International Journal of Research in Engineering and Science (IJRES)
ISSN (Online): 2320-9364, ISSN (Print): 2320-9356
www.ijres.org Volume 11 Issue 3 ǁ March 2023 ǁ PP. 547-556

Accident Prevention System using Deep Learning

E. Prakruthi ,U. Srikanth,E. Aishwarya , B.Pruthvi Raj Goud
[1]*Assistant Professor,Departmentof Information Technology, Anurag University,Hyderabad,Telanagana*
[234*]*. IV th B.Tech, Department of Information Technology, Anurag University ,Hyderabad,Telanagana*

ABSTRACT
Most of the Accidents Occur in these days are during the night time. As per the Reports of the Accident, Most of the Accidents are due to Improper vision of the Drivers during the night time. In order to minimize and prevent the Accidents we came with a Deep Learning Model which Continuously Monitors the Road in the Range of 20 Meters and Specifies if there are people or Animals passing across the Road. The Significance of the project is to help the innocent people who might lost their lives due to the Accident without their intervention.
The Model is also useful for the animals detection . The main purpose of the project is to detect the humans or animals like dog at night and dim light conditions. As the light intensity during night is less, Even our human eye cannot detect a person. The existing system are less effective due to the less accuracy of algorithms such as YoloV2 and YoloV3. The night vision systems indeed work on mainly image processing with assistance of camera and processing units. In this way the problem of detection in case of Night vision is reduced to greater extent. This helps the Driver to reduce the accidents rates in the dim lights.
KEYWORDS: *Night Vision, Machine Learning, Coco dataset,YoloV4Algorithm.*

Date of Submission: 14-03-2023 Date of acceptance: 29-03-2023

I. INTRODUCTION

Road Accidents is a very serious and high priority public health concern as people die each year as a result of road crashes. Different risk factors such as Speeding, Drunk drive, No safety equipments, Distracted driving, Unsafe Vehicle, Improper vision may cause accidents. With the advancement in the fields of Deep learning we are able to make our device smarter. Traffic surveillance cameras are already installed in almost every part of the city.There are different techniques of classifying the Image such as CNN and K Means .CNN algorithm is majorly used for the Object detection.

In addition to its benefits, CNN also has certain drawbacks, such as the need for a large training data set that adds accuracy, the length of time required for training, the difficulty of encoding images after they have been decoded, and the final image's improper orientation.

So on the subject of all these factors the proposed model is Yolov4, It is abbreviated as You Only Look Once as name suggests it performs the object detection as the Image given into the input. It is one of the fast algorithm,Yolov4 is the improved versions of the Yolov3 , Yolov4ItoperatesonaCSPNetstrategyofdividingDenseBlockconsistingfeaturemap in two halves and then merging them together viacross-stagehierarchy.

Inthisstudy,variousmachinelearningalgorithmssuch as K Means Clustering, AdaboostAlgorithm,ConvolutionNeural Network and YoloV4 are being implemented toidentify the Person from dataset which is extracted fromkaggleanddetectthepersonoranimalbasedonthevideo.

Thecontentflowofthisresearchpapergoesasfollows:Section-IIisregardingLiteraturesurvey,SectionIIIaboutmethodology, Section IV deals with results and Section Vendswiththeconclusion.

