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Social Distancing Detection withDeep Learning Model

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Abstract: ***The social distancing detection using deep learning is to evaluate the distance between people to mitigate the impact of this coronavirus pandemic. The detection tool was developed to alert people to maintain a safe distance with each other. The open-source object detection pre-trained model based on the YOLOv3 algorithm was employed for pedestrian detection. The distance between people can be estimated and any noncompliant pair of people in the display will be indicated with a red frame. The number of people in an image and video with bounding boxes can be detected via the YOLO method which was employed to detect the video stream taken by the camera. We will be using YOLOv3, trained on COCO dataset for object detection. In general, single-stage detectors like YOLO tend to be less accurate than two-stage detectors and are significantly faster. YOLO treats object detection as a regression problem, taking a given input image and simultaneously learning bounding box coordinates and corresponding class label probabilities.***

I. INTRODUCTION

This work aims to facilitate the enforcement of social distancing by providing automated detection of social distance violation in workplaces and public areas using a deep learning model. This social distancing detection tool was developed to detect the safety distance between people in public spaces. Depending on the present minimum distance, any distance less than the acceptable distance between any two individuals will be indicated with red lines that serve as precautionary warnings. When it comes to deep learning-based object detection, the YOLO model is considered one of the state-of-the-art object detectors which can be demonstrated to provide significant speed advantages suitable for real-time application. Using Real-Time alert we can send an email alert in real-time if the total number of violations (say 10 or 30) exceeded in a store/building, we simply alert the staff. We can set the max violations limit in config (Threshold = 15).

II. TECHNIQUES

A. You Look Only Once (yolov3):

The "You Only Look Once," or YOLO, familyof models are a series of end-to-end deep learning models designed for fast object detection and this approach involves a single deep convolutional neural network (originally a version of Google Net, later updated and called Dark Net based on VGG) that splits the input into a grid of cells and each cell directly predicts a bounding box and object classification. The result is a large number of candidate bounding boxes that are consolidated into a final prediction by a post-processing step.

B. Numpy

NumPy is a Python library used for working with arrays. It also has functions for working in domain of linear algebra, Fourier transform, and matrices.

C. Scipy

SciPy is a scientific computation library that uses NumPy underneath. SciPy stands for Scientific Python. It provides more utility functions for optimization, stats and signal processing. Like NumPy, SciPy is open source so we can use it freely.

D. Imutils

Imutils are a series of convenience functions to make basic image processing functions such as translation, rotation, resizing, skeletonization, and displaying Matplotlib images easier with OpenCV and both Python 2.7 and Python 3.

E. OpenCV

OpenCV-Python is a library of Python bindings designed to solve computer vision problems and makes use of Numpy, which is a highly optimized library for numerical operations with a MATLAB-style syntax. All the OpenCV array structures are converted to and from Numpy arrays. This also makes it easier to integrate with other libraries that use Numpy such as SciPy and Matplotlib.

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F. ArgParse

The argparse module makes it easy to write user-friendly command-line interfaces. The program defines what arguments it requires, and argparse will figure out how to parse those out of sys.argv. The argparse module also automatically generates help and usage messages and issues errors when users givethe program invalid arguments.

III. PERFORMANCE METRICS

We were able to find its precision by testing it in alive webcam and then tested it with a video.

Fig a.1 Sample Output

IV. IMPLEMENTATION

A. Object Detection

Object Detection is a common Computer Visionproblem which deals with identifying and locating objects of certain classes in the image. Interpreting the object localisation can be done in various ways, including creating a bounding box around the object or marking every pixel in the image which contains the objects and we have used the predefined yolov3 for object detection.

B. Frame Capturing

Frames are captured from the camera at regularintervals of time. The captured frame is converted to green or yellow or red based on the distance between 2 people.

C. Detection of Human Object

It is based on your look only once (YOLOv3) architecture and was trained to detect classes, herethe human objects. The detected classes are visualized as detection boxes with the corresponding coordinates: (xmin,ymin),(xmax,ymin),(xmin,ymax),(xmax,ymax) are returned.

1) Steps: Getting detection box from the detection moduleFinding centroid of the detection box Finding Euclidean distance

a) Getting Detection Box From The DetectionModule: The detection module detects the human objects and also returns the bounding box to the distance calculator module

b) Finding Centroid Of The Detection Box: The bounding box consists of the (xmin,ymin,xmax,ymax) from this the midpoint is found using the following formula # use the center (x,y)-coordinates to derive the top # and left corner of the bounding box x = int(centerX - (width /2)) y = int(centerY - (height / 2) # update our list of bounding box coordinates for centroid centroids.append((centerX,centerY))

c) Finding Euclidean Distance: This technique estimates and calculates the distance of all the human as object. This method of distance calculation is used because surveillance cameras are placed at the room corner. dist((x,y),(a,b))=$\sqrt{(x - a)^2 + (y - b)^2}$.

