

Social Distancing Analyser

A Synopsis Submitted
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Introduction:

With the spread of coronavirus worldwide, as this virus spreads from person to person through their physical contact or through the droplets which fall while people speak it became necessary for the nations to call for the lockdown or being home quarantine in order to prevent the spread of the virus as it is highly contagious.

But it is not always possible to stay indoors and people have to go out for their daily basic necessity therefore the world health organization recommended some guidelines for the prevention of the virus. Among these guidelines the most important guideline was to maintain a safe distance of minimum 6 feet from each other while people are in crowded places. But in a country like India it is not possible for maintaining a safe distance therefore it became necessary to develop a system to detect if the necessary distance is being followed by the people while they are outwards or in a crowded place.

So, **Developing a deep learning model for detecting if social distance with the minimum distance between persons is being followed or not.**

Developing such a system allows the government to check and analyze if proper distance is maintained or not and frame the rules accordingly.

Problem Statement:

In order to check and analyze if the social distance is being obeyed or not, a social distance detection tool has to be developed which will alert the people to maintain proper distance.

Developing the social distancing detection tool using a deep learning model. A video frame from the camera will be given as the input to the object detection model which will be based on YOLO algorithm which will detect the pedestrian. After detecting the people the model will calculate the distance between the people and if the distance between any two people is less than the 6 feet, it will show that area or the people in different color patches(box).

Thus the output of the model will show the people who are not following the social distancing by highlighting them in different color.

Objective & Scope:

- a) Creating a system to detect if social distance is being followed or not.
- b) To detect the people using YOLO object detection algorithm.
- c) Calculate the distance between the two people.
- d) Check if the social distance is followed or not by comparing it with the minimum distance.
- e) Display if social distancing is followed or not by people in boundary boxes.

Literature Survey:

This section highlights some of the related works about human detection using deep learning. Deep learning has shown a research trend in multi-class object recognition and detection. The survey mainly focuses on human descriptors, machine learning algorithms, occlusion, and real-time detection.

Deep CNN is a deep learning algorithm with multilayer perceptron neural networks which contain several convolutional layers, sub-sampling layers, and fully connected layers. For object detection in image, the CNN model was one of the categories in deep learning which are supervised feature learning methods robust in detecting the object in different scenarios. Different CNN models for object detection with its object localization had been proposed in terms of network architecture, algorithms, and new ideas.

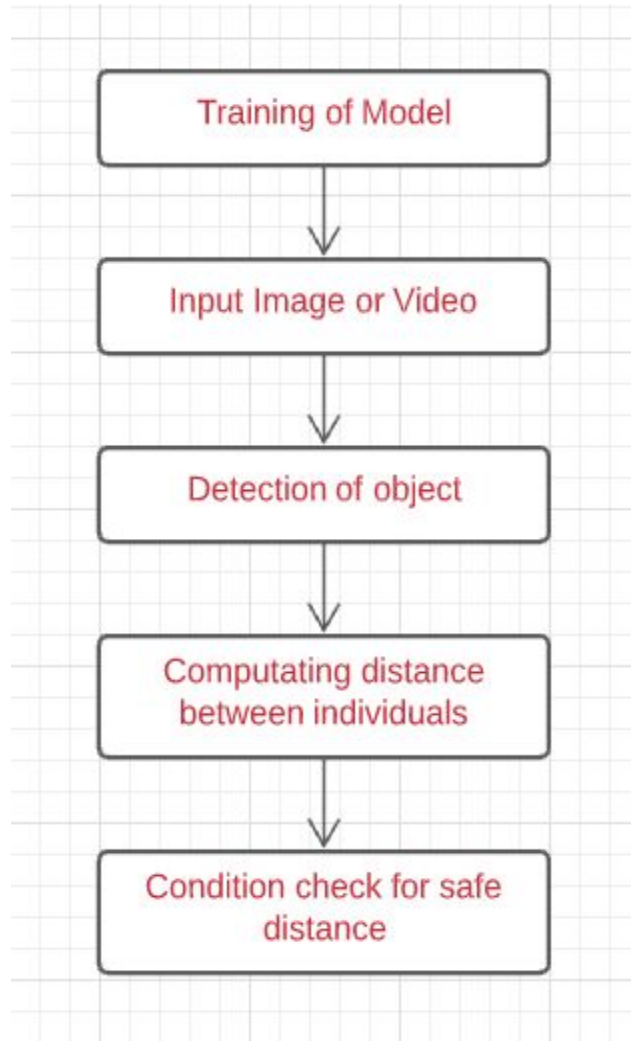
In recent years, CNN models such as AlexNet, VGG16, InceptionV3, ResNet-50 and Single Shot Object Detection (SSD) are trained to achieve outstanding results in object recognition.

