DEEP LEARNING MODEL FOR COVID 19 PATIENT MONTITORING AND TRACKING

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Abstract— ***Due to the increase in the new variant called Omnicron being continuously spreading thus further increasing the Covid – 19 virus certain measures are required to reduce or control it. As there are many factors that might lead to the increase the number of cases, one of the major factor can be said as the spread of the virus from the patients that can include due to their negligence or can even be un intentionally. This risk can be reduces when we completely reduce the interactions or the physical contact with the others. In this project we would be working on to develop a machine learning model that would consider different images or a series of images to identify the most possible threats that indicate if a covid person has come closer to any other people based on the social distancing norms. This would be identified by creating a bow around all the humans present in that image or the series of images and draw a box around them, thus with the help of these boxes we calculate the Euclidean distance between themselves and compare them to the threshold value which we set as the minimum safety measure. We also aim to consider the people wo are very close to the threshold values as the possible patients and then plan to continuously monitor them. We would even plan to include various features to check if the possible patient is wearing a mask or not, for this we plan to use the convolution neural networks along with the computer vision features and OpenCV.***

Keywords—Deep Learning, Social Distancing, Regnet50, Face Detection, YOLOv3, OpenCv

I. INTRODUCTION

Coronavirus is a common virus that causes infections in the nose, sinuses, or upper throat. Most coronaviruses are not dangerous. After an outbreak in China in December 2019, it reached in early 2020, and the World Health Organization has identified SARSCoV2 as a new type of coronavirus. The outbreak quickly spread around the world. COVID19 is a disease caused by SARSCoV2 that can cause what is known as a respiratory infection. It can affect the upper respiratory tract (sinuses, nose, throat) or lower respiratory tract (trachea and lungs). It spreads like any other coronavirus, primarily through human-to-human contact. Infectious diseases range from mild to fatal. Based on the information from the World Health Organization, social distancing is the best practice where individuals can minimize physical contact with possible COVID-19 carriers by maintaining a certain distance between one person and another. Due to the sudden rise in the Omnicron Variant we propose our models to reduce the number of causalities and also to reduce the number of victims for the virus. This research aims at reducing the spread of this virus and saving the lives of people. In this work, we propose a deep learning model for social distance detection along with a deep learning model for face mask detection. In this work we were successfully able to do the basic analysis for the measures identifying the number of cases vs the number of deaths in india and also with that we even considered another dataset for the united stated that helped us identify the relationship between the covid cases rising the deaths occurring , the number of people being discharged and also the number of people following the social distance. In today's technology era, the demand of Artificial Intelligence in every field is predominantly increasing. AI in the areas like signal and image processing, and in the field of computer vision aided in solving enormous range of challenging tasks and also helped in developing many applications and algorithms. One such useful application is object detection. Object detection is a complex task which belongs to field of computer vision, where technique or task is to locate the hidden objects or to detect a class of required objects in an image or video. With the help of this capability of software systems and computer to find objects, many applications like vehicle detection, face detection, tracking, anomaly detection, self-driving cars, crowd counting, surveillance and security systems. This technique of Object detection is a subtask which comes under Object recognition which is preliminary and main important tasks of computer vision. To endeavor this object detection there are several algorithms and all these approaches can be classified into traditional