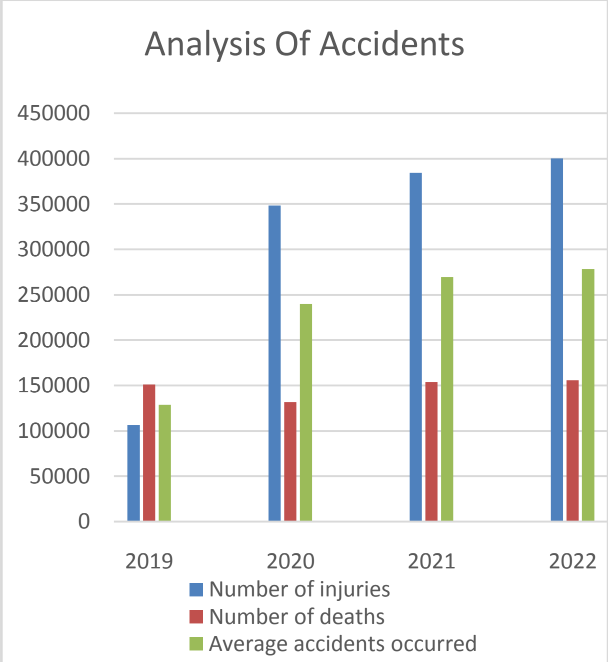


Figure 1. Analysis of Accidents

According to Ministry of Road transport and Highways, It was recorded that the number of injuries caused due to the accidents in the year 2019 on the average was 100000 and In the year 2020 there was rapid increase in the injuries caused it was about 350000. In the year 2021 and 2022 there was slight increase.

The number of deaths recorded were about 150000 in the year 2019 and it was seen that deaths was decreased in 2020 compared to 2019. In the year 2021 and 2022 there were almost same number of deaths caused.

The Average number of accidents occurred was observed that there is rapid increase from 2019 to 2022. Even though the Electric vehicles and Autonomous Vehicles was introduced the accidents occurred were increased.

II. Literature survey

There are several reasons why accidents happen, includingdrowsy driving, low light levels, and other situations whenthe vehicle is going too fast for the conditions. Here, ourfocus is on the low light levels that prevail at night. Thetraditional method of recognising pedestrians, which hasbeenthesubjectofnumerousstudies,involvescharacterising the pedestrian and their key characteristicsbeforeusingthosecharacteristicstotrainclassifiersthatcantellpedestriansapartfromotherobjectsinanimageframe.

DalalandTriggsintroducedalandmarkalgorithmforpedestrian recognition after Traditional approach in 2005.Based on HOG characteristics and an SVM classifier, adetection.

AnothermethodofclassifyingtheindividualisbyusingtheTwoStageDetectionFramework.R.Girshick's2014 proposal for RCNN detection starts with using selectivesearch to create a region suggestion box on the image,followedbytheuseofCNNforfeatureextraction,trainingoftheSVMclassifier,bounding-boxregression,andpredictionoftheoutcome.

Othermodelsexist,includingYolov3,Mobilenetssd,andResnet Models. Resnet was neither accurate nor quick,Yolov3 was accurate but slow, Yolov3 tiny was fast butlacked accuracy, therefore Yolov4 ended0 up being thebest option. Mobilenetssd provided higher speed butlackedprecision.

Algorithm	**Speed**	**Accuracy**
Resnet	Less	Less
Mobilenetssd	High	Less
Yolov3	Less	High
Yolov3-tiny	High	Less

Yolov4-tiny	High	High

III. PROPOSED SYSTEM

In Early stages there are various ways of detecting personsorthingsinavideousingpopularalgorithmssuchasCNN,RCNN,SVMandHOG(HistogramOrientedGradient) butintheproposedsystemweareusingtheYOLOv4algorithmwhichisproposedbyAlexeyBochkovskiyin2020.Thead vantagethroughthismodelisMultipledetectionisavailableandfastdetectionisalsoavailable,backbonebasicallyusesC SPNetstructureproposedbyWang. The schematic diagram of applying CSP to ResNetisshowninFigurewhichaddsapathtoeachcycleblock.

The trained model we are utilising in this case isYolov4-tiny, which is the fourth iteration of the well-knownYouOnlyLookOncemodelthatprioritisesspeedaboveaccuracy.JosephRedmoncreatedYolo,oneofthetopreal-timeobjectidentificationmodels.

