

Annexure-1

Social Distancing Detector

A Project Work

Submitted in the partial fulfilment for the award of the degree of

BACHELOR OF ENGINEERING

IN

ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Submitted by:

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DECLARATION

I, **Lokesh Deshwal**, student of **Bachelor of Engineering in Artificial Intelligence and Machine Learning, session: 2018-2022**, Department of Computer Science and Engineering, Apex Institute of Technology, Chandigarh University, Punjab, hereby declare that the work presented in this Project Work entitled '**Social Distancing Detector**' is the outcome of our own bona fide work and is correct to the best of our knowledge and this work has been undertaken taking care of Engineering Ethics. It contains no material previously published or written by another person nor material which has been accepted for the award of any other degree or diploma of the university or other institute of higher learning, except where due acknowledgment has been made in the text.

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Date: 10th December, 2020

Place: Chandigarh

Abstract

COVID-19 has made people learn a new word Social Distance and thereby encouraged people to maintain Social Distancing. Social Distance is a self-explanatory word that means to distance ourselves from everyone around us. Social distance aims in reducing close contact with others like handshakes and hugs. It thereby helps in reducing the spread of contaminated and contagious diseases like the novel COVID-19 these days. People should believe and practice social distancing where ever possible in these harsh times as well if feasible in future. Previously, the models were not able to clearly differ between the two objects standing or sitting all together. This could lead to issues in the model evaluation. Their result will not be accurate and may lead to fake decisions. Our model/project used OpenCV, deep learning and computer vision for the detection of social distancing. Object detection is applied to detect only people from the input video. Then the distances are calculated pairwise among the people and finally the distance between two persons, if it is less than 'n' pixels then a violation is counted else Social Distancing is followed. Our model is capable of segregating people(only) in the input provided along with this, persons in close contact, sitting or standing near each other can be detected easily. Real time input i.e. the video stream can be provided to the model using a webcam or a high definition CCTV camera which enables real time monitoring of the norms to be followed. This model is capable of providing best results in today's COVID-19 situation. This model is no less and no more but it is the need of the hour.

Acknowledgement

I have taken efforts in this project. However, it would not have been possible without the kind support and help of many individuals and organizations. I would like to extend my sincere thanks to all of them.

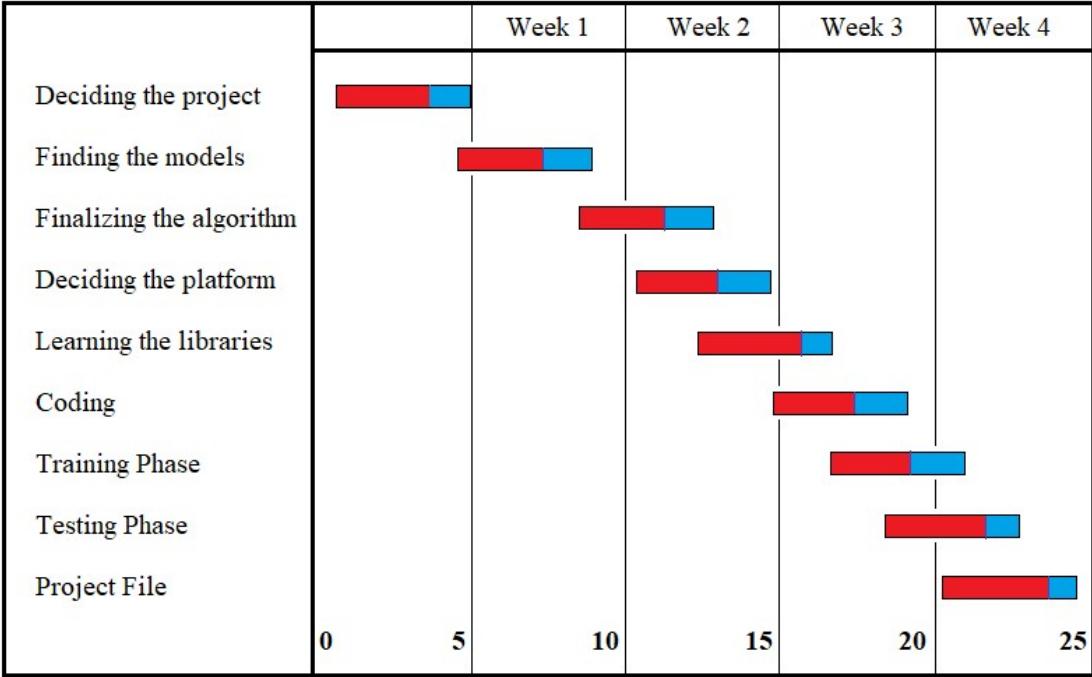
I take this opportunity to express my profound gratitude and deep regards to my teacher **Prof. Shifali Sharma** (Chandigarh University, Gharuan, Punjab) for their exemplary guidance, monitoring and constant encouragement throughout the course of this project. The blessing, help and guidance given by them time to time shall carry me a long way in the journey of life on which I am about to embark.