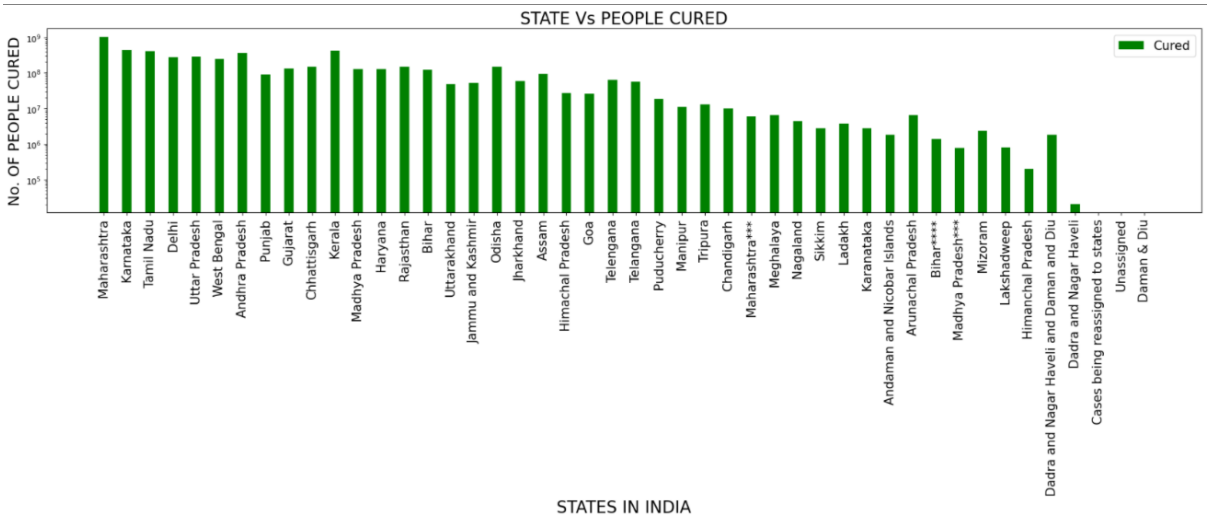


Fig 1.1

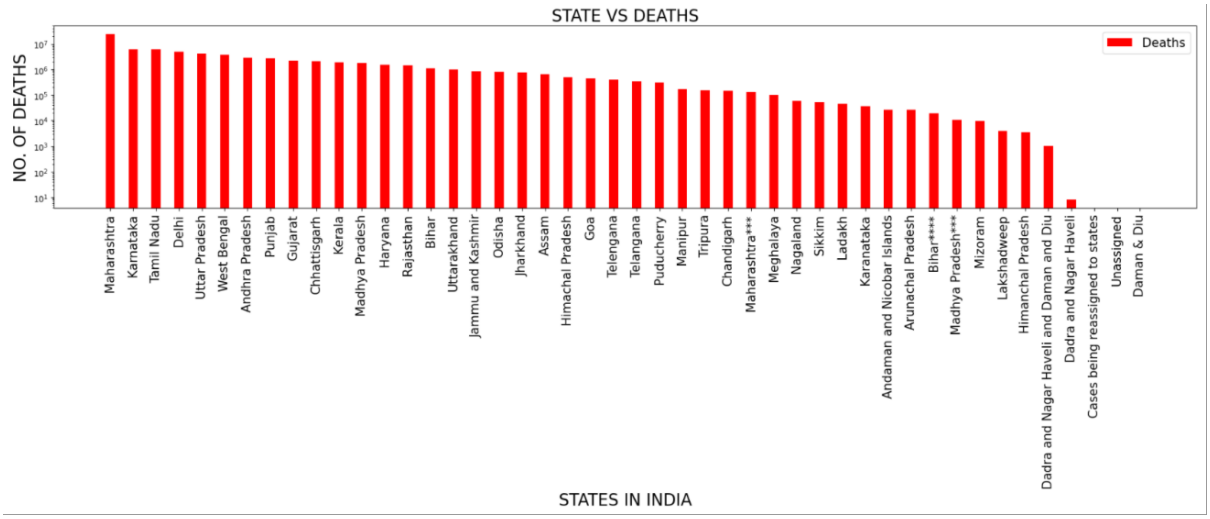


Fig 1.2

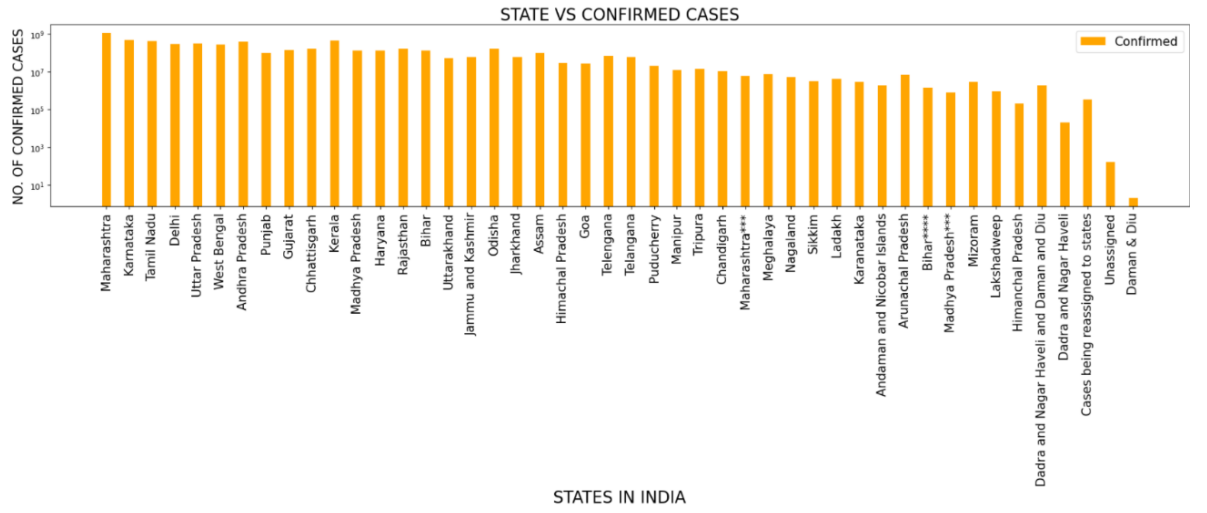


Fig 1.3

approaches and modern approaches. To achieve object detection through traditional approach through three stages of complex tasks which are informative region selection, feature extraction and categorization of the object. Though this approach has its significance in achieving in object detection, it has its disadvantages of slow and poor results. And coming to modern approaches, all these approaches are based on neural network models which are part of artificial intelligence, where the mimic the human nature of self-learning to solve critical computational problems and developing innovative tasks. And all the modern approaches can be widely categorized into region proposal based and regression/classification based.