A. *Datasets*

A dataset is a collection of data that is used to train the model. A dataset acts as an example to teach the machine learning algorithm how to make predictions. The common types of data include:

- Text data
- Image data
- Audio data
- Video data
- Numeric data

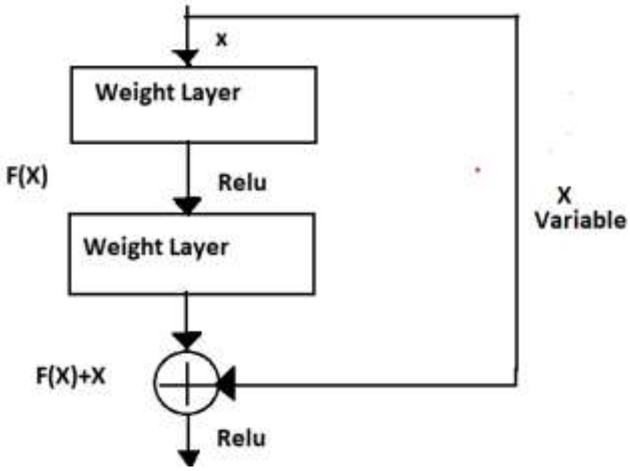
TheKaggledatasetofnumerousphotosofpedestriansorpeoplestrolling on the streets and footpaths is the one we utilisedin thisarticle.
Wecanobtainamodelwithhighspeedanddecentaccuracy thankstotheextensive dataset.

B. Algorithms

In the Yolov4-tiny is more efficient because in Yolov4 is trained 129 Pre trained Convolutional Layers and in Yolov4-tiny there are only 29 Convolutional layers, It was implemented in Keras framework and converted to TensorFlow* framework. This model was pre-trained on COCO dataset with 80 classes.

1.Resnet:

Shaoqing Ren, Kaiming He, Jian Sun, and Xiangyu Zhangintroducedthepopulardeeplearningmodelknownas Resnet in their study. With the advent of these Residualblocks, the issue of training very deep networks has beenresolved,andtheResNetmodelisbuiltupoftheseblocks.



Thefirstthingwecanseeintheabovediagramisthatthereis a direct connection that skip one model layers. The coreofleftoverblocksisaconnectionknownasa"skipconnection."Thisskipconnectioncausestheoutputtodiffer.Input'X ismultipliedbythelayerweightsintheabsenceoftheskipconnection,andthenabiastermisadded.

2.Mobilenet:

MobileNet is a type of convolutional neural network designed for mobile and embedded vision applications. An object detection model called MobilenetSSD uses aninput image to determine an object's bounding box andcategory. AdvantageofMobilenetisAsalightweightdeepneuralnetwork, MobileNet has fewer parameters and higher classification accuracy.

MobileNets are small, low-latency, low-power models parameterized to meet the resource constraints of a variety of use cases. They can be built upon for classification, detection, embedding,segmentation.

3.Yolo V3:

YOLOv3 (You Only Look Once, Version 3) is a real - time object detection algorithm that identifies specific objects in videos, live feeds, or images. The YOLO machine learning algorithm uses features learned by a deep convolutional neural network to detect an object.

YOLOv3 has the advantages of detection speed and accuracy and meets the real-time requirements for object detection. Yolov3'sbenefitsincludeYOLOv3israpidandaccuratein terms of mean average precision (mAP) and intersectionoverunion(IOU)values.

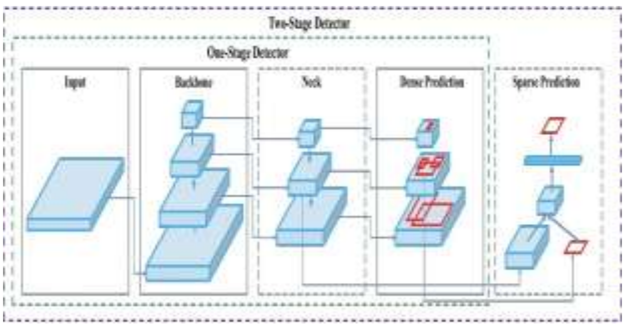
Yolov3's drawbacks include its inability to recognise andseparatesmallthingsinphotoswheretheyappearinclustersbecauseeachgridcanonlydetectoneobjectatatime.Asaresult,YOLOhastroublelocatinganddetectinglittleitemsthatordinarilyformgroups,likealineofants.

4.Yolo V4:

The Yolov4 algorithm is primarily used for quickobjectdetectioninvideo,picture,andimageframesequences.The fourth model in the You Only Look OncefamilyiscalledYoloV4.

