

# AUTOMATIC SOCIAL DISTANCING AND FACE MASK VIOLATION DETECTION IN PANDEMIC SITUATION USING YOLO & TENSOR FLOW

Diksha Yadav<sup>1</sup>, Jeetendra Singh Yadav<sup>2</sup>

<sup>1</sup> M.Tech Scholar, Department of Computer Science & Engg, B.E.R.I., Bhopal, M.P., India

<sup>2</sup> Assistant Professor, Department of Computer Science & Engg, B.E.R.I., Bhopal, M.P., India

## ABSTRACT

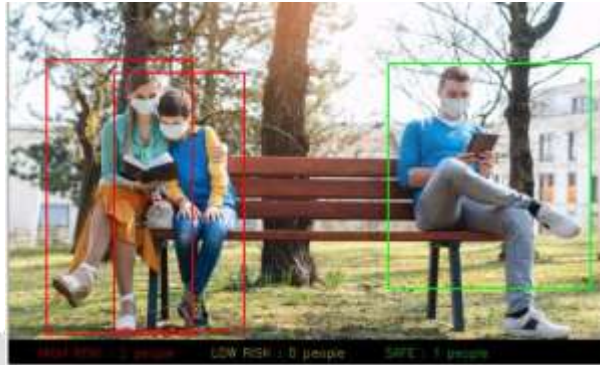
*Virus epidemics might be moderated if individuals consent to orders to remain at home and stay away from strangers in the open. All things considered, there is general well-being interest in social distancing consistency. The accessible proof on distancing rehearses out in the open space is restricted, be that as it may, by the absence of observational information. Consistency with 1.5 meter distance orders is brief and harmonizes with the quantity of individuals in the city and with consistency to remain at-home orders. Expected ramifications of these discoveries are that keep-distance mandates may work best in mix with stay-at-home orders and spot explicit group control methodologies, and that the quantity of individuals in the city and local area wide portability as caught with cell information offer effectively quantifiable intermediaries for the degree to which individuals stay away from others at explicit occasions and areas. Here the system uses Yolov3 and Tensorflow for implementation. Yolov3 is precompiled library through which object classification can be done in a very effective manner as compare to the other conventional techniques. Tensorflow helps Yolo to classify the objects with high preciseness. System is able to detect pedestrian with high level of accuracy and it has been designed to detect the social distancing rule violation as per their physical distance which has been measured as per their appearance. System achieved 93.84% of accuracy.*

**Keyword:** - Social Distancing Rule Violation Detection, Physical Distancing, Yolov3, Machine Learning, CORONA Virus, Tensorflow, Computer Vision, Artificial Neural Network.

## 1. INTRODUCTION

COVID-19 has a place with the group of CORONAVIRUS caused sickness, at first revealed at Wuhan, China, during late December 2019. On March 11, it spread more than 114 nations with 118,000 dynamic cases and 4000 deceased, WHO pronounced this a pandemic [1], [2]. On July 16, 2021, more than 189,785,636 cases and 4,084,260 deceased had been accounted for around the world. A few medical services associations, clinical specialists and researchers are attempting to foster legitimate medications and antibodies for this dangerous virus, however till date, no achievement is accounted for. The present circumstance powers the worldwide local area to search for substitute approaches to stop the spread of this irresistible virus. Social distancing is asserted as the best spread plug in the current situation, and all influenced nations are secured to carry out social distancing. This examination is intended to help and alleviate the coronavirus pandemic alongside least loss of monetary undertakings, and propose an answer for distinguish the social distancing among individuals assembled at any open spot. "Social distancing" is best practice toward endeavors through an assortment of means, intending to limit or interfere with the transmission of COVID-19. It targets diminishing the actual contact between conceivably tainted people and solid people. According to the WHO standards [3] it is recommended that individuals ought to keep up with somewhere around 6 feet of distance among one another to follow social distancing. A new report shows that social distancing is an important regulation measures and fundamental to forestall SARS CoV-2, since individuals with gentle or no indications may for tuitously convey corona contamination and can taint others [4]. It demonstrates that legitimate social distancing is the most ideal approach to diminish irresistible actual contact, thus

lessens the contamination rate [5]. This decreased pinnacle may doubtlessly coordinate with the accessible medical services foundation and help to offer better facilities to the patients engaging against the coronavirus pandemic. The study of disease transmission is the investigation of elements and purposes behind the spread of irresistible infections. To consider epidemiological marvels, numerical models are consistently the most favored decision.