The fig 1.1 depicts how each state is related to the number of people cured in that particular frame during that time frame. Fig 1.2 depects how each state is related to the number of deaths that occurred during that time frame and fig 1.3 depects the number of cured.

II. RESEARCH AND BACKGROUND WORK

Social Distancing and Face Mask Protection are very effective measures that can be used for preventing the spread of the disease. These methods are suggested by various healthcare organizations and also by the world health organization (WHO). We have done a analysis depicting how there is an effect of the number of caes with the respective states in india and also the deaths and the corresponding number of cured ones.

A. Social Distance Prediction

There are many research projects that elevate on the face detection, mask detection and many projects relating to the same. Here the problem arises when there are people who doesn't follow the covid 19 norms and such could be a direct cause for the sudden rise in the covid cases. This problem can be overcome when we detect the human presence detection in image processing to get the higher accuracy in the detection of the make presence. For this we mainly target the locations previously visited by the patient such as the hotel, school, college, movie theatre, offices, parks or any other place and then we gather the video recording from the place and identify all the people who don't follow the social distance norms that is come closer to the person within 1 meter and approach the patient and consider them as the most probable next victim. This identification can be used to completely identify the next victim or the next carrier of the virus as there is a sudden rise in the omnicron variant of the virus, this kind of identification can be used to inform the next carrier or the next victim that they had come in contact with a covid positive person and it would be better for them to do a check up to confirm if they are a carrier or not and irrespective of the result ensuring that that person would follow the isolation procedure for at least fourteen days.

B. Mask prediction

There are many research projects that elevate on the face detection, mask detection and many projects relating to the same. Here the problem arises when there are people who doesn't follow the covid 19 norms and such could be a direct cause for the sudden rise in the covid cases. This problem can be overcome when we detect the human presence detection in image processing and then furtherer to the face detection of the human to get the higher accuracy in the detection of the make presence. For this we mainly target the locations previously visited by the patient such as the hotel, school, college, movie theatre, offices, parks or any other place then we gather the video recording from the place and identify all the people who doesn't wear a mask and approach the patient and consider them as the most probable next victim. This identification can be used to completely identify the next victim or the next carrier of the virus as there is a sudden rise in the omnicron variant of the virus, this kind of identification can be used to inform the next carrier or the next victim that they had come in contact with a covid positive person and it would be better for them to do a check up to confirm if they are a carrier or not and irrespective of the result ensuring that that person would follow the isolation procedure for at least fourteen days

C. Patient Monitoring

There are many situations where the patients that would require monitoring as all the patients would not listen to the health care workers present. Thus even endangering the ive of the healthcare workers present to protect them. Now with our project we were able to completely monitor the patient in the hospital room and identify wether that person is wearing a mask or not and also we are successfully able to identify the movements of those persons present

III. OBJECT DETECTION OVERVIEW

. In today's technology era, the demand of Artificial Intelligence in every field is predominantly increasing. AI in the areas like signal and image processing, and in the field of computer vision aided in solving enormous range of challenging tasks and also helped in developing many applications and algorithms. One such useful application is object detection. Object detection is a complex task which belongs to field of computer vision, where technique or task is to locate the hidden objects or to detect a class of required objects in an image or video. With the help of this capability of software systems and computer to find objects, many applications like vehicle detection, face