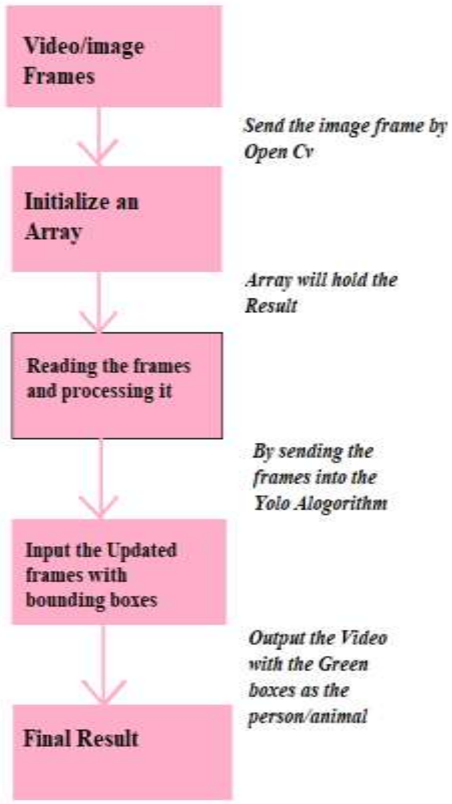
Modelsforobjectdetectionaretrainedtoscanapicturefora certain subset of object types. When discovered, theseobject classes are placed inside the bounding boxes andgivenaclassdesignation.

The COCO dataset can be used to train object detection models. The dataset provides bounding box coordinates for 80 different types of objects, which can be used to train models to detect bounding boxes and classify objects in the images.



The main advantage of YOLOv4 is twice as fast as EfficientDet (competitive recognition model) with comparable performance. In addition, AP (Average Precision) and FPS (Frames Per Second) increased by 10% and 12% compared to YOLOv3.

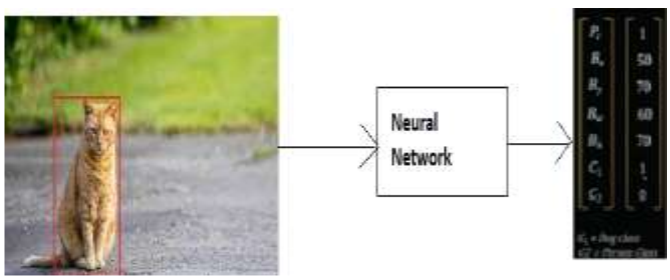
C. Work Flow
Through a flow chart, we can easily navigate through eachstepoftheproject'soperation,fromcollectingimagesfromthe cameras to initializing an array to store the results topassing frames to the yolo algorithm, updating the frameswithboundingbox,andfinallyalertingthedriverbybeepinganalarm.



IV. IMPLEMENTATION:

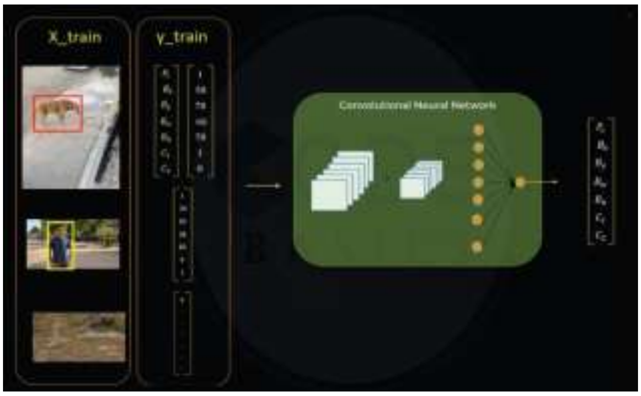
Yolo algorithm which stands out from the other algorithms like RCNN,Faster RCNN because of its highspeed,high accuracyand simple architecture.
Before looking at the working model lets understand howobjectlocalizationactuallyworks.
UsingaNeuralNetworkforaObjectLocalization.

