# Social Distancing Detection using Deep Learning Model

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***Abstract*: Social distancing is possibly the only way to contain the spread of COVID-19. Recently, AI teams are created Social Distancing Tools using the concepts of Computer Vision. This project is inspired by their work. This project proposes a methodology to detect social distance using deep learning for the evaluation of distance between people to mitigate the impact of this corona virus pandemic. The detection tool was developed to alert people to keep safe distance among each other by evaluating a video input feed. The video frame from the 'avi' file was given as input, and the object detection pre-trained model based on the YOLOv3 algorithm was employed for pedestrian detection. Then, the video frame was transformed into top-down view for distance measurement from the 2D plane. The distance between people can be estimated and any noncompliant pair of people in the display will be indicated with a red frame and red line. The proposed method was validated on a pre-recorded video of pedestrians walking on the street. The output result shows that the proposed method is able to determine the social distancing measures between multiple people in the video. The developed technique can be further developed as a detection tool in real time application. The project is designed using Python 3.5.2 with opencv-python 4.2.0.**

***Keywords*: Social Distancing, Pedestrian Detection, Deep Learning, Convolutional Neural Network**

## 1. Introduction

In Social Distancing Detector, the weights of the YOLO v3 Object Detection Algorithm and the COCO dataset are used which are easily available online. Additionally, the main library being used will be the Open CV along with the Deep Neural Network (dnn) module.

When the novel coronavirus (Covid-19) pandemic emerges, the spread of the virus has left public keep anxiety if they do not have any effective cure. The World Health Organization (WHO) has declared Covid-19 as a pandemic due to the increase in the number of cases reported around the world. To contain the pandemic, many countries have implemented a lockdown where the government enforced that the citizens to stay at home during this critical period. The public health bodies such as the Centers for Disease Control and Prevention (CDC) had to make it clear that the most effective way to slow down the spread of Covid-19 is by avoiding close contact with other people.

To flatten the curve on the Covid-19 pandemic, the citizens around the world are practicing physical distancing. To implement social distancing, group activities and congregations such as travel, meetings, gatherings, workshops, praying had been banned during the quarantine period. The people are encouraged to use phone and email to manage and conduct events as much as possible to minimize the person-to-person contact.

To further contain the spread of the virus, people are also informed to perform hygiene measures such as frequently washing hands, wearing mask and avoiding close contact with people who are ill. However, there is a difference between knowing what to do to reduce the transmission of the virus and putting them into practice. The world has not yet fully recover from this pandemic and the vaccine that can effectively treat Covid-19 is yet to be discovered. However, to reduce the impact of the pandemic on the country's economy, several governments have allowed a limited number of economic activities to be resumed once the number of new cases of Covid-10 has dropped below a certain level.

As these countries cautiously restarting their economic activities, concerns have emerged regarding workplace safety in the new post-Covid-19 environment. To reduce the possibility of infection, it is advised that people should avoid any person-to-person contact such as shaking hands and they should maintain a distance of at least 1 meter from each other. In Malaysia, the Ministry of Health Malaysia (MOHM) has recommended several disease prevention measures for workplaces, individuals, and families at home, schools, childcare centres, and senior living facilities.

These measures include implementing social distancing measures, increasing physical space between workers at the workplace, staggering work schedules, decreasing social contacts in the workplace, limiting large work-related gatherings, limiting non-essential work travel, performing regular health checks of staff and visitors entering buildings, reducing physical activities especially for organizations that have staff in the high-risk category, and conducting company events or activities online. Individuals, communities, businesses, and healthcare organizations are all part of a community with their responsibility to mitigate the spread of the Covid-19 disease.

In reducing the impact of this coronavirus pandemic, practicing social distancing and self-isolation have been deemed as the most effective ways to break the chain of infections after restarting the economic activities. In fact, it has been observed that there are many people who are ignoring public health measures, especially with respect to social distancing. It is understandable that given the people's excitement to start working again, they sometimes tend to forget or neglect the implementation of social distancing.

Hence, 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. In the area of machine learning and computer vision, there are different methods that can be used for object detection. These methods can also be applied to detect the social distance between people.

**Related Work**

In paper [1], WHO is issuing the COVID-19 Strategic Preparedness and Response Plan (SPRP) for 2021 and accompanying documents as a package aimed at guiding the coordinated action that we must take at national, regional, and global levels to overcome the ongoing challenges in the response to COVID-19, address inequities, and plot a course out of the pandemic. Over the past year, much has been achieved by national authorities and communities with the support of WHO, donors and partners, and an unprecedented effort by the scientific community and the private sector.

In paper [2], This document describes the goals, guiding principles, and strategies for community mitigation to reduce or prevent local COVID-19 transmission. Community mitigation activities are actions that people and communities can take to slow the spread of a new virus with pandemic potential. COVID-19 is an infectious disease caused by a new coronavirus. Community mitigation actions are especially important before a vaccine or therapeutic drug becomes widely available.