**Figure-1:** Social Distancing Detection

In any case, an absence of spatial mindfulness may cause accidental infringement of this new measure. Against this background, we propose a functioning reconnaissance framework to moderate the spread of Coronavirus by notice people in a district of-premium. Our commitment is twofold.

In the first place, we present a dream based ongoing framework that can identify SD infringement and send non-meddling general media signs utilizing cutting edge profound learning models. Second, we characterize a novel basic social thickness worth and show that the possibility of SD infringement event can be held almost zero if the walker thickness is held under this worth. The proposed framework is additionally morally reasonable: it doesn't record information nor target people, and no human manager is available during the activity. The proposed framework was assessed across genuine world datasets.

## 2. RELATED WORKS

Narinder Singh Punn et al. [6] proposes an effective constant profound learning based system to robotize the way toward observing the social distancing by means of item identification and following methodologies, where every individual is recognized in the continuous with the help of jumping boxes. The created jumping encloses help recognizing the bunches or gatherings of individuals fulfilling the closeness property registered with the assistance of pairwise vectorized approach. The quantity of infringement are affirmed by registering the quantity of gatherings shaped and infringement record term processed as the proportion of the quantity of individuals to the quantity of gatherings. The broad preliminaries were led with mainstream best in class object identification models: Quicker RCNN, SSD, and YOLO v3, where YOLO v3 delineated the productive execution with adjusted FPS and Guide score. Since this methodology is profoundly delicate to the spatial area of the camera, a similar methodology can be tweaked to all the more likely change with the comparing field of view. Sreetama Das et al. [7] proposed a framework where the execution of social distancing in broad daylight places is a significant methodology for guaranteeing individual wellbeing and work environment security, until antibodies and medications become accessible in enormous volumes for mass use. This work talks about a PC vision based methodology for social distancing observation, including a mechanized camera alignment technique for simple organization at scale. We propose the utilization of time based edges to recognize transient and industrious infringement of social distancing strategy and use measurements like infringement bunches to evaluate hazard. Hendra Adinanta et al. [8] proposed the rule of work that is to be distinguish people, then, at that point to evaluate the physical distancing infringement from their distance. The vast majority of the scientists have attempted to use object identification strategies, for example, quicker RCNN, Yolo, and SSD to recognize people from the edge. Those strategies depend on, the help of Designs Handling Unit (GPU) to execute their hefty calculation. In this works, we propose social distancing checking by applying foundation deduction strategies dependent on Gaussian Blend Models (GMM) for example Geo metric Multigrid (GMG), k- Closest Neighbor (KNN), Combination of Gaussian (MOG), and Combination of Gaussian 2 (MOG2). These techniques have been utilized to channel people from the casing with computational

interaction. A few boundaries assessment measures have been resolved to check the best strategy appropriate for this works. As far as execution, better strategies are positioned as KNN, MOG, MOG2, and GMG.

Zhenfeng Shao et al. [9] proposed a lightweight person on foot discovery network which can precisely identify walker by human head progressively, and afterward determined the social distancing of every common on UAV pictures. Our person on foot identification network comprises of three sections, PeleeNet, multi-scale spatial consideration module and recognition layer. To investigate the highlights of little size object like human head, we combine three sizes of highlight maps ( $19 \times 19$ ,  $38 \times 38$ ,  $76 \times 76$ ) by deconvolution and link. The spatial consideration module is especially used to improve the element data and disregard the unimportant data. Then, at that point the area of human head is anticipated in discovery layer. We contrasted our strategy and the best in class object identification techniques (SSD model and YOLOv3 model) on a combined human head dataset. The test results show that our technique accomplishes 92.22% AP and 76 FPS, which turns out exact and ongoing discovery in real applications. Particularly, the removal tests show that multi-scale highlight and spatial consideration can significantly work on the presentation of walker location. The test results on UAV Head dataset show that our strategy can likewise accomplish high exactness walker recognition on UAV pictures with 88.5% AP and 75 FPS. Afiq Harith Ahamad et al. [10] proposed a work for identification of individuals social distance observing as a careful step in diminishing actual contact between individuals. This examination centers around recognizing individuals in spaces of interest utilizing the MobileNet Single Shot Multibox Locator (SSD) object following model and OpenCV library for picture preparing. The distance will be registered between the people identified in the caught film and afterward contrasted with a fixed pixels' qualities.



