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Social Distance Detector Using YOLO v3

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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 v3 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 v3 are compared to other popular modern models, e.g. CNN-based regional speed (convolution neural network) and single-shot 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 pairwise 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 v3 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 v3 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 theater or airport. With the help of this project we can ensure that people follow the process of socialization*.

Key Words: **YOLO v3, Covid-19, Social Distancing, Pre-trained Model, Webcam, CNN.**

1. INTRODUCTION

Social distancing is not a new concept. Social distancing is a method used to control the spread of contagious diseases. As the name suggests, social distancing implies that people should physically distance themselves from one another, reducing close contact, and thereby reducing the spread of a contagious disease (such as corona virus).

COVID-19 belongs to the family of corona virus caused diseases, initially reported at Wuhan, China, during late December 2019. Several health care organizations, medical experts and scientists are trying to develop proper medicines and vaccines for this deadly virus, but till date, no success is reported.

The rampant Corona virus disease has brought a global crisis with it's deadly spread to more than 180 countries. It is found that the lack of immunity against Covid-19 increases the vulnerability to the population. This is the reason that social distancing is being encouraged even after the development of vaccines, because it is the only feasible approach to stay completely safe. 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 corona virus pandemic along with minimum loss of economic endeavors, and propose a solution to detect the social distancing among people gathered at any public place.

Social distancing 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. 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 health care infrastructure and help to offer better facilities to the patients battling against the corona virus pandemic.

To study epidemiological phenomena, mathematical models are always the most preferred choice. Emerging technologies like Convolutional Neural Networks, Deep learning, and AI can enable us to enforce social distancing. YOLOv3 and Deepsort are being proposed to detect and track pedestrians followed by calculating a violation index for non-social distancing behaviour. Furthermore, if the violation index crosses a set parameter, the system is to show a notification on the screen to the authorized personnel, following which they can use protocols to alert the people in such public places. No audio alarms are to be used, keeping in mind the panic situations that could be caused by such warning alarms. The paper deals with the problem statement, objectives and implementation of such a system in detail.

2. MOTIVATION

Social distancing is surely the most trustworthy technique to stop the spreading of infectious disease. some law enforcement departments have been using drones and other surveillance cameras to detect mass gatherings of

people, and taking regulatory actions to disperse the crowd. Such manual intervention in these critical situations might help flatten the curve, but it also brings a unique set of threats to the public and is challenging to the workforce. Many research findings have been reported in the last few years. Social distancing is an effective measure against the novel corona virus Disease 2019 (COVID-19) pandemic. However, the general public is not used to keep an imaginary safety bubble around themselves. Every place where their is high chances of crowd gathering such as a mall or movie theatre or an airport can use this application

3. RELATED WORK

This section highlights some of the related works about human detection using deep learning A number of recent object planning and acquisition activities that include in-depth study are also discussed. Recent reviews have focused on current research that works to find an object using machine learning. The discovery of a person can be considered as the discovery of an object in the computer viewing function of segmentation and the creation of a built environment in video images. In-depth studies have shown research trends in the recognition of a wide range of high-quality materials and the acquisition of artificial intelligence and have achieved outstanding performance in challenging databases. Nguyen et al. presented a comprehensive analysis of state-of-the-art technology with the latest developments and adoption challenges. The research focuses on human interpretations, machine learning, closure, and real-time detection. With visual recognition, techniques using a deep convolutional neural network (CNN) have been shown to achieve high performance on multiple image recognition benchmarks. Deep CNN is an in-depth learning algorithm with multiple multi-layer perceptron neural networks consisting of several convolutional layers, small sample layers, and fully integrated layers. Later, the weight of all the layers in the networks is trained to classify each item based on its database. With object acquisition in imagery, the CNN model was one of the stages in deep learning which are supervised learning methods that are powerful in acquiring an object in a variety of contexts.

CNN has made great strides in the wide range of image-sharing functions thanks to a recently developed computer program and large database such as Image-net. CNN's various types of object detection have been proposed for network design, algorithms and new ideas. In recent years, CNN models like Alex-net, VGG16, InceptionV3, and ResNet-50 are trained to accomplish effects left on object perception. The success of in-depth learning in object recognition is due to its neural network structure that is able to construct an object definition and learn high-quality features that are not directly assigned to the database. In the meantime modern high-tech acquisition equipment had its advantages and disadvantages with accuracy and speed. The object may have a variety of location and feature dimensions within the image.

Therefore, real-time discovery algorithms using an CNN model such as R-CNN and YOLO were further developed to detect multiple classes in a different region in the generated images. YOLO (You Just Look Once) is CNN's most comprehensive discovery feature in terms of speed and accuracy

4. METHODOLOGY

In this project, we are using a YOLO-COCO Detector for our task. We have created 2 different folders one for keeping the detection and configuration and other consisting of the pre-trained model. YOLO-COCO file consists of coco.names, yolov3.cfg, yolov3.weights. We are using the pre-trained models for object detection. Other than the two folders we have kept in the main folder in the main folder we have the main python file which we are going to run in order to check if the program is running successfully or not. The main python file is interconnected internally with the other two files which has configuration and the one which use the trained model to detect the people and label them. When we call the main file it access the webcam of the laptop to take the input of the video file. Once the live video is detected the trained model and configuration file start doing its work and the main file then uses all the feature and detect the people in the frame not following and following social distancing. As per the program their is kept a certain 10 second gap between the pop up of warning notification if the number of people not following social distancing norm increases. The pop up can be seen in the side of the screen by the viewer who is watching the live feed.