In paper [3], the authors trained a large, deep convolutional neural network to classify the 1.2 million high-resolution images in the ImageNet LSVRC-2010 contest into the 1000 different classes. On the test data, they achieved top-1 and top-5 error rates of 37.5% and 17.0%, respectively, which is considerably better than the previous state-of-the-art. The neural network, which has 60 million parameters and 650,000 neurons, consists of five convolutional layers, some of which are followed by max-pooling layers, and three fully connected layers with a final 1000-way softmax.

In paper [4], the authors stated that the explosion of image data on the Internet has the potential to foster more sophisticated and robust models and algorithms to index, retrieve, organize and interact with images and multimedia data. But exactly how such data can be harnessed and organized remains a critical problem.

In paper [5], the authors investigated the effect of the convolutional network depth on its accuracy in the large-scale image recognition setting. Their main contribution is a thorough evaluation of networks of increasing depth using an architecture with very small (3×3) convolution filters, which shows that a significant improvement on the prior-art configurations can be achieved by pushing the depth to 16–19 weight layers. These findings were the basis of their ImageNet Challenge 2014 submission, where their team secured the first and the second places in the localisation and classification tracks respectively. They also showed that their representations generalise well to other datasets, where they achieve state-of-the-art results. They have made their two best-performing ConvNet models publicly available to facilitate further research on the use of deep visual representations in computer vision.

In paper [6], the authors stated that Convolutional networks are at the core of most state-of-the-art computer vision solutions for a wide variety of tasks. Since 2014 very deep convolutional networks started to become mainstream, yielding substantial gains in various benchmarks. Although increased model size and computational cost tend to translate to immediate quality gains for most tasks (as long as enough labeled data is provided for training), computational efficiency and low parameter count are still enabling factors for various use cases such as mobile vision and big-data scenarios.

## 2. Proposed Methodology

In existing system, image acquisition is carried out by first selecting the video file and split them into frames. Then the images are taken for pedestrian detection. For better results, images can be resized here. If the distance less than the acceptable distance between any two individuals, will be indicated with red lines that serve as precautionary warnings. The YOLO trained on the COCO dataset which consists of 80 labels like 'person', etc including human or pedestrian classs. In this work, the only box coordinates, object confidence and pedestrain object class from detection result in the YOLO model were used for pedestrian detection. Confidence value for label "person" is adjusted here with default value set as 0.5.

## 3. Advantages

The proposed system has following advantages.

- The image obtained from video file can be resized.
- Confidence value for class label "Person" can be adjusted.
- Multiple group of persons closest with them is considered.
- Half body human image can be labeled as person.