**Fig -2:** System GPU [10]

Savyasachi Gupta et al. [11] proposed a system to use the Cover R-CNN profound neural organization to recognize individuals in a video outline. To reliably recognize whether social distancing is worked on during the association between individuals, a centroid following calculation is used to follow the subjects throughout the recording. With the guide of valid calculations for approximating the distance of individuals from the camera and between themselves, we decide if the social distancing rules are being clung to. The structure achieved a high exactness esteem related to a low bogus alert rate when tried on Custom Video Film Dataset (CVFD) and Custom Individual Pictures Dataset (CPID), where it showed its adequacy in deciding if social distancing rules were polished. Yew Cheong Hou et al. [12] proposed a strategy of social distancing identification device utilizing a profound learning model. By utilizing PC vision, the distance between individuals can be assessed and any resistant pair of individuals will be demonstrated with a red casing and a red line. Shi-hui Zhen et al. [18] proposed a system which is based on Deep learning method. Author used CNN to develop an in-depth study system (DLS) to classify liver tumors based on clinical data, including improved MR images, improved MR images, and text and laboratory test results. Using data from 1,210 patients with liver tumors ( $N = 31,608$  images), we trained CNLs to obtain seven-way classification, binary classification, and three-way malignant-classification (Model-A-Model G). Samples were validated in an externally independent extended group of 201 independent patients ( $N = 6,816$  images). Mohd. Aquib Ansari et al. [13] proposed an article recommends profound learning based human recognition procedures to screen social distancing in the ongoing climate. These methods have been created with the assistance of profound tangled organization that has utilized sliding window idea as an area proposition. Further, they are utilized with the social distancing calculation to gauge the distancing standards among

individuals. This assessed distancing measures choose whether two people groups are following social distancing standards or not. The broad analyses were performed with CNN based article finders. In experiments, it is discovered that CNN-based item discovery models are preferred in precision over others. In some cases, it delivers some bogus positive examples when managing constant video successions.

Zhiming Chen et al.[14] proposed a system with regards to the Coronavirus pandemic, author foster a self-ruling observation robot framework to advance social distancing. The robot framework is chiefly made out of social distance identification, metropolitan route, and smart voice collaboration. The legged robot shows great variation to various territory with the goal that they can function admirably in human existence situations. This present reality try additionally exhibits that our robot effectively maintains human's social separation. In this end, we effectively convey the framework in a genuine climate to forestall the spread of Coronavirus. Meirui Qian et al. [15] proposed a social distancing included keeping a distance of 1.5 m between individuals, which can forestall the spread of most respiratory irresistible sicknesses. Social distancing is perhaps the best measures to diminish the spread of the infection, which is communicated via air drops. The drops created by hacking, sniffing or constrained talking have a specific transmission distance. By maintaining this separation, we can decrease the spread of the infection.

### 3. PROBLEM IDENTIFICATION

This paper reviewed various implemented systems that detect social distancing rule violations using CNN, DNN, SSD Filtration and many more. Most of the system uses CNN and a training model for creating templates that later match for nearest classification. But there is no appropriate model for actual feature extraction, instead of that it can be achieved through Tensorflow or any object classifier along with various pre-processing models. Most of the system uses machine learning methods to train the system with various samples. But a large dataset can consume the large amount of memory that increases the execution time where it is very important to communicate as earlier as possible with high level of accuracy. So the feature extraction step is enough depending on the area where the violation is detected. So, appropriate segmentation algorithm is required which can be effectively detecting the social distancing rule violations. Hendra Adinanta et al. [8] proposed a system that uses KNN, MOG, MOG2, and GMG for classifying pedestrian and their social distancing. System uses background subtraction methodology for detecting pedestrian and social distancing with various samples of social distancing frames. But background subtraction model is very conventional and based on binary model. Binarization of an image may erode the information from the image that degraded the accuracy of the system. It is not enough capable to dealing with irregular crowd or backgrounds. Background subtraction model is poor for crowd based image and hard to predict correct decision on the basis of that. System achieved 9.00%, 8.67%, 7.49%, and 5.74% respectively accuracy which could be bit higher. The system can be enhanced in by implementing it with Yolo and tensor flow, which acquire good accuracy and minimal false alarm rate. Because as per the ideal system, accuracy is an important parameter, that is why accuracy of system can be enhanced with Yolo and Tensorflow.