Various research work has been carried out on social distancing using different techniques. According to Nagrath, P., Jain, R., Madan, A., Arora, R., Kataria, P. and Hemanth, J., 2021. *SSDMNV2: A real time DNN-based face mask detection system using single shot multibox detector and MobileNetV2* they have used a single shot multibox detector in order to detect the moving people and check if they have been wearing a mask or not and alert accordingly. A similar project has been developed to detect if the social distance is being maintained or not. In this a webcam is used to take the real-time captures of the people and a single shot object detection(SSD) model is used to detect the people in the video. A boundary box is displayed around every person detected. Then the Euclidean distance is calculated between the mid points of the boundary boxes of the detected persons. If the distance between two people is less than 2 metres then the box will be displayed in red color indicating that they are not maintaining social distance. And the people who are maintaining proper distance are shown in green boundary boxes. Since the Single shot object detection model is relatively slower so in this project we will be using YOLO(You Only Look Once)Object detection algorithm which is one of the most effective object detection algorithms. So we will be using YOLO algorithm rather than SSD algorithm which will improve the performance and accuracy of the object detection.

Methodology:

The Social Distancing Analyser is a tool based on the Deep Learning Model that mainly uses CNN(Convolutional Neural Network) method and computer vision techniques. We will be using the Python programming language for implementation of the project.

The pipeline of the methodology for the Social Distancing Analyser :



Firstly, we will train the model by a suitable dataset (that will have images with proper labels) and accordingly will update the model. Then feature extraction will be carried out by a pre-trained convolutional neural network (CNN) model. Image resizing and Data augmentation will be carried out to improve the accuracy by randomly transforming the data while training.

The trained working Model will follow following methodology:

(1)Input :

Image or a Video frame will be given as an input to the model for testing.

(2) Detecting of objects:

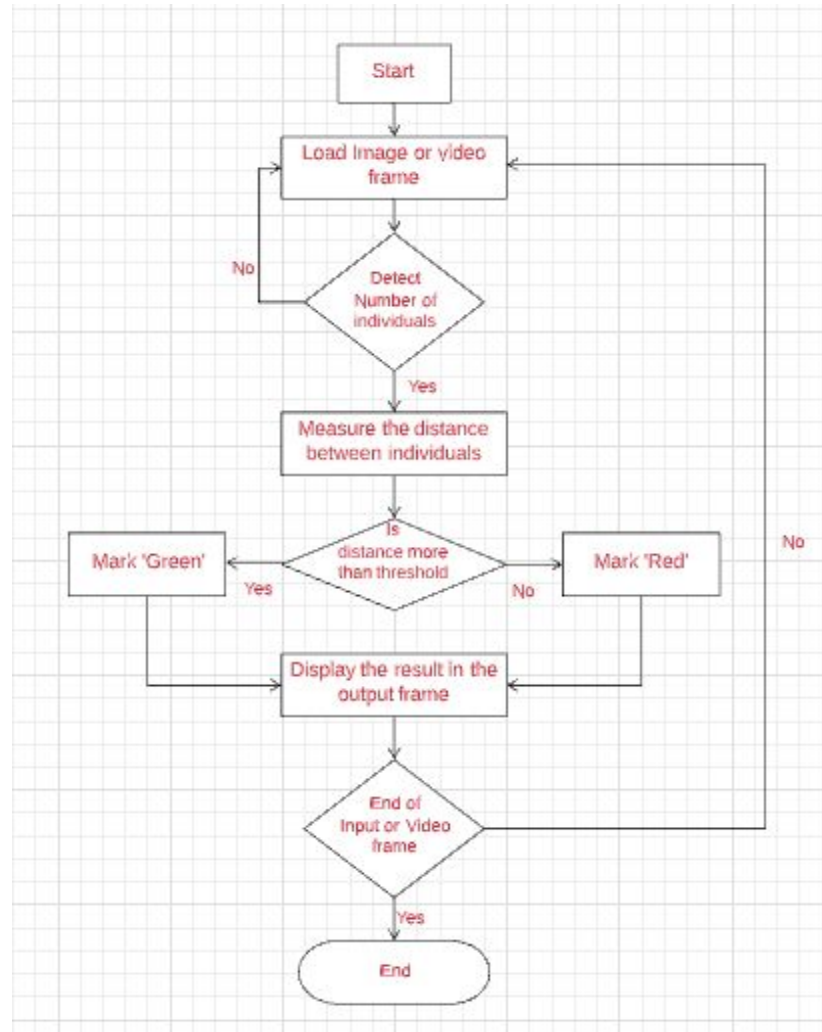
Detection of the objects/people in the input image or video frame will be done by using an object detection network based on the YOLO Model/algorithm which will detect the frame and centroid of each person.

(3) Computation of pairwise distances between centroids:

The distance between individuals will be computed from the top-down view of the input frame. The euclidean distance will be calculated and used to find the distance between centroids. After the comparison of the distance between the centroids of two persons, it is compared with the minimum distance in terms of pixels.

(4) Checking conditions for safe distance:

The pair of individuals whose distance is below the predefined threshold distance, will be marked as unacceptable(red), and the rest will be marked as acceptable(green). Based on these labels, the total number of pairs of individuals violating the social distancing rule will be calculated.



Resources:

Hardware:

CPU - 2.3 GHz Processor and above
RAM - Minimum 4GB
Operating System - Windows 7 or above

Software & language:

Python 3
Pycharm

Github

Main Packages and libraries:

OpenCV

Keras

Tensorflow

Numpy

Scipy

References:

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