



Social Distancing Monitoring System Using Deep Learning.

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Abstract : The main objective of this proposed idea is to provide better control over pandemic by monitoring the social distancing among people when used in certain places via video feed. This system will also be able to detect whether people are wearing a face mask. In 2019 one of the most dangerous pandemic in mankind history the coronavirus disease (COVID-19) has brought global crisis with its global spread of virus to more than 180 countries if no less, and about 3,518,901 confirmed cases along with 247,641 deaths globally as on May 10, 2020. The absence of any active Vaccines and the lack of immunity against COVID19 has made the entire human race/population vulnerable. Since there are no vaccines available yet, Governments from all over world has put certain rules like social distancing and wearing a face mask to fight against this pandemic and to control its spread. Motivated by this notion, this article proposes a deep learning based framework for automating the task of monitoring social distancing using video. This proposed framework utilizes the YOLO v3 object detection pre trained model to detect humans from the background and then track those identified people with the help of bounding boxes and then calculate distance to detect social distancing and it also uses keras/tensorflow Mobilenet SSD model to detect face mask from the objects faces.

I. INTRODUCTION

COVID-19 is the major issue faced by whole world at the present time. The very first covid case was found in Wuhan, China. After which its outbreak was declared in late December 2019, And in and around 114 countries on March 2020. Considering this the WHO declared this as a pandemic. This situation has affected everyone not only physical as well as mentally too. The number of active cases and the deaths are increasing day by day. So far, there was no vaccine made for such kind of virus outbreak. Several Health care organizations are on there verge of making the efficient vaccine that could counter-attack this virus. Though this situation forces the global community to come up with alternate ways to control spread of this deadly virus. So, the social distancing and the face masks, were considered as the major factors/conditions to be followed.

To battle against this COVID-19 virus many remarkable organizations helped with advanced and skilled innovations. For example, Arogya setu application which manually takes information from user and keeps track on it. Also by using computerized methods like CT-Scan reports and X-Ray data the system can recognize the symptoms/expectation of COVID-19 with the assistance/use of man-made consciousness (AI Technology). Where as on other hand certain government organizations are on streets to monitor the public gathering and social distancing so that the spread of corona virus could be controlled. Many rules and measures were declared by the government regarding the gathering in the public places, But many peoples are seen breaching them. Due to these recently the hike of corona cases is increasing day by day. This could be because the inability of public servants to physically monitor at multiple places or also because there's not an appropriate system available for monitoring the social gatherings. Still it's the top priority and concern of the higher authorities to stop corona virus spread and even monitor the measures of social distancing and face masks are being followed

II. LITERATURE SURVEY

[1] In a certain social distancing model that predicts and helps the peoples by alerting them in the public places. In that model they had graphically represented four types of spacing namely intimate space, personal space, social space and public spacing. The spaces were measured on the base of measurement formula like euclidean formula. They used certain methods like scene understanding and geometrical measurement, homograph estimation, metric references and density estimation etc. and the secondary analysis of the model consists of two dimensional people detection along with multi-angle people detection.

[2] In a multi-face detection model that used Supervised machine learning algorithms like Ada-Boost, SVM (support vector machine) and gradient boost models. Here it is clearly certain that these techniques were used to achieve high accuracy with one another. Here the major challenge that they faced was the false positive rate increases in certain.

[3] In a Detection Framework for monitoring the social distancing and face mask in the pandemic situation. They have utilized the pre-trained model of recurrent CNN ie. R-CNN to analyze the different models. The human detection process is done using blob segmentation method. These blobs or the detected objects are tracked with respect to the other objects in this case persons to measure the distance between the them. But the major problem they faced was that the challenge of detecting the person's body object in the outdoor area because of the correlations of other nearby objects . They found this challenge need to be solved in further research.

III. PROPOSED SYSTEM

This system is used to predict objects like people and then using those object detect social distancing from background not only that it will also detect face of those people detected and will check whether they are wearing any face mask. The system accepts inputs like video feed or live video feed from webcam and process the inputs to predict the objects. This system will predict the person object using pre-trained model of YOLO v3 model (You only look once) which is a fast and efficient deep learning model. After predicting objects ie. Person objects it will track those objects and then calculate the distance between the peoples to find out which people are not following the social distancing rule. It will also check for a face mask using MobileNet SSD pretrained model, it will first detect the facial region in each frame of the video, then the desired region of interest (ROI) within the face bounding box will be chosen .