detection, tracking, anomaly detection, self-driving cars, crowd counting, surveillance and security systems. This technique of Object detection is a subtask which comes under Object recognition which is preliminary and main important tasks of computer vision. To endeavor this object detection there are several algorithms and all these approaches can be classified into traditional approaches and modern approaches. To achieve object detection through traditional approach through three stages of complex tasks which are informative region selection, feature extraction and categorization of the object. Though this approach has its significance in achieving in object detection, it has its disadvantages of slow and poor results. And coming to modern approaches, all these approaches are based on neural network models which are part of artificial intelligence, where the mimic the human nature of self-learning to solve critical computational problems and developing innovative tasks. And all the modern approaches can be widely categorized into region proposal based and regression/classification based. The YOLO detector is displayed at the same time as the complete image. Therefore, that prediction is affected by the context of the image. Unlike other object detectors such as RCNN, which require thousands for a single image, it predicts with a single network evaluation. The YOLO algorithm takes the input image and divides it into an S × S grid. Extract features from each raster. Predict the bounding box using the confidence score of the predicted class in the bounding box. Each grid cell recognizes a bounding box and a confidence score. The bounding box consists of five predictions, represented by (x, y, w, h) and confidence values. The (x, y) coordinates reflect the center of the grid cell's bounding box. (W, h) represents the width and height of the frame. The confidence score is a measure of how confident the detector is that the box contains the object to be predicted. YOLO predicts several bounding boxes for each grid cell. The training phase requires only one bounding box predictor for each class. Predictors are assigned to predict the object with the highest union over intersection (IoU) value in ground truth. This process leads to specializations within the bounding box forecast. The YOLO algorithm uses the errors accumulated between ground truth and bounding box loss prediction. This least squares method calculates model classification, localization, and loss of reliability.

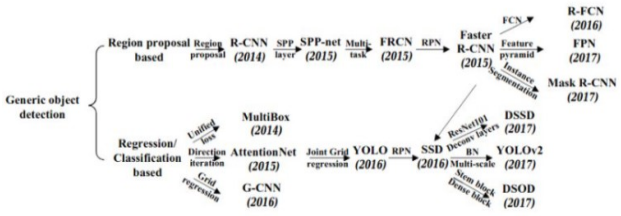


Fig 3.1

The above image depects the basic structe of the object detection model that can be used and also with the help of this model we would be able to understand wach and every block to finnaly get the required outputs

IV. ARCHITECTURE

We proposed multiple systems and these are the social distance monitoring and face mask detection system based on the videos recorded at the places the patient went to, we find all the people who come closer to the patient breaking the social distance norms and also the patients who are not wearing any masks. This is done using the Yolo and Resnet models and the other model which we build is the live patient monitoring system that always checks whether the patient is wearing a mask or not and also check the locations movements in the hospital of the patient.

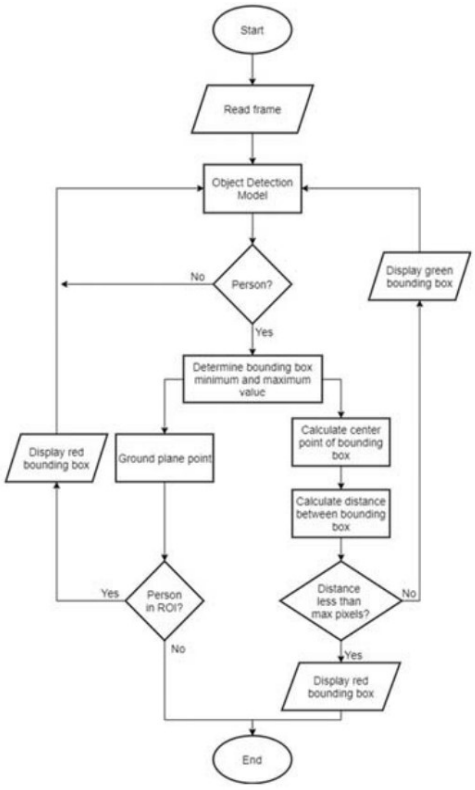
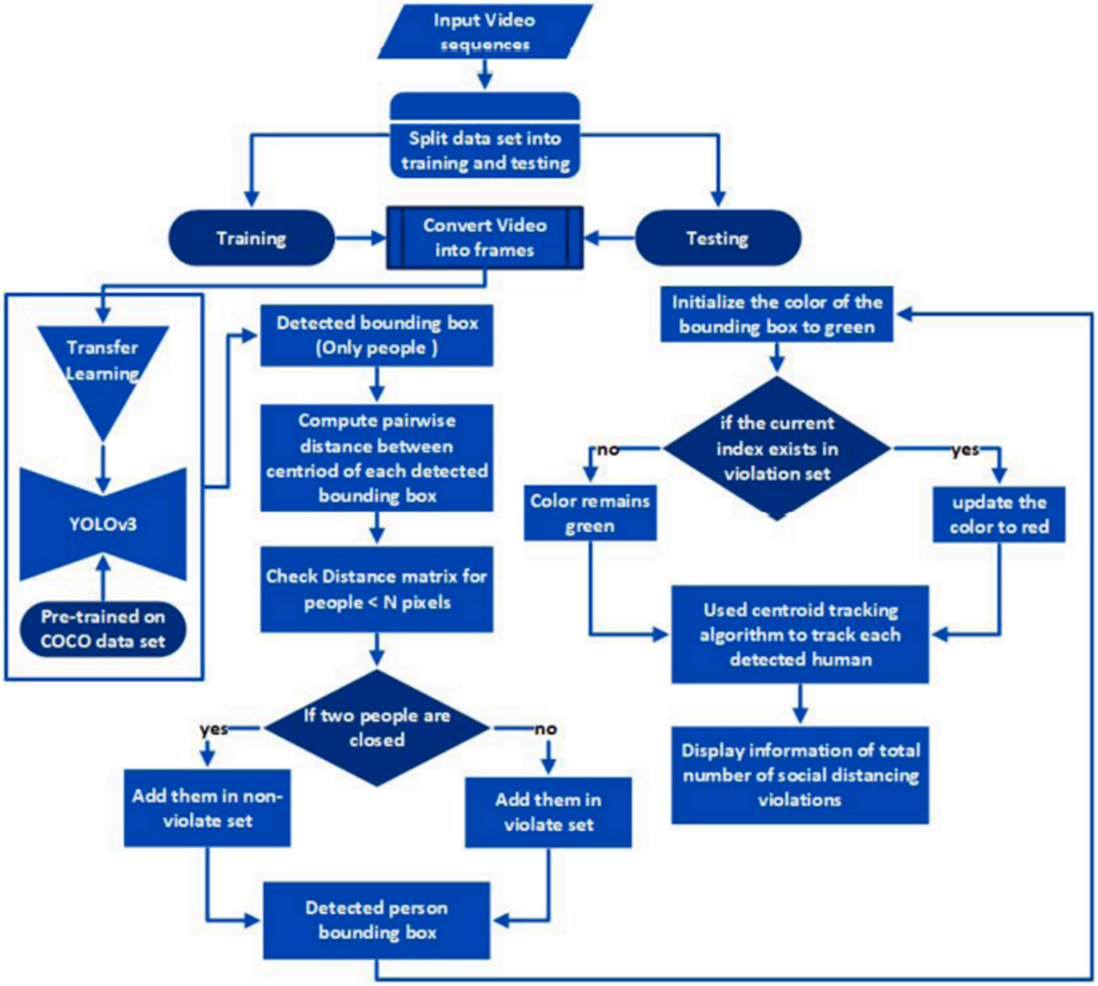


