

COVID PRECAUTION SYSTEM

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Abstract - Covid 19 pandemic is bringing adverse effects to the entire mankind but in order to break the chain and stop the spread of Covid 19 we have to take proper precautions and follow the rules proposed by our government. Rules like maintaining safe distance between every individual, avoid overcrowding, and wearing mask are some which will surely help in putting an end to the spread of this deadly virus. In the past many technologies are used in order to make sure proper prevention is taken by the people and the rules are followed which are mentioned above. This project can surely play a vital role in helping the organization make sure that protocols are properly followed by integrating this project with their CCTV systems and can be deployed in monitoring people in places like railway stations, shopping malls, etc.

The paper consists of three parts.

- To avoid large social gathering using OpenCV and YOLO V4 object detection model.
- To ensure people are maintaining required amount of distance between each other and setting a minimum required distance without making use of focal length of camera, angle of declination, distance between camera and object, using OpenCV and YOLO V4 object detection model.
- To ensure and check whether a person is wearing a mask using support vector machine.

Key Words: Covid precautions, social distancing, counting people, human detection, OpenCV, YOLOV4, CNN, Darknet.

1.INTRODUCTION

Coronavirus also known as Covid 19 was declared as a health emergency by WHO because of the adverse effects which was faced by the mankind. Many countries all over the world reported large number of cases of this disease. It mostly affects the people having weak immune system and the elder people. WHO has told the importance of conducting testing regularly but in rural areas because of unavailability of test kits, PPE, etc many of the cases go undetected.

Many organisations are working in order to reduce the number of cases and is taking all the necessary steps to fight the consequences of this invisible enemy which is in the form of a pandemic which involves doctors, NGOs, police force. In

addition to this there is also a need to work scientifically to combat this disease. Even the education system is facing the heat because they are afraid of the spread of disease and in order to safeguard the life of students mostly all the courses are held through online medium. Poverty, starvation also increased because of unemployment and isolation also lead to psychological stress to many people.

In order to put an end to this pandemic, WHO has recommended to strengthen the tracking process related to practice of social distancing, wearing mask, disinfecting with sanitizer, washing hands regularly are some of the measures to control the spread. If cost is considered then social distancing will also help in saving medical resources like sanitizers, masks, etc. Unless we don't follow the rules properly this pandemic will continue for some period of time. So we should strictly follow the rules when it comes to wearing masks and wearing them properly. By following proper precautions we can reduce the risk of transmission of the disease.

To stop the spread of this deadly virus, Covid 19, social distancing is one of the main keys. To keep safe distance from the infected person is not a new thing be it is Covid 19 or any disease, keeping a 2 feet distance will surely reduce the risk of getting the infection from infected person. This method of social distancing will not cost anything but in turn will help to reduce the transmission of the disease.

The main objective in today's world is to leverage technology and alleviate the pressure on the health care system and reduce transmission of the disease.

Social distancing and wearing masks will help in reducing the spread of the disease. It has been proved that the healthy person when comes in contact with the droplets of cough or sneeze of a person who is infected with Covid 19, then they easily catch the infection. Wearing mask and maintaining safe distance will surely reduce the risk of catching infection because the droplets of cough or sneeze will not spread easily.

Prevention is better than cure, everyone is aware of this idea and this is the time when we have to understand and literally learn from this idea which will stop the spread of this disease.

We all know that technology has developed to that extent that we can leverage it to come up with solution to many problems. So why not use it to protect our mankind from this pandemic which is having adverse effects over the lives of people?

This basically motivated us to work on this topic.

2. Domain overview:

Using visual observation framework, human recognition is dependent on manual strategies and it has restricted capacity. In order to identify a mobile object, there are two phases which is object recognition and item order. For identification the alternative of SSD is yolo. This method basically do the work by looking only once at the picture. Yolo has four versions. Yolo v1 by GoogleNet focuses on grouping objects in a picture. This comprises of 24 convolutional layers and 2 completely associated layer. Yolo v2 uses Darknet 19, consisting of 19 convolutional layers and 5 max pooling layers. In yolo v3 and yolo v4 are improved versions which helps in detecting even little objects proficiently. [1]

DNN (Deep Neural Network) was a part of opencv_contrib repo. It was moved to the expert part of opencv, enabling people to run on pre-prepared learning models inside OpenCV itself. It's used only for training on pictures/videos. Over the years support for various libraries like Tensorflow is added for YOLO/DarkNet has been included late. The OpenCV :-dnn module with a pre-prepared YOLO model is required for recognizing regular items. [4]