A. YOLO v3(You only look once)

Object detection is one of the important problem in computer vision where you have to detect classify what objects are present inside the given image or video frame. The problem of the object detection is more complex than the classification problem which also can recognize objects but doesn't indicate where the object is located in the image or frame . Also the classification doesn't work on images with multiple objects or the frame containing more number of objects. Therefore Deep Learning algorithms were created to detect objects in a frame or image. There are many Deep learning algorithms like ANN, RCNN ,CNN, Faster RCNN etc.

YOLO is one of the most efficient object detecting algorithm. YOLO uses a totally different method than RCNN or CNN. YOLO is a clever convolutional neural network for doing object detection in real time. This method can predict the type and location of an object by looking only once at the image. The network does not look at the complete image. Instead, parts of the image which have high probabilities of containing the object .The algorithm applies a single neural network to the full image and then divides the image or the frame into different regions and this helps it to predict and detect different bounding boxes and probability for different regions and objects. This bounding boxes are weighted by the predicted probabilities.

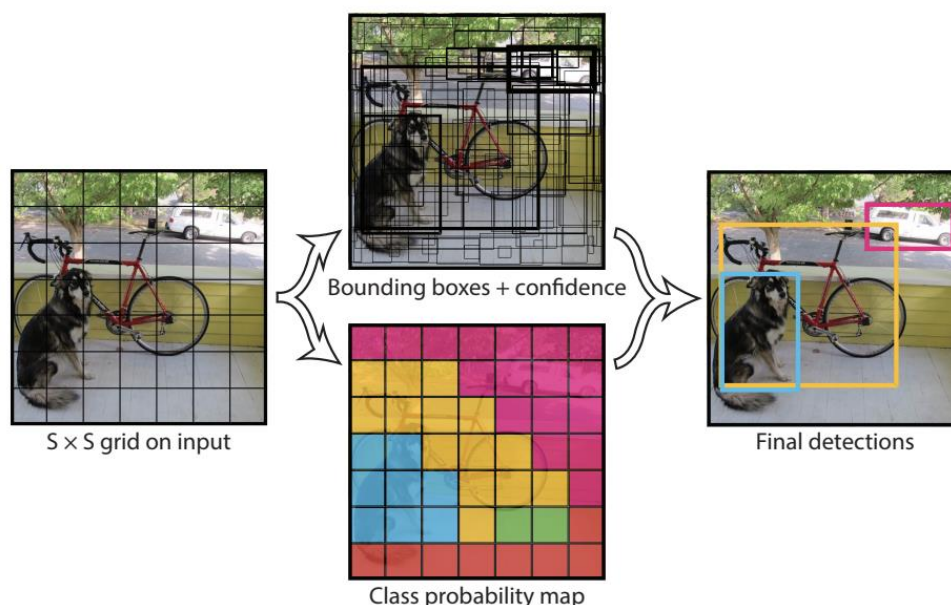


Fig. How YOLO works

YOLO is more popular than other Deep learning algorithms because its more accurate than any other while it is also able to run in real-time. This algorithm in sense only look once at the image which means that it requires only one forward propagation pass through the neural network to make predictions. It uses non-max suppression which make sure that the algorithm only detects each object once and then detects objects with the bounding boxes.

YOLO in depth uses the CNN algorithm which simultaneously predicts multiple boxes and class probabilities for those boxes. These YOLO model has multiple advantage over the other deep learning object detection algorithms:

- 1.YOLO is extremely fast.
- 2.YOLO sees the entire image /frame during training and test time so it implicitly encodes contextual information about classes as well as their appearance.
- 3.YOLO learns generalizable representations of the objects so that when trained on natural images and testes on artwork the algorithm outperforms other detection method.

B. SSD Mobile-Net

The SSD (Single shot Detector) is a framework which consists different base architecture. Here in this system we are using Mobile-Net SSD to detect Face Mask. Keras / Tensorflow is one of the most famous object detector API which has many pre-trained model , one of it is the Mobile-Net SSD model.

The SSD architecture is a single convolution network that learns to predict boundary boxes locations and classify these location in one pass. The Mobile-Net model is based on depth wise separable convolution which are the form of factorized convolution called a pointwise convolution. For real-time processing, SSD further improves the accuracy and FPS by using multiscale features and default boxes in a single process. It follows the principle of the feed-forward convolution network which generates bounding boxes of fixed sizes around the face detected and then extract all the ROI feature along with a score .