V. OUTPUT

Fig a.2.With Livecam

VI. CONCLUSION

Social distancing is one of the important precautions in reducing physical contact that may lead to the spread of coronavirus. Consequences of non-compliance with these guidelines will be causing the higher rates of virus transmission. A system has been developed using Python and OpenCV library to implement two proposed features. The first feature is on detecting violations of social distancing, while the second feature is on detecting violations of entering restricted areas. Both features have been tested for accuracy. Based on the overall results, this study is seen to meet all of its objectives. However, there are some limitations to the results obtained. Based on the tests performed on the system, the results show that the object detection model used for detecting persons is having the difficulty in detecting people correctly in the outdoor environment and difficult scenes with distant scenes. For further improvement in the future,a better object detection model can be implemented.

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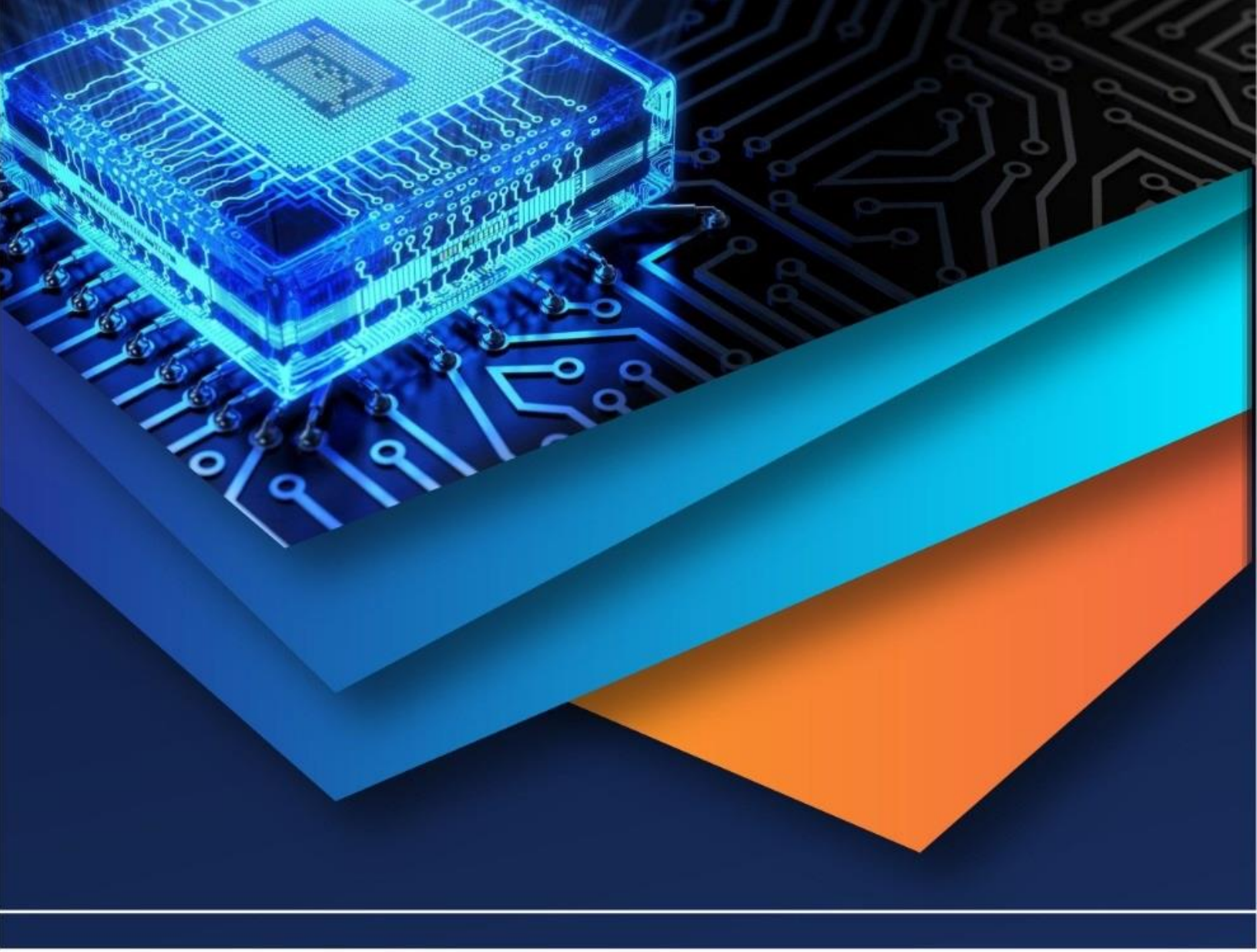

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