Fig 4.1

The above image indicates the workflow of our model for the social distance monitoring for a video. Here in this first we start our machine and then give our video as the input for the model. This given input video is then considered and this video is broken as a number of frames and a single frame is collected from that and for this single frame we perform the object detection operation to finannly categorize wether there is person present or not, if the person is present we check if that persons face is visible or nor, if visible then we identify that wether the person is waering a mask or not. This is done



ResNet50 Architecture

layer name	output size	18-layer	34-layer	50-layer	101-layer	152-layer
conv1	112×112	7×7, 64, stride 2				
conv2_x	56×56	3×3 max pool, stride 2				
		$\begin{bmatrix} 3\times3, 64 \\ 3\times3, 64 \end{bmatrix}\times2$	$\begin{bmatrix} 3\times3, 64 \\ 3\times3, 64 \end{bmatrix}\times3$	$\begin{bmatrix} 1\times1, 64 \\ 3\times3, 64 \\ 1\times1, 256 \end{bmatrix}\times3$	$\begin{bmatrix} 1\times1, 64 \\ 3\times3, 64 \\ 1\times1, 256 \end{bmatrix}\times3$	$\begin{bmatrix} 1\times1, 64 \\ 3\times3, 64 \\ 1\times1, 256 \end{bmatrix}\times3$
conv3_x	28×28	$\begin{bmatrix} 3\times3, 128 \\ 3\times3, 128 \end{bmatrix}\times2$	$\begin{bmatrix} 3\times3, 128 \\ 3\times3, 128 \end{bmatrix}\times4$	$\begin{bmatrix} 1\times1, 128 \\ 3\times3, 128 \\ 1\times1, 512 \end{bmatrix}\times4$	$\begin{bmatrix} 1\times1, 128 \\ 3\times3, 128 \\ 1\times1, 512 \end{bmatrix}\times4$	$\begin{bmatrix} 1\times1, 128 \\ 3\times3, 128 \\ 1\times1, 512 \end{bmatrix}\times8$
conv4_x	14×14	$\begin{bmatrix} 3\times3, 256 \\ 3\times3, 256 \end{bmatrix}\times2$	$\begin{bmatrix} 3\times3, 256 \\ 3\times3, 256 \end{bmatrix}\times6$	$\begin{bmatrix} 1\times1, 256 \\ 3\times3, 256 \\ 1\times1, 1024 \end{bmatrix}\times6$	$\begin{bmatrix} 1\times1, 256 \\ 3\times3, 256 \\ 1\times1, 1024 \end{bmatrix}\times23$	$\begin{bmatrix} 1\times1, 256 \\ 3\times3, 256 \\ 1\times1, 1024 \end{bmatrix}\times36$
conv5_x	7×7	$\begin{bmatrix} 3\times3, 512 \\ 3\times3, 512 \end{bmatrix}\times2$	$\begin{bmatrix} 3\times3, 512 \\ 3\times3, 512 \end{bmatrix}\times3$	$\begin{bmatrix} 1\times1, 512 \\ 3\times3, 512 \\ 1\times1, 2048 \end{bmatrix}\times3$	$\begin{bmatrix} 1\times1, 512 \\ 3\times3, 512 \\ 1\times1, 2048 \end{bmatrix}\times3$	$\begin{bmatrix} 1\times1, 512 \\ 3\times3, 512 \\ 1\times1, 2048 \end{bmatrix}\times3$
	1×1	average pool, 1000-d fc, softmax				
FLOPs		1.8×10^9	3.6×10^9	3.8×10^9	7.6×10^9	11.3×10^9