### 4. PROPOSED IMPLEMENTATION

Here the system uses Yolov3 and Tensorflow for detecting the social distancing rule violations from various frames. A component extractor will in general encode the model's contribution to certain element portrayal which helps in learning and finding the examples related with the ideal items. To recognize various objects of shifting scale or size, it additionally utilizes predefined boxes covering a whole picture named as anchor boxes. These cases are overlaid on the info images over different spatial areas (per channel) with shifting sizes and angle proportion. In this article for a picture of measurement breadth (b)  $\times$  height (h) the anchor encloses are created the accompanying way. Think about the boundaries, size as p (0, 1) and viewpoint proportion as  $r > 0$ , then, at that point the anchor confines for a specific area a picture can be developed with measurements as  $bp\sqrt{r} \times hp\sqrt{r}$ . For object recognition, another contender of SSD is YOLO. This technique can anticipate the sort and area of an item by looking just a single time at the picture. YOLO considers the article discovery issue as a relapse task rather than characterization to allot class probabilities to the anchor boxes.

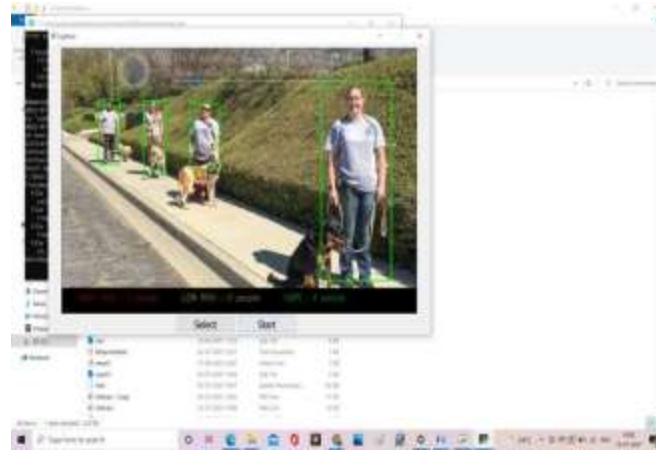


Fig. 3. Proposed System

A solitary convolutional network all the while predicts various bounding boxes and class probabilities. Significantly, there are three variants of YOLO: v1, v2 and v3. YOLO v1 is roused by GoogleNet (Commencement organization) which is intended for object grouping in a picture. This organization comprises of 24 convolutional layers and 2 completely associated layers. Rather than the Commencement modules utilized by GoogLeNet, YOLO v1 basically utilizes a decrease layer followed by convolutional layers. Afterward, YOLO v2 is proposed with the goal of further developing the precision altogether while making it quicker. YOLO v2 utilizes Darknet-19 as a spine network comprising of 19 convolution layers alongside 5 max pooling layers and a yield softmax layer for object characterization. YOLO v2 beat its archetype (YOLO v1) with huge enhancements in Guide, FPS and item arrangement score. Conversely, YOLO v3 performs multi- mark grouping with the assistance of strategic classifiers as opposed to utilizing softmax as if there should arise an occurrence of YOLO v1 and v2.