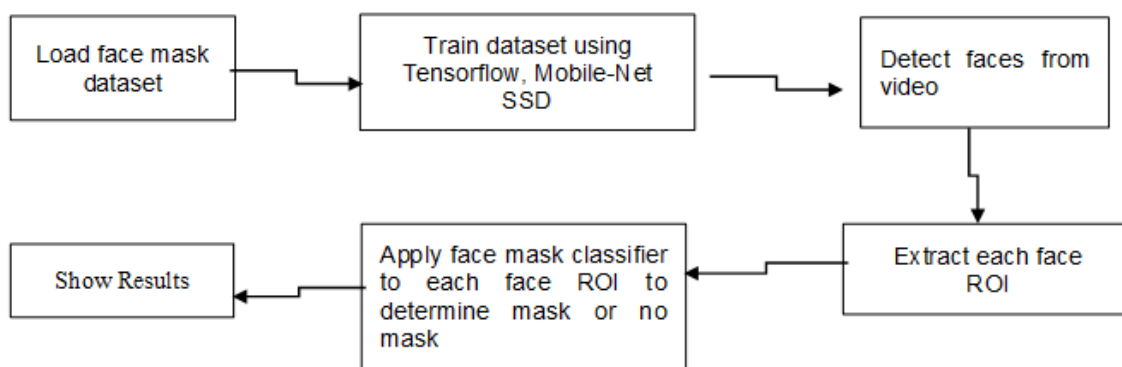
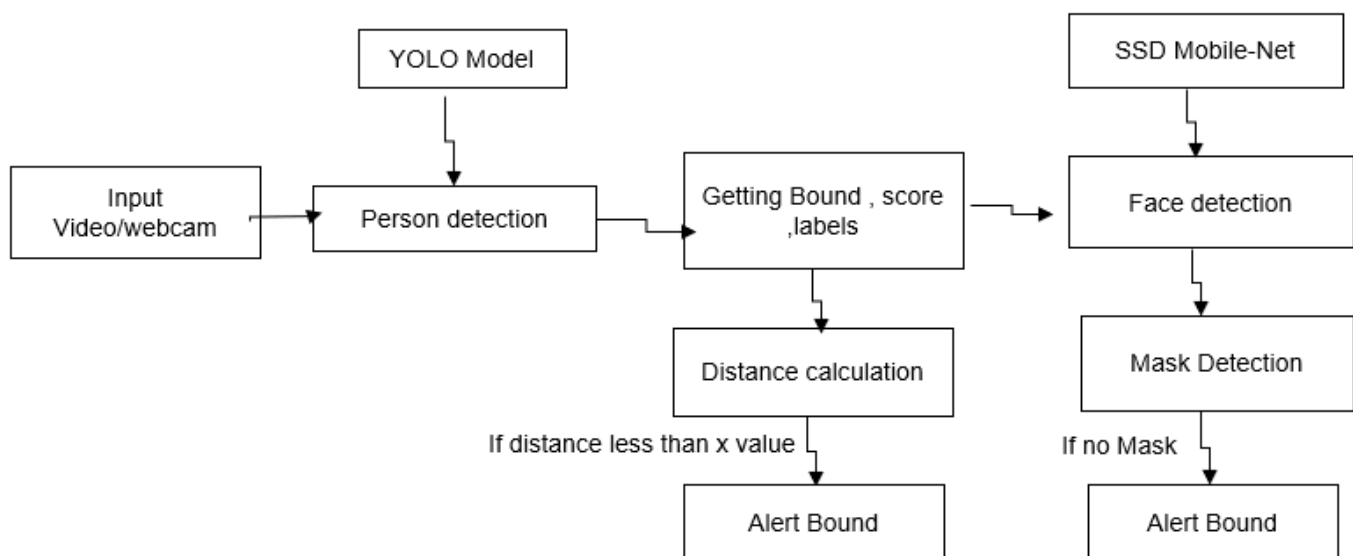


Fig. Basic face detection flowchart using Mobile-Net SSD

IV. PROPOSED SYSTEM ARCHITECTURE



V. CONCLUSION

The concept of Social Distancing is new to the world. As many research is going on to provide better control over the Pandemic via different technologies .Research on detecting the Social Distancing and Mask using Deep learning are still going on in hopes of providing better accuracy and better results .The research can be further extended by implementing the robust prediction system and real time monitoring of face mask detection system with large data size. The proposed model also needs to be implemented in large outer coverage area to increase the accuracy of the prediction model with respect to improving the training model.