repeatedly such that we complete with the frames and identify correctly.

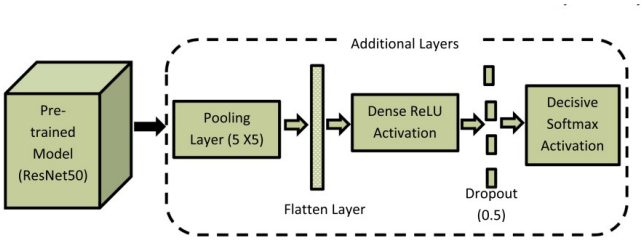
A. Yolov3

YOLO is an abbreviation for the term "You Only Look Once". This is an algorithm that recognizes and recognizes various objects in an image (in real time). Object recognition in YOLO is done as a regression problem and provides the class probability of the recognized image. The YOLO algorithm uses a convolutional neural network (CNN) to detect objects in real time. As the name implies, the algorithm requires only a single forward propagation through a neural network to recognize an object. This means that the entire image is predicted in one algorithm run. CNNs are used to simultaneously predict probabilities and bounding boxes for different classes. The YOLO algorithm consists of various variants. Some of the most common are the small YOLO and YOLO v3. Why the YOLO algorithm is important The YOLO algorithm is important for the following reasons: Speed: This algorithm can predict objects in real time, improving detection speed. High accuracy: YOLO is a predictive method that provides accurate results with minimal background error. Algorithms have excellent learning skills that can be applied to object recognition by learning the representation of objects. This is how the YOLO algorithm works The YOLO algorithm uses three techniques: Residual block Bounding box regression Transfer (IOU*)*.

The YOLO detector is displayed at the same time as the complete image. Therefore, that prediction is affected by the context of the image. Unlike other object detectors such as RCNN, which require thousands for a single image, it predicts with a single network evaluation. The YOLO algorithm takes the input image and divides it into an S × S grid. Extract features from each raster. Predict the bounding box using the confidence score of the predicted class in the bounding box. Each grid cell recognizes a bounding box and a confidence score. The bounding box consists of five predictions, represented by (x, y, w, h) and confidence values. The (x, y) coordinates reflect the center of the grid cell's bounding box. (W, h) represents the width and height of the frame. The confidence score is a measure of how confident the detector is that the box contains the object to be predicted. YOLO predicts several bounding boxes for each grid cell. The training phase requires only one bounding box predictor for each class. Predictors are assigned to predict the object with the highest union over intersection (IoU) value in ground truth. This process leads to specializations within the bounding box forecast. The YOLO algorithm uses the errors accumulated between ground truth and bounding box loss prediction. This least squares method calculates model classification, localization, and loss of relaiability.

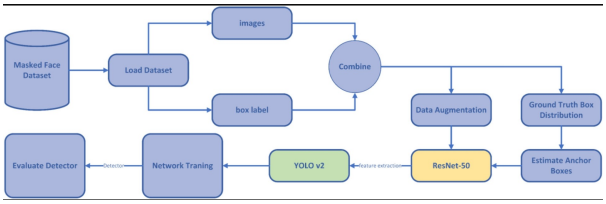
B. Resnet50

ResNet 50 is a 50-layer deep CNN. Network trained with over 1 million images from ImageNet database. Architecture [6] consists of convolutions with a kernel size of 7 * 7 and 64 different ones. All kernels with size 2 steps. Then there is the maximum pooling layer in step 2. In the next fold There are 1 * 1.64 kernels, 3 * 3.64 kernels, and finally 1 * 1.256 kernels. These three layers will be warmed up with Absolutely 3 times. Next is the 1 * 1,128, 3 * 3,128 kernel, and finally the 1 * 1,512 kernel. The progression has been rehashed. There are two kernels, 4.1 * 1.256 and 3 * 3.256. And 1 * 1, 1024, which is processed 6 times. And again there are two, 1 * 1,512 kernels and more 3 *. 3.512 and 1 * 1, 2048, which have been processed 3 times. Then create an average pool layer and It is a fully connected layer of 1000 nodes, and towards the end the architecture has a softmax function. Yes Adding these layers creates a deep convolutional network of 50 layers.