Letstry tounderstand whattheoutputvectorrepresents:



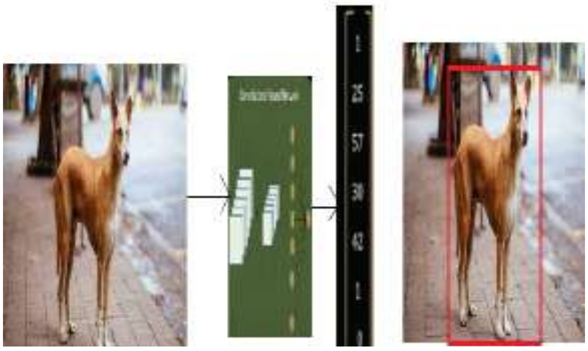
Hereoutputvectorsizeis7 withthebelowindications.
1. Pc indicates whether any object of interest is there or notin the image.
2. BxtoBhindicatesboundingboxcoordinates.

3. C1 will be 1 if the object detected is a dog otherwise itwillbe0.
4. C2 willbe1iftheobjectdetectedisapersonotherwiseitwillbe0.
5. So for training, we should give images with boundingboxes as x_train and its corresponding output vector asy_train for theneuralnetwork.



As previously indicated, the neural network will be fed alarge number of images together with their ground truthvectors.

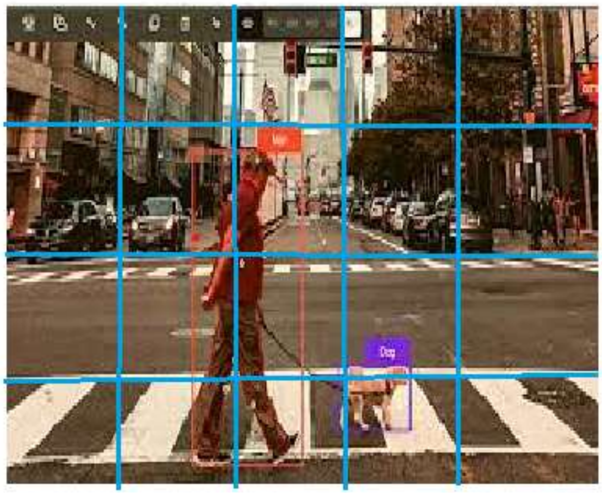
The trained neural network will predict the object's classand position when given anewimageasseenbelow.



As C1 in the output vector is 1, the object predicted is ofclass dog and its coordinatesare predictedas[25,57,30,42].
ButwhatiftheImagecontainsmultipleobjects.Sohowdowechoosethesize oftheoutputvector?
If our image has n objects, then the output vector of sizen *7willlikely solve the issue.
Letssay wehavean imagewith two objects.

Steps of Working of the Yolo:

Step1: DividestheImageintotheGrids.

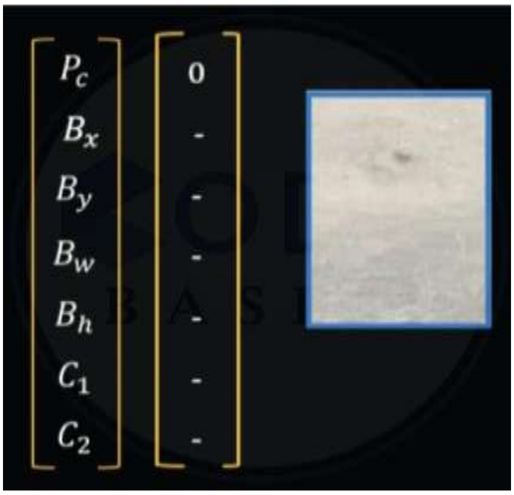


You can divide an image into grids by drawing horizontalandverticallinestocreateaseriesofsquaresorrectangles.Thiscanbeusefulforavarietyofpurposes,suchasorg anizing the elements of the image, making it easier toedit or analyze, or simply to create a visually appealingeffect.This can help you to understand the various segmentsofthe image.

Step2: Markthecenterofeach object

It might be helpful to mark the centre of each object in animageforanumberofreasons,includingobjectalignment,compositionanalysis,orjustforreference.Youmayquickly and precisely mark the centre of each object in yourimagebyusingthegridor guidetool.