I would also like to thank my parents and friends who helped me complete this project within the deadline

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1. INTRODUCTION

1.1 PROBLEM DEFINITION

COVID-19 has made people learn a new word Social Distance and thereby encouraged people to maintain Social Distancing. Social Distance is a self-explanatory word that means to distance ourselves from everyone around us. Social distance aims in reducing close contact with others like handshakes and hugs. It thereby helps in reducing the spread of contaminated and contagious diseases like the novel COVID-19 these days. People should believe and practice social distancing where ever possible in these harsh times as well if feasible in future. This Social Distancing Detector basically detects whether social distancing is properly followed in the input provided.

1.2 WHOM IT MAY HELP?

This simple but efficient approach of Social Distancing Detector can be applied in the fields where social distancing is not followed in a strict manner. Shopkeepers can use this model effectively to view the violation of social distancing in their shops/stores. Malls, public places, cinemas can implement Social Distancing Detector for there mere use in detecting whether their norms are being followed by the customers/clients or not.

1.3 PROJECT OVERVIEW/SPECIFICATIONS

This project Social Distancing Detector aims at detecting whether social distancing is being followed under a given input in the form of a video. This project uses OpenCV, Deep learning and computer vision in implementing the Social Distancing. The input is the video or mp4 file of any street or shop where we have moving objects (humans here). After the computational work done at the backend in the code, the output is the objects traced by red and green rectangles. Red illustrates Social Distance Violation and Green represents that the Social Distancing norms are followed. The output also consists of the number of Social Distancing Violations that could help a lot.

1.4 HARDWARE SPECIFICATION

- 1: Camera (High resolution)
- 2: CPU – i3 and above.
- 3: NVIDIA GPU
- 4: Screen

1.5 SOFTWARE SPECIFICATION

- 1: Windows 10 and above.
- 2: Anaconda Jupyter Notebook.
- 3: Python 3

Libraries:

- OpenCV
- Argparse
- Imutils
- os

2. LITERATURE SURVEY

2.1 EXISTING SYSTEM

Various research work has been carried out on social distancing using different techniques. A system was proposed that used raspberry pi4 with a camera to track public spaces in real-time to prevent the spread of Covid-19. The trained model with the custom data set was installed in the raspberry pi4, and the camera was attached to it. It monitors public places and detects whether people keep safe social distances. When the detection of a social distance violation by individuals was detected continuously in threshold time, there rings an alarm that instructs people to maintain social distance and a critical alert is sent to the control center for further action. The method was verified using 3 different pedestrian crowd datasets. But there were some missing detections in the train station dataset, as in some areas the density of pedestrians is very high and occlusion happens. However, after some analysis, they concluded that the maximum pedestrians were captured and the idea of social density is valid. The models were not able to clearly differ between the two objects standing or sitting all together. This could lead to issues in the model evaluation. The result will not be accurate and may lead to fake decisions.

2.2 PROPOSED SYSTEM

Our model/project used OpenCV, deep learning and computer vision for the detection of social distancing. Object detection is applied to detect only people from the input video. Then the distances are calculated pairwise among the people and finally the distance between two persons, if it is less than 'n' pixels then a violation is counted else Social Distancing is followed. Our model is capable of segregating only people in the input provided along with this, persons in close contact, sitting or standing near each other can be detected easily. Real time input i.e. the video stream can be provided to the model using a webcam or a high definition CCTV camera which enables real time monitoring of the norms to be followed. This model is capable of providing best results in today's COVID-19 situation. This model is no less and no more but it is the need of the hour.