## 4. Experimental Results

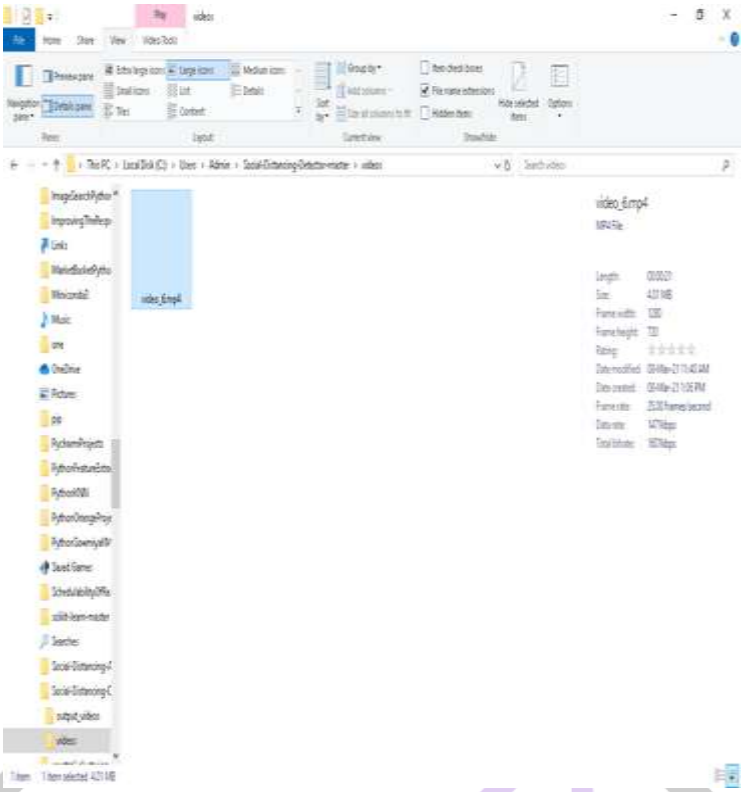

**Figure 1 Input Video Folder**

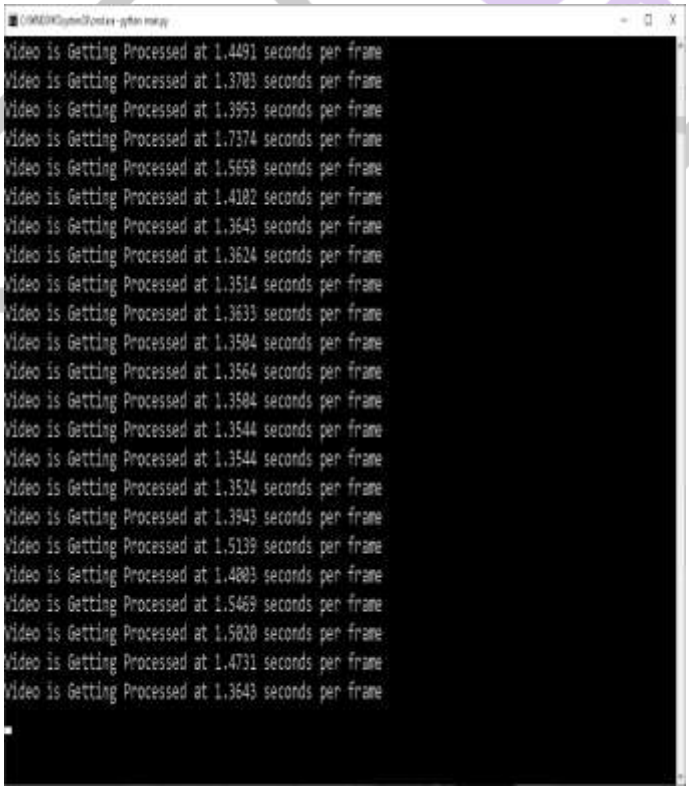


**Figure 2 Frame by Frame Image Processing**

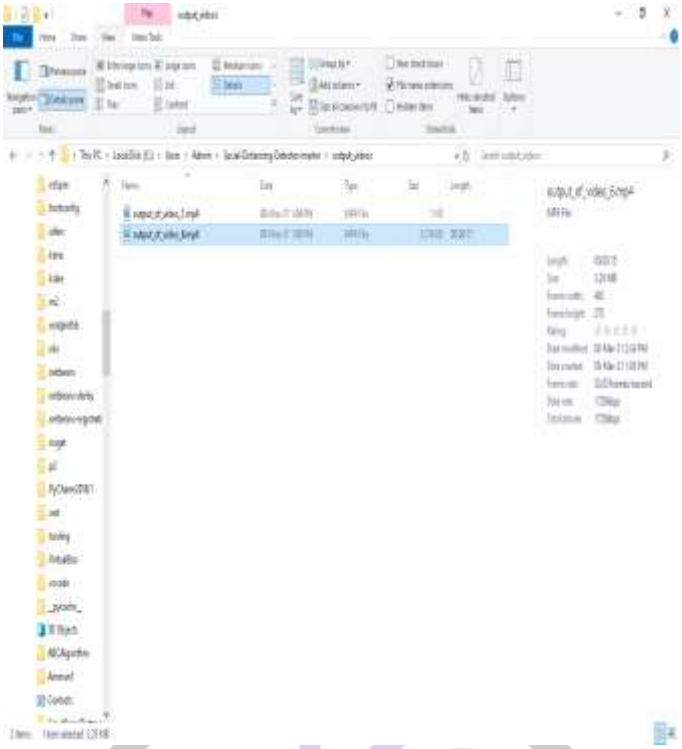

**Figure 3 Output Video File**


**Figure 4Output Video File During Playing – (Partial File Taken Due To Long Processing)**

## 5. Conclusion

This project solved the problem of social distance measure in the given image frames between two human objects to alert/avoid the covid problem.

This project introduces the methodology of social distancing detection tool using a deep learning model. By using computer vision, the distance between people is estimated and any noncompliant pair of people is indicated with a red frame and a red line. The proposed method is validated using a video showing pedestrians walking on a street.

The visualization results showed that the new method is capable to determine the social distancing measures between people which can be further developed for use in other environment such as office, restaurant, and school. In addition, the work can be further improved by optimizing the pedestrian detection algorithm, integrating other detection algorithms such as mask detection and

human body temperature detection, if the computing power of the hardware is improved, and calibrating the camera perspective view.

The system is very flexible and user-friendly, so the maintenance based on the changing environment and requirements can be incorporated easily. Any changes that are likely to cause failures are prevented with security and preventive measures could be taken. The coding is done in understandable and flexible method program which helps easy changing. Since Python is very flexible programming language, user can easily incorporate any modular program in the application.

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