5. IMPLEMENTATION DETAILS

5.1 Sequence Design

In the below sequence design you can see how the program begins with reading the frame followed by object detection model, YOLO v3 in this case. Once the object detection begins working using the pre-trained models, it is then followed by checking the social distancing of all the person present in the live video frame which will be detected by the webcam. The choices are made on the basis of the applied condition and accordingly the red or green box will surround the person detected by the pre-trained model in the live video frame which is being currently detected and will send alert on the basis of the count. The alert will be seen by the person that will be monitoring the video at that time and accordingly he or she can take the required actions and measures to make sure that social distancing is being followed. The total count of people not following social distancing that is the people in the red boxes will be seen in the bottom left side of the screen and as per the count when the certain limit is crossed their will be a notification pop up on the bottom right side of the screen in the laptop.

Fig -1: Sequence Design

5.2 Proposed Data Flow diagram

The above mentioned application will run by running a single python file which will be connected with the other two files in the folder and will also have access to the trained model which will be used to detect the people. When we run the social_distance_detector.py file it will use the detection.py file to detect the people and social_distancing_config.py file for the distance at which it has to give the alert.

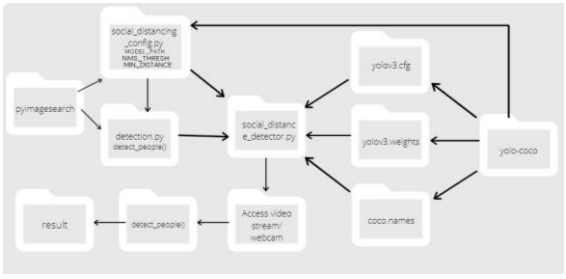

Fig -2: Proposed Data flow diagram

6. RESULTS

Below are some of the snapshots of the output of the working program model. It is categorized into two stages, stage one is where the pedestrians are detected from the inputted video and the total count is displayed in the right bottom corner.In stage two we have added the warning notification which can be seen in the right bottom corner of the screen.

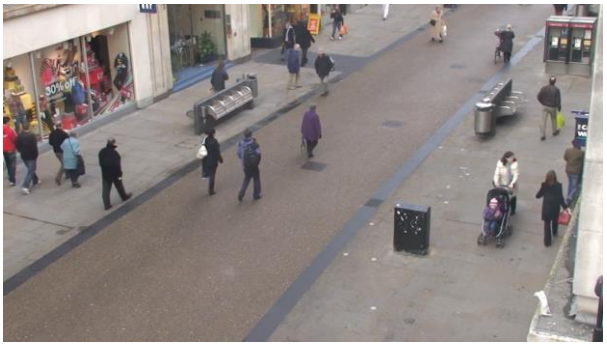

Fig -3: The Video Input

Fig -4: The Stage 1 Detection

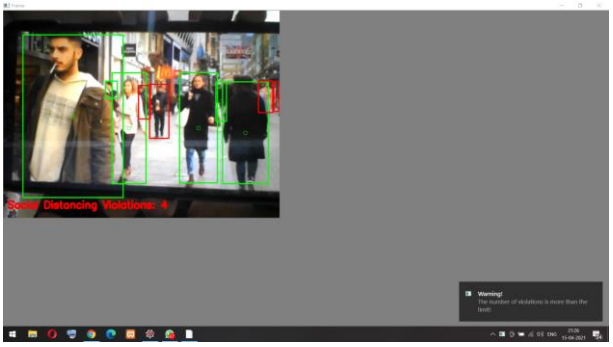

Fig -5: The Stage 2 Detection with Warning Notification

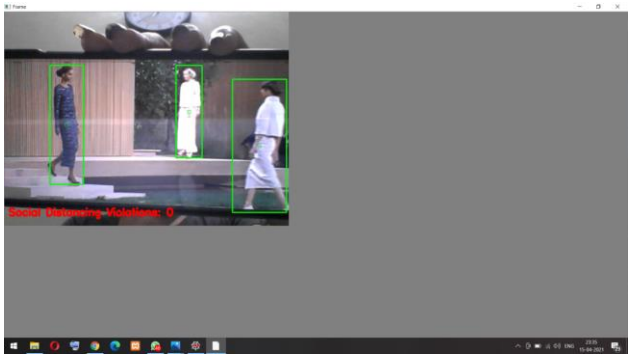

Fig -6: The Stage 2 Detection without Warning Notification As Their Is No Violation

7. CONCLUSIONS

A tool for detecting social deviations using an in-depth learning model is proposed. Using computer vision, the distance between people can be measured and any people who do not obey the law will be shown in red Frame and red line. The proposed approach was confirmed using a video showing pedestrians walking down the street. The visual results showed that the proposed method is It is able to determine measures of social isolation that can be developed for use in other environments such as office, restaurant and school. In addition, the work can be improved by expanding the pedestrian detection algorithm, integrating other detection algorithms such as mask detection and human body temperature detection, improving computer hardware power, and measuring camera view.

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