3. PROBLEM FORMULATION

COVID-19 is the toughest time the world is suffering through. The mental state of every individual is disturbed due to this pandemic and everyone is in the wait of vaccine. Economy suffered a steep decline and the graph of COVID-19 patient accelerated like a rocket. But all we can do is to maintain Social Distance and wear a mask. Social Distancing is a new problem these days. We have to fight this pandemic but by staying apart. On one side there are people who take all these terms like Social Distancing, wearing mask seriously but a coin has two sides and on the other side people are violating Social Distancing and here is the scenario where this model solves the problem. Social Distancing Detector is a model which is capable of segregating humans and then identifying whether social distancing is followed or not. The model detects humans and then calculate the distance between them by considering the moving people as objects and allocating rectangles to them. If two persons are close enough that the distance among them is less than the set value of 'n' then RED colour is assigned to the rectangle else GREEN which helps us to identify where social distancing is not followed. The output also provides the 'Number of Violations' in the input provided to the model.

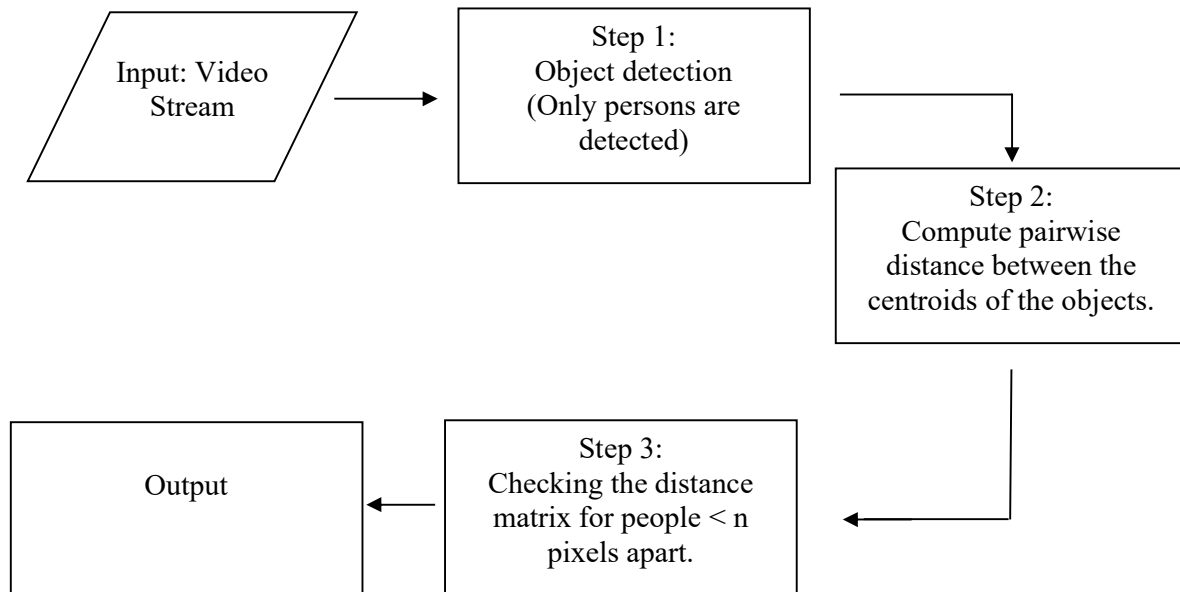


Fig 3.1

The steps for the model as illustrated in fig 3.1 are followed as a framework for the model working. This model is the need of the hours as it can be implemented almost everywhere wherever one want to provide Social Distancing surveillance.

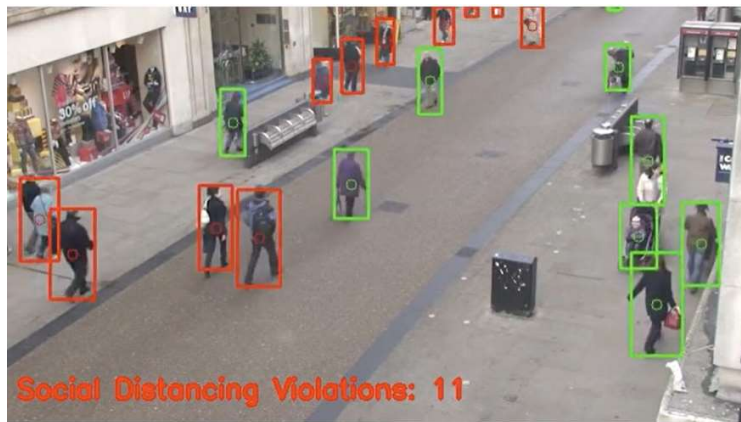


Fig 3.2

Social Distancing detector works as a surveillance system which can be implemented in real life situations where there is need for maintaining social distancing. Fig 3.2 illustrates the output of the Social Distancing Detector model which portrays the working of the model as detecting humans (Fig 3.3) from the input video stream and marking the rectangle as red and green based on the distance calculated by the model.