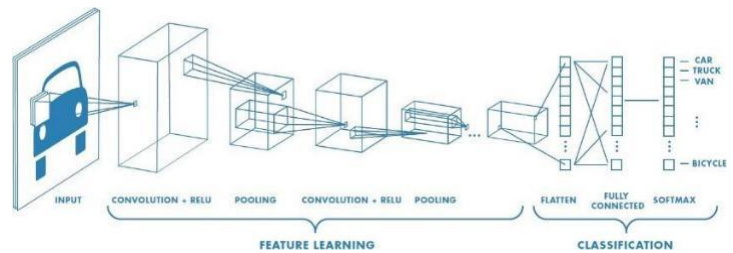


Fig 2.2 Representation of convolutional neural network

Object detection have advanced in last few years. Currently the best object detection model is considered to be YOLO V4 for video usage. It can detect the objects listed in coco names at 65 fps and with a good accuracy as shown in Fig 2.3 which is sufficient for object detection in videos. Thus we chose YOLO V4 model for this project.[5]

Deep neural network

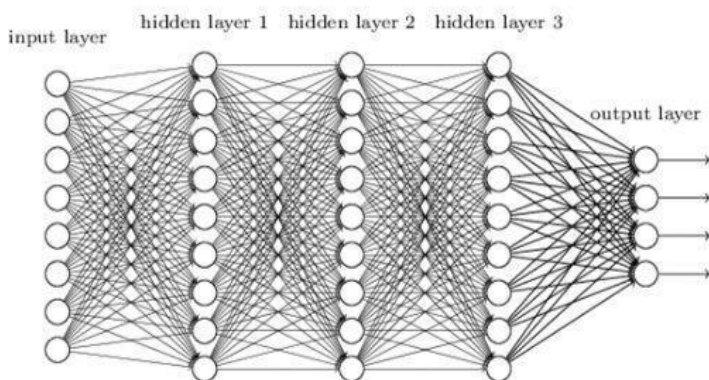


Fig 2.1 Representation of neural network

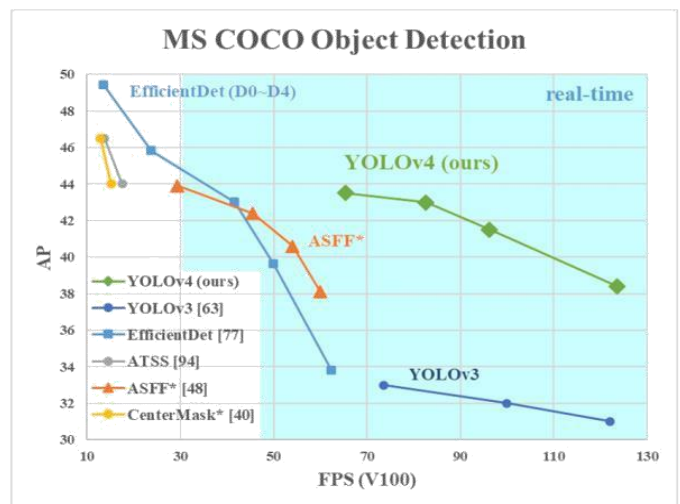


Fig 2.3 AP vs FPS graph for object detection models

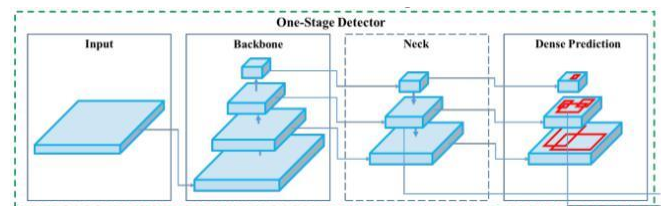


Fig: 2.4 One stage object detector

In today's world pictorial data is rising at a faster rate than textual data. Support vector machine's major idea is to make a hyperplane as the choice surface. In order to settle this hyperplane for example issue, the Lagranges Multiplier method is changed into its double issue. There are different needs of classifying images or frames in videos. This is possible using the support vector machine classification algorithm which divides the data using a plane or line according to the dimensions of data input. This algorithm can be also used for images, since images can be converted

into matrices and pre-processed further. Binary classification is possible using svm to classify person who is wearing mask(1) or not wearing mask(0). [9]

For the detection of face mask the most important fact is the extraction of the specific pixels from that image. The key pixels are extracted and the new output image is formed which is precise. An ample number of images are dimensionally converted to an efficient image in this part, with a specific area of the image acting as a main capture.

