DETECTION OF NON-HELMET RIDERS AND EXTRACTION OF LICENSE PLATE NUMBER USINGYOLO-V2 AND OCR METHOD

Dr. REKHA C
Associate Professor, ISE, BIET, Davangere, rekhac1976@gmail.com

ANUSHA A SHIRODKAR
B.E, Student of ISE, BIET, Davangere, anushashirodkars@gmail.com

TANUJA V M
B.E, Student of ISE, BIET, Davangere, tanujavm2014@gmail.com

VEEKSHITA S JAKKARADDI
B.E, Student of ISE, BIET, Davangere, veekshitajakkaraddi@gmail.com

SHANU KUMAR SINGH
B.E, Student of ISE, BIET, Davangere, shanukumarsing@gmail.com

Dr. SHREYAS J*
Creencia technologies Pvt. Ltd., Bangalore, India, shreyasj.email@gmail.com

Abstract-

In current situation, there are various problems in traffic regulations in India which can be solved with different ideas. Ridingmotorcycle/mopeds without wearing helmet is a traffic violation. Existing system monitors the traffic violations primarily through CCTV recordings. What if there is a system, which would automatically look for traffic violation and automatically extract the vehicles' license plate number. Recent research have successfully done this work based on CNN, R-CNN, LBP, HoG,HaaR features, etc. In this project of "Detection of Non-helmet Riders and Extraction of license plate number using YOLOv2 and OCR Method" attempts to satisfy the automation of detecting the traffic violation of not wearing helmet and extracting the vehicles' license plate number.

Keywords- CNN, R-CNN, LBP, HoG, HaaR, YOLOv2, OCR.

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I. INTRODUCTION

All over the world around 1.35 million lives are lost each year, 50 million people are getting injured due to road accidents, according to a report titled "The Global status report on road safety 2018" released by world health organization. It is very hard to imagine that this burden is unevenly borne by motorcyclists, cyclists and pedestrians. Worrying fact is that India ranks number one as far as road crash deaths are considered. Rapid urbanization, avoiding helmets, seat belts and other safety measures while driving are some of the reasons behind this trend according to analysis done by experts. When a two-wheeler meets with an accident, due of sudden deceleration, the rider is thrown away from the vehicle. If head strikes any object, motion of the head becomes zero, but with its own mass brain continues to be in motion until the object hits inner part of the skull. Sometimes this type of head injury may be fatal in nature. In such times helmet acts as life savior. Helmet reduces the chances of skull getting decelerated, hence sets the motion of the head to almost zero. Cushion inside the helmet absorbs the impact of collision and as time passes head comes to a halt. It also spreadsthe impact to a larger area, thus safeguarding the head from severe injuries. More importantly it acts as a mechanical barrier between head and object to which the rider came into contact. Injuries can be minimized if a good quality full helmet is used. Traffic rules are there

to bring a sense of discipline, so that the risk of deaths and injuries can be minimized significantly. However strict adherence to these laws is absent in reality. Hence efficient and feasible techniques have to be created to overcome these problems. Manual surveillance of traffic using CCTV is an existing methodology. But here so many iterations have to be performed to attain the objectiveand it demands a lot of human resource. Therefore, cites with millions of population having so many vehicles running on the roads cannot afford this inadequate manual method of helmet detection. So proposed a methodology for full helmet detection and license plate extraction using YOLOv2, YOLOv3 and OCR.

II. LITRATURE SURVEY

The research works pertaining to the object detection domain have been more frequent due to the evolving object detection algorithms that provide improved accuracy and less detection time in the newer versions. However, it is important to analyze theprevious research works carried out in this domain to understand how the algorithms improved over time, and what are the limitations of previous versions of algorithms, the technical difficulties faced while working through the project and how to overcome them. Object detection algorithms that suit this application are SSD, MobileNet, Faster R-CNN, Inception and YOLO. It is important to understand how these algorithms works, advantages and disadvantages of choosing the algorithm that suits this application. This review of the previous literature work will focus on the discussed aspects of each algorithm and the reason for choosing a specific algorithm for this project will be justified. Literature surveys of some papers-

- Vakani et al. (2020)[1] in this study motorcyclists without helmets are recognised, and the picture of the license plate isrecorded as an image, according to the research. The investigation is limited by the fact that no characters from the licenseplate are recognised. This approach creates duplication, and it is not possible to digitally save the pictures of the licenseplate and utilise them for future research.

- The Histogram of Oriented Gradient (HOG) and Circular Hough Transform (CHT) are some of the widely used featureextraction techniques in the object detection domain Rachmad Jibril et al. (2021)[2]. CHT is utilized in the detection of circular objects. HOG feature extraction and classification using KNN are the two components of the classification module. Pre-processing of the recorded frames, computing the gradient and then calculating the HOG value in each cell, normalizing each block, and calculating the feature is all part of the HOG feature extraction process. In pre-processing, all frames in the footage are transformed to greyscale, contrary to previous studies. In each cell