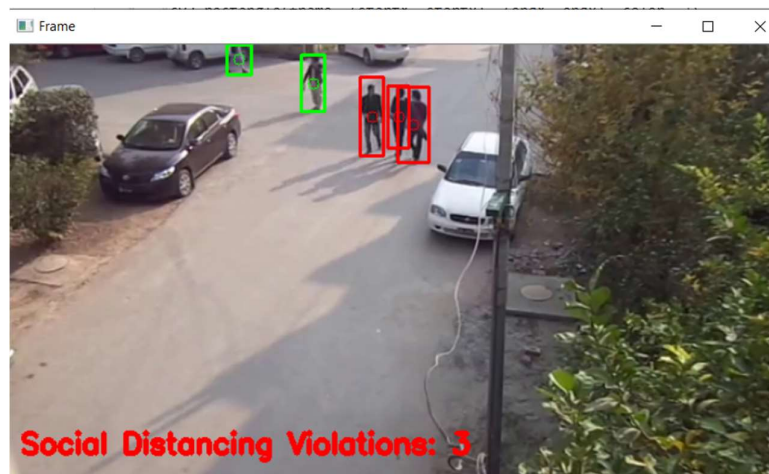


Fig 3.3

4. OBJECTIVES

The research objectives for the Social Distancing Detector can be defined as:

4.1: General Objective: Social Distancing Detector aims at providing accurate results of the given input stream by effectively calculating the distance between the persons and separating them as violation of the norms or social distance is maintained.

4.2: Specific Objectives: The model is based on basically three steps that are

- Object detection (people only)
- Computing pairwise distance between the centroids of the objects (persons) detected.
- Checking the distance, if $< n$ then Social Distancing violated else safe.

4.3: Immediate Objectives: We have proposed this model as this model is the need of the hour. It helps in maintaining social distancing and detecting whether social distancing is followed or not.

5. METHODOLOGY

The following methodology will be followed to achieve the objectives defined for proposed research work:

The model/project used OpenCV, deep learning and computer vision for the detection of social distancing. Object detection is applied to detect only people from the input video. Then the distances are calculated pairwise among the people and finally the distance between two persons, if it is less than 'n' pixels then a violation is counted else Social Distancing is followed. Our model is capable of segregating only people in the input provided along with this, persons in close contact, sitting or standing near each other can be detected easily. The YOLO object detector file includes the convolutional neural network architecture definition, pre trained weights and some class names. This model is compatible with OpenCV DNN module. This YOLO object detector is used to detect people in the input stream. Then the bounding box coordinated are computed and then the centroid is calculated, then scaled the frame dimensions. The input of the video stream can be provided by giving the path else the webcam will be used as an input. The output of the video is must else the video will not be exported to the disk. The violate set maintains the list of people who violates the regulations. Euclidian distance is calculated between the centroids of the boxes. If the distance calculated is violated then it is added to the violate variable or list. The box coordinates are extracted and the boxes are initialised as green colour. The bounding of the persons is drawn and their centroid. The number of violations is displayed on the output screen.

6. CONCLUSION

This project Social Distancing Detector aims at detecting whether social distancing is being followed under a given input in the form of a video. This project uses OpenCV, Deep learning and computer vision in implementing the Social Distancing. The input is the video or mp4 file of any street or shop where we have moving objects (humans here). The model is tested using a video stream and images. Of which, we could see the proper detection of people according to the distance between a pair. The frames were also coloured as Red and Green accordingly. Also, the count of the violations made were counted and were constantly updating. While using the webcam, it is necessary to have people moving continuously else the detection goes incorrect. This could happen due to the detection method, wherein the entire frame is detected, and further, the distance calculation and comparison between the centroids takes place. The results obtained by the model are displayed in Fig 3.2. Our work distinguishes the social distancing pattern and classifies them as a violation of social distancing or maintaining the social distancing norm. Additionally, it also displays labels as per the object detection. The classifier was then implemented for live video streams and images also. This system can be used in CCTV for surveillance of people during pandemics. Mass screening is possible and hence can be used in crowded places like railway stations, bus stops, markets, streets, mall entrances, schools, colleges, etc. By monitoring the distance between two individuals, we can make sure that an individual is maintaining social distancing in the right way which will enable us to curb the virus.

7. REFERENCES

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