After the training of the model is completed it provides the data with accuracy.[10]

3] Implementation and results:

a) Room capacity management

Avoiding contact with others is necessary during a pandemic and thus people should also avoid overcrowding in certain regions. Regulating this requires manpower which can be avoided by the use of computer vision and A.I. the room capacity management system will continuously monitor the count of people in the room. For human body detection it uses YOLO V4 pre-trained model and open cv for converting each frame of the video into matrices. Members in the room will be encapsulated in green bounding boxes whenever the count is below the preferred capacity of the room or else they will be encapsulated in red boxes if the count of members in the room exceeds the preferred room count limit. The room count limit can be set by the admin according to the condition of the area and necessity of people gathering in that area. Once the number of people in the room exceeds the monitoring system will trigger an audio based warning/alert that will insist people in the room to reduce overcrowding in that area.

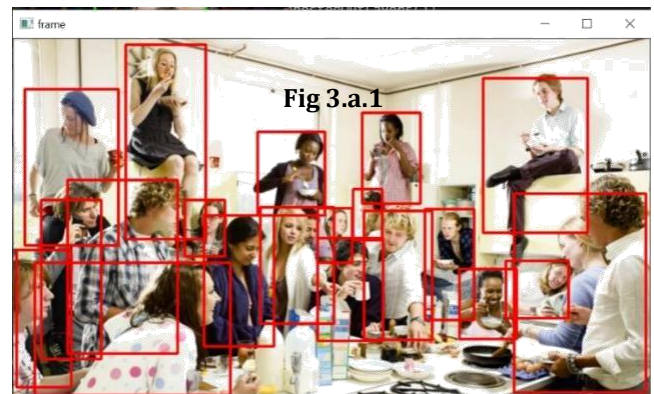
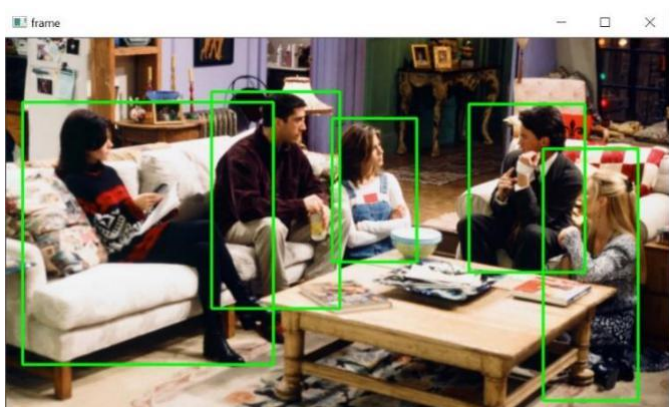


Fig 3.a.2

In fig 3.a.1 and fig 3.a.2 the room capacity is set to 6 members. As we can see in fig 3.a.1 number of members in the room (5) is less than the preferred count set by the admin (6) , so members in the room are encapsulated in green boxes signifying that room is safe for current member count. On the other side in fig 3.a.2 the number of members in the room(>6) is greater than the preferred member count of the room(6), thus all the members are encapsulated in red boxes signifying that the room is not safe due to overcrowding. This monitoring system will help in maintaining the member count in a particular room and thus avoid overcrowding.

b) Social distance monitoring

Maintaining social distance for avoiding spread of contagious disease plays a very important role and regulating such social distancing rules in a pandemic like COVID-19 can be difficult for frontline workers. Computer vision can be used for such monitoring purpose. Social distance monitoring can track the distance between every consecutive human body and thus warn people in the vicinity if the social distancing rule is violated. All human bodies in each frame of a video will be encapsulated in green boxes and whenever two adjacent human bodies violate (have lesser distance than the minimum distance between them) the social distancing rules, will be encapsulated in red boxes also triggering an audio based alert/warning insisting to maintain social distance. For human body detection, YOLO V4 pre-trained object detection model is used as it is trained on a huge dataset for human body detection. This model uses convolutional neural network image classification algorithm and darknet framework. Open CV is used for converting each frame of video into matrices and highlighting the location of every human body in the given video. Calculation of distance is done between two consecutive centroids of human bodies. The required minimum distance is calculated as follows:-