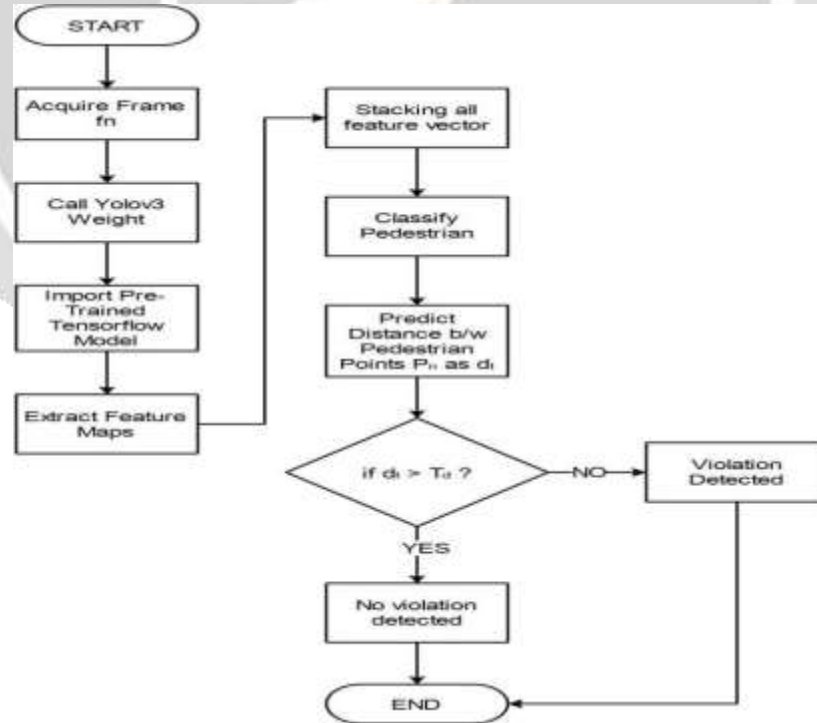


Fig. 4. Proposed System

In YOLO v3 Redmon et al. proposed Darknet-53 as a spine engineering that concentrates highlights maps for characterization. As opposed to Darknet-19, Darknet-53 comprises of lingering blocks (short associations) alongside the up sampling layers for connection and added profundity to the organization. YOLO v3 produces three expectations for each spatial area at various scales in a picture, which dispenses with the issue of not having the option to identify little items effectively. Every one of the models accessible on the Tensorflow article recognition model zoo have been prepared on the COCO dataset (Normal Items in Setting). This dataset contains 120,000 pictures with an all out 880,000 named objects in these pictures. These models are prepared to distinguish the 90 distinct kinds of articles named in this dataset. In the wake of calling this capacity on each casing, a rundown containing every one of the new changed focuses is returned. From this rundown I needed to process the distance between each pair of focuses. These days, social distancing alongside other essential clean measures are vital to keep the spread of the Covid-19 as lethargic as could really be expected. Yet, this task is just a proof of idea and was not made to be use to screen social distancing openly or private regions in view of moral and protection issues. As per the flowchart as in Fig. 4, first of all a frame has to be acquired for processing. Then system will call the yolov3 weight along with tensorflow. Then feature maps will be extracted and all feature vectors will be stacked as the size of the object and their appearance. Then system classifies the objects and focuses on pedestrian only. Then system predicts the distance between the various pedestrians and if that computed distance is greater than the threshold value, it means that pedestrian follows the social distancing rule otherwise they are violating the rules and system indicates both the situations accordingly.

### A. Yolov3 & Tensorflow Weight Model

Input: Datasets

Output: Distance Prediction

#### Step 1. Import data

$D = \{x_n, y_n\}$  is a dataset

#### Step 2. Transform and normalize data by mean, standard deviation and float to integer

$$\sigma = \sqrt{\frac{1}{N} \sum_{i=1}^N (x_i - \mu)^2}$$

Where  $\mu$  is mean,  $N$  is total no. of dataset,  $x_i$  is an individual value

$(1 - 2s) \times (1 + f) \times 2^e$

$s$  is the sign bit (0 or 1),  $f$  is the mantissa and  $e$  is the biased exponent

#### Step 3. Initialize the parameters for generating bounding boxes as the predicted detection outputs

#### Step 4. Set Parameters $W$ and $b$ as tensorflow variables.

#### Step 5. Load the model and classes as yolov3.weights

#### Step 6. Built Computation Graph

#### Step 7. Compute distance between the pedestrian points as $d_t$

#### Step 8. if $d_t > T_d$ then

No Violation Detected;

else

Violation Detected;

end else

end if

#### Step 9. End

## 5. RESULT ANALYSIS

The result has been computed on the basis of various tests. Various frames have been tested and evaluated the information as per the social distancing rule. There are four parameters True Positive (TP), True Negative (TN), False Positive (FP) and False Negative (FN).

**Table No. I Result Analysis**

Terms	Outcomes
True Positive	646
True Negative	19
False Positive	56
False Negative	16
Frames	305

$$\text{Accuracy} = \frac{TP+FP}{TP+TN+FP+FN} * 100 \%$$

$$\text{Accuracy} = 95.25 \%$$

If a frame contains pedestrian with following the social distance and system detected it positively then it encountered in the category of true positive but if system detect the same as violating the rule then it comes in the category of true negative. If a frame contains pedestrian with violating the social distancing and system detected it positively then it encountered in the category of false positive but if system detect the same as following the rule then it comes in the category of false negative.

**Table No. II Result Comparison**

Method	Average Detection Rate
GMG [8]	4.79
MOG [8]	5.74
MOG2 [8]	8.67
KNN [8]	9.00
<b>Yolov3 &amp; Tensorflow (Proposed)</b>	<b>9.52</b>

## 6. CONCLUSION & FUTURE SCOPE

Here the system has been implemented through Tensorflow and Yolov3 that efficiently recognizes the pedestrian along with social distancing rule violations. System pertains pedestrian classifier more efficiently using Tensorflow model. System achieved 95.25 % of accuracy with minimal false alarm rate. The system can be enhanced in future by implementing it with different techniques and filters, which may acquire good accuracy and minimal false alarm rate. Because as per the ideal system, accuracy is an important parameter, that is why accuracy of system can be enhanced in future with different techniques or filters like Yolov4 and Keras.

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