Marking the Centre of each object in an image may beuseful for a variety of purposes, such as object alignment,compositionanalysis,orjustasapointofreference.Using thegridorguidetool,youmayquicklyandpreciselyindicatethe centreof eachobjectinyourimage.
Step 3: Generates the output vector for each grid formed.Foreachandeveryvectorwecangetthegridandthatcangivethe classificationof theimage.
Gridswithoutanyobjectswillbejustmarkedwithemptyvectorsasbelow.



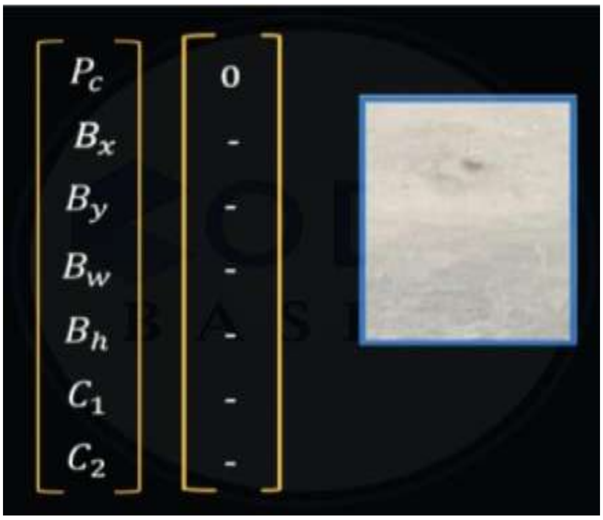
Let'sthinkaboutthegridbelow.Here,thegridisclassifiedinto a certain class by the model using the object's centre.Thisgridwillbehandledasadogobjectbecauseitscentre isa dog.

This is how YOLO generates output vectors of size 7 foreach grid.So, forourimagewith4 x4grid,wewillget4 x 4 x 7 vectors. This will be fed into a neural net fortraining.

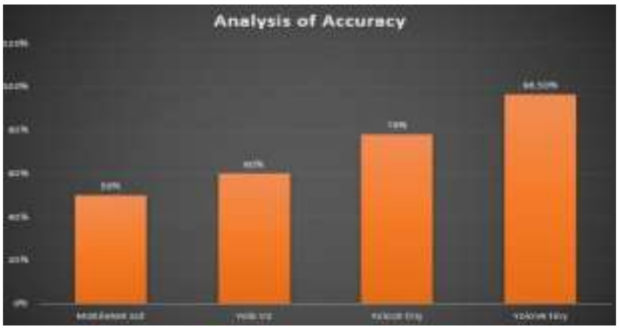
V. RESULT AND ANALYSIS

Theresultsandanalysisofapedestriandetectionprojectwill depend on the specific goals and objectives of theproject, as well as the techniques and methods used. Ingeneral, a pedestrian detection project may seek to assessthe effectiveness of various algorithms or strategies forspotting pedestrians in pictures or videos or to contrast theeffectivenessofvariousmethodsonvariousdatasets.

The mean average precision is one typical indicator forassessingtheeffectivenessofapedestriandetectionalgorithm(mAP).Thisstatisticassesseshowwellthesystem detects and identifies pedestrians in the pictures orvideos. The false positive rate, false negative rate, andoverall accuracy are additional metrics that can be used toassesshowwellapedestriandetectionsystemperforms.



Inadditiontoassessingthealgorithm'sperformance,it'scrucial to take into account other elements, such as thealgorithm's speed and efficiency, robustness to changes inlighting and weather, and capacity to deal with obstacleslikeocclusions.



Overall, the results and analysis of a pedestriandetectionprojectwillprovideinsightsintothestrengthsandweaknessesofdifferentapproaches,andcanhelpguidethedevelopmentofmoreeffectiveandreliablepedestriandetectionsystems.