$$d_{min} \propto \frac{\sum_{i=1}^n w_i}{n};$$

$$d_{min} = \frac{k \cdot \sum_{i=1}^n w_i}{n}$$

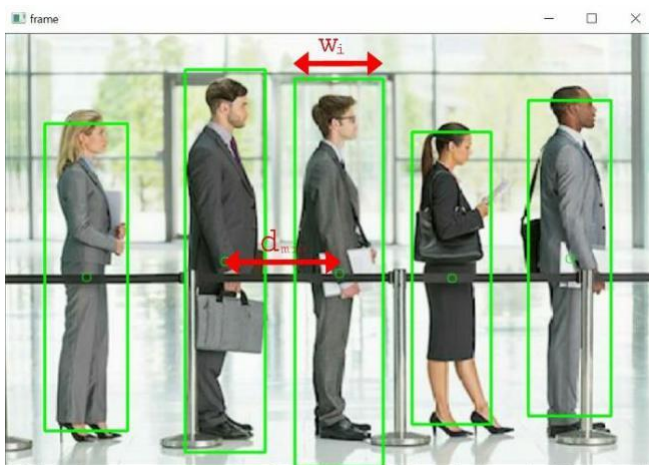


Fig 3.b.1

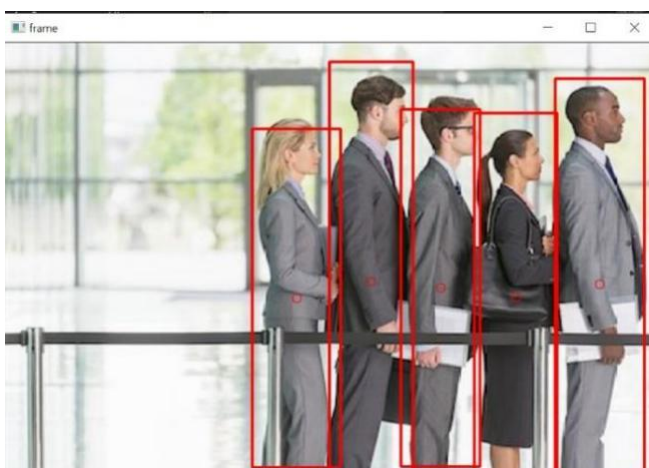


Fig 3.b.2

Where, d is the minimum distance required between two adjacent human bodies, n is number of human bodies in each frame of the given video, w_i is width of i th human body in a frame, as shown in fig 3.b.1. Required minimum distance is directly proportional to the mean width of every human body in the frame. Thus d can be adjusted according to the

constant k as given in the equations. This will allow us to set the required minimum distance without using focal length of the camera and distance between camera and human bodies. This method will be also suitable even if the camera is far or closer to human bodies without any dependence on where it is installed.

c) Mask detection

Masks should be used as part of a comprehensive strategy of measures to reduce transmission of COVID-19 virus, wearing masks can bring a significant change in the number of cases in such a pandemic. There is a need to avoid violation of this rule and such task can be done by using computer vision and artificial intelligence. Using support vector machine classification algorithm the frames of video can be classified (binary) into whether the person in front of CCTV is wearing a mask(1) or not wearing a mask(0). This can prevent people who are not wearing masks from entering public premises. Thus this rule can be regulated using computer vision.

4. CONCLUSIONS

In our work, yolo v4 object detection model is used to check number of people are present in a room or public place in order to prevent social gathering, the second part focusses on detecting whether required amount of distance is maintained between people and the third part is to ensure a person is wearing a mask using SVM classification algorithm.

As we all dream to lead to the world where everything was normal that is post pandemic scenario, the need to become self responsible is a major thing which everyone should think about. The rising covid 19 cases also increases the need of various medical resources which in turn leads to rise in the need of money in order to meet the needs of these resources especially to provide them to the entire population is not easy, so, finally it is a responsibility of every human being to be alert and attentive in taking the necessary precautions. It is necessary that we as educated people of this society make sure to follow the proper rules proposed by our government and take actions according to our conscience which will reduce the spread of the disease. Social distancing, wearing masks and avoiding large social gatherings will be an important factor to alleviate sufferings. Implementing the ideas of our project will surely reduce the risk of catching the disease. It will also reduce the manpower required to monitor whether proper precautions are taken. If we leverage technology and make sure that proper precautions are taken then we can surely put an end to this pandemic.

5. REFERENCES

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