS and mAP score. Because this method is highly sensitive to the camera's spatial placement, it can be fine-tuned to better align with the matching field of vision.

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