Model	Accuracy	Precision	F1Score
MobileNetssd	50%	61.2%	68%
YoloV3	60%	68.9%	71%
Yolov3tiny	78%	75.5%	77%
YoloV4tiny	96.5	88.8%	89%

Table1.AnalysisofAccuracy,Log-LossandF1Score

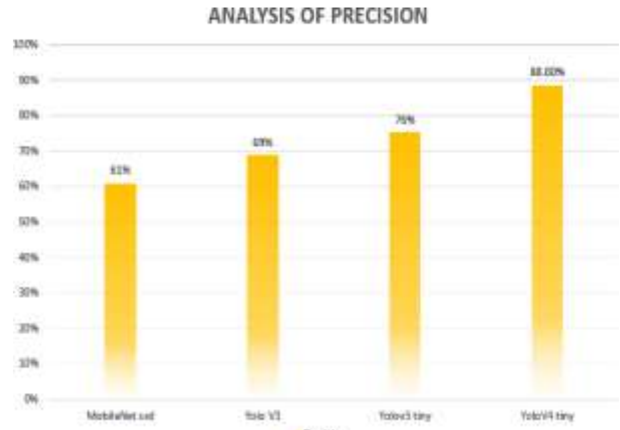


Fig 2 Analysis of Precision

From the above figure 2, it gives a clear picture of variousalgorithmsandtheirrespectivePrecisionvalues.Itisevidentthatthe Log-Loss valueis minimum whenthemodel is Mobile Net SSD with a value of 61% only, whereasthe maximum value of Log-Loss can be observed when themodelisYoloV4tinywithavalueof88.8%approximately.

Theabovefigure3,detailsabouttheaccuracyvalueswhentestedbyvariousmachinelearningalgorithms.Theaccuracyhasbeenthemaximumwhenthemodelis Yolov4tinywithawhoopingvalueof96.5approximately.

Whereas the minimum value of accuracy when comparedwithfouralgorithmsisobservedwhenthemodeliswithof50% approximately. Hence the study clearly mentions thattheLogisticRegressionalgorithmisproventobethehighlyoptimizedalgorithmprovidingthemostpromisingresults.

VI. CONCLUSION

Accident Prevention System is one of the most important and effectivelyaddressestheissuesthatpeopleandanimalswhocrosstheroadface. YoloV4 is an algorithm that allows us to categorisephotos with high precision and a low error rate. It operateswellinlowlightsituationsandcanidentifypeopleupto30metresaway.

FUTURE SCOPE

Inordertodevelopmorecomplexandadvancedintelligenttransportationsystems,itisalsopossibletocombinepedestrian detection systems with other technologies, suchascommunicationnetworksandlocationservices.Forinstance,pedestriandetectioncouldbeemployedtoincrease the effectiveness and security of traffic flow or togivepedestriansreal-timeinformation anddirection..

Overall,thefuturescopeofdetectionisvastandthere are many exciting opportunities for further researchand developmentinthisarea.

REFERENCES

[1]. G.Howard,etal.,"Mobilenets:Efficientconvolutionalneuralnetworksformobilevisionapplications," IEEE/CVF Conf. on Computer Vision andPattern Recognition, Apr. 2017.

[2]. Padilla, Rafael, Sergio L. Netto, and Eduardo A. B. daSilva."ASurveyonPerformanceMetricsforObject-Detection Algorithms." *2020 International Conference onSystems,SignalsandImageProcessing(IWSSIP)*,237-242(2000).

[3]. E.Coelingh,A.Eidehall,andM.Bengtsson,"Collisionwarning with full auto brake and pedestrian detection - apracticalexampleof automaticemergency braking,"in13thInternationalIEEEConferenceonIntelligentTransportationSystems, Sept2010,pp.155–160

[4]. Hu Jie, et al., " Squeeze and Excitation Networks,"IEEE/CVFConf.onComputerVisionandPatternRecognition,p.p.7132-7141,May2019

[5]. Kaiming He, et al., " Deep residual learning for imagerecognition," IEEE/CVF Conf. on Computer Vision andPattern Recognition, p.p.770-778,2016

[6]. B. Wu and R. Nevatia, "Detection of multiple, partially occluded humans in a single image by bayesian combination of edgelet part detectors," in Computer Vision, 2005. ICCV 2005. Tenth IEEE International Confer ence on, vol. 1. IEEE, 2005, pp. 90–97.

[7]. D. Park, D. Ramanan, and C. Fowlkes, MultiresolutionModels for Object Detection. Berlin, Heidelberg: SpringerBerlin Heidelberg, 2010,pp.241–254.