C. Patient Monitoring

We proposed a system that recognizes patients in the hospital without a mask. That's why we Decided on a pre-trained CNN architecture ResNet 50 with an ImageNet database. Through this training The model can learn to recognize students with or without masks. First, I need a photo of Students use OpenCV and these images are preprocessed, so these images also need to be saved The name of the corresponding student. Currently, Opencv is recording live video in the classroom and using it to convert it into frames. the Face photos are cropped and used to distinguish students without masks on their faces. The CNN model ResNet50 is used to extract facial features from images. Functions are learned from a number of hidden layers. At each point, the model recognizes the student. The mask and name will be added to the list of unmasked students. Then the model produces the following list Students who did not wear a mask. Below is the architecture that depects how our model is run



V. RESULTS

The following are the results of our deep learning model. As we mentioned in the previous sections , our project is divided into 3 different subparts first one being the complete analysis for the basic covid 19 dataset along with the main part of relation between the number of cases, number of deaths, number of states and also for the major inclusion of relation between the social distance parameters and also other excluding factors in each and every state present in india. Fig 5.1 depects the social distance and mask prediction monitoring of a video as said by the patient as he visited a near by café and that belong to the road of that café. As we can see that from the video we are able to identify the number of

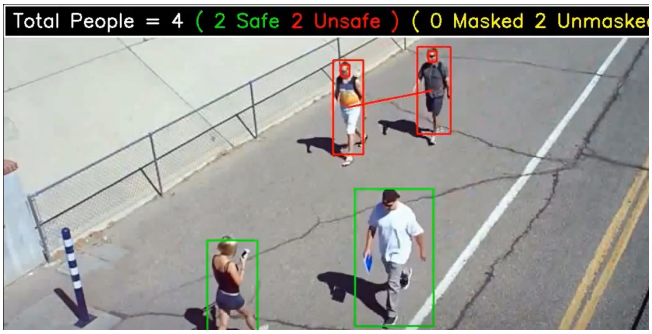


Fig 5.1

Fig 5.2

The fig 5.2 depects the entrance of that café where we can similarly identify the number of people whi visited that place along with factors like did they wear their mask or not were the following the social distance practices or notNow we go to the implementation of our other part and that would be the live system montoring of the patient as we can see fro the images 5.3, 5.4 , 5.5 we are able to take the snapshots from the live feedback and this tells us that when a person wears a mask completely then the model would say that we are able to find the pearson waering the mask and if the person wears the mask partially as in fig 5.4 our model tells that the person isnt wearing a mask and if a person doesn't wear a mask then if finnally say sthe person doesn't wear a mask. We even trained a machine learning model with the help of resnet50such that we would be able to find the accuracy of the model base don the epochs values, we considered for 20 epochs to get the accuracy and the plot for the accuracy is in figure 5.6.

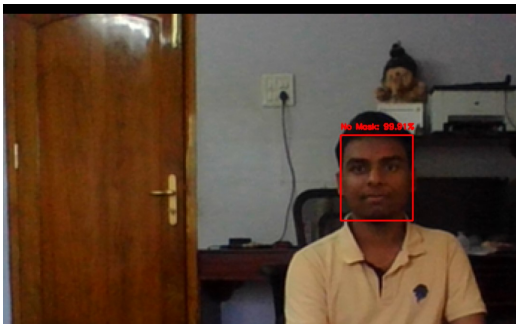


Fig 5.3

Fig 5.4

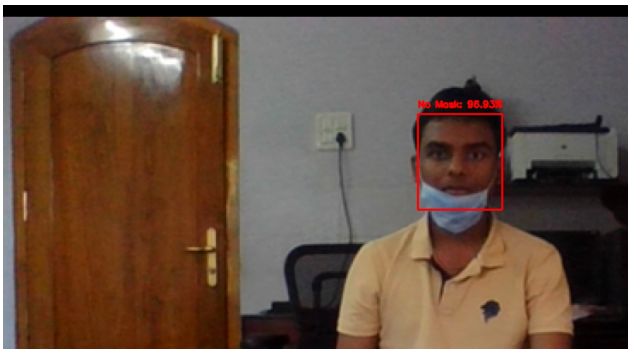


Fig 5.5

Now with this we are successfully able to identify wether a person wera a mask or not when considered in a hospital and for this when considering a camera from the inspiron 5000 series laptop we were able to tell the distance for getting a accurate result was around 2 m

and when a web camera is seperately attached we would get a better result.The accuracy plot is give below for the trained model. It is in fig 5.6.

Fig 5.6

This is a small analysis on a dataset titled imputed_data to understand how social distancing and masks usage is related to COVID-19 related fatal cases. It is important to maintain specified distance between to people to avoid the spread of virus. As, this virus is easily spreading through air, so if two people are conversing or walking past each other, there is a chance for transmitting of virus. So, all countries have strictly taken measures to impose social distancing norms to avoid and reduce this transmission. When it comes to, wearing masks, this also a prevention of spreading virus. What we speak, there is a chance for virus transmission. If a person with COVID speaks, there is a high probability of other people getting effected. So, it is equally important for both people, the people who have COVID and the ones who don't to wear mask at all times. This way, the people who are not affected can prevent themselves from getting effected and the people who have COVID can take care of not transmitting the disease. This analysis helped us understand how people are getting effected due to COVID. The features in our dataset include 'country_name','covid_19_confirmed_cases','covid_19_deaths','social_distancing_total_grade', 'social_distancing_encounters_grade', 'social_distancing_travel_distance_grade', age_groups from 0 to 85 and many other features. Of all these, we took the most relevant and informative features which are grades, confirmed cases, deaths etc. so, basically a grade is given to each individual according to he/she abiding to the norms imposed. A higher grade is given to a person if he/she follows social distancing. According to our analysis, a person with higher grade is less prone to getting affected by COVID. The confirmed cases for higher grade is also less.

social_distancing_total_grade	covid_19_confirmed_cases	covid_19_deaths
A	244.0	6.0
B	6129.0	220.0
C	264283.0	12277.0
D	382230.0	12282.0
F	4002495.0	87643.0

The above image shows the number of confirmed covid_19 cases and the covid_19_deaths with respect to the overall social distance grade given. So, grade-A is the highest grade given and the confirmed cases and deaths with respect to that grade is least of all with 244 confirmed cases and 6 deaths.

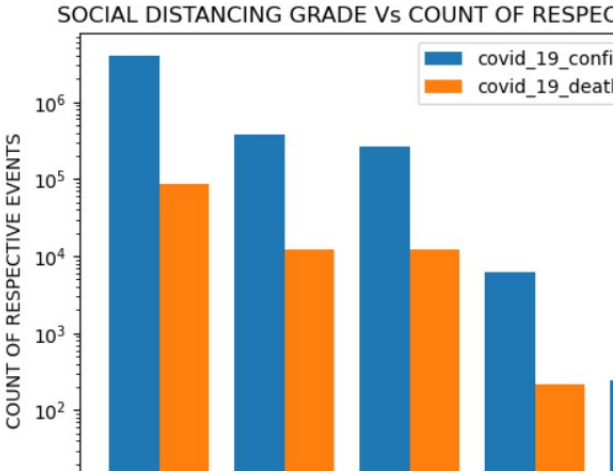


Fig 5.7

When it comes to grade-B, there is an increase in number of cases the number of positive cases with a rise of 5885 which is around 58.85 percent increase in the confirmed cases and cases tally of 6129. Also, there is an increase of 2.14 percent deaths with 220 deaths recorded for people who are given grade-B.

When it comes to grade-C, there is a significant increase in the number of confirmed cases with 264283 cases which is around 2640.39 percentage increase compared to grade-A and 2581.54 percentage increase in cases compared to grade-B with cases being 258154. When it comes to deaths, there is a sharp increase 122.71 percentage increase in number of deaths compared to grade-A with increase in deaths being 12271 and a tally of 12277 and 120.57 percent increase in deaths compared to grade-B with increase in deaths being 12057 and now tallying 12277.

The people with grade-D, there is an increase of 3819.86 percent in cases compared to grade-A, with a increase tally of 381986, 3761.01 percent increase compared to grade-B with a increase tally of 376101, 1179.47 percent increase compared to grade-C with an increase tally of 117947. When it comes to deaths, there is a 122.76 percent increase in deaths compared to grade-A with an increase tally of 12276, 120.62 percent increase compared to grade-B with an increase tally of 12062 and 0.05 percent increase in deaths compared to grade-C with an increase tally of 5.

The people with grade-F, are most prone to COVID cases and deaths. There is a 40022.51 percentage increase in number of cases compared to grade-A with increase in cases

being 4002251, 39963.66 percentage increase in cases compared to grade-B with cases increase in cases being 3996366, 37382.12 percentage increase in cases compared to grade-C with increase in cases being 3738212, 36202.65 percentage increase in cases compared to grade-D with cases being equal to 3620265.

FUTURE SCOPE

In the future scope we would like to develop the project in such a way that after identifying the people who can be the probable cases we would contact those people automatically with the help of a machine learning model and inform them about the situation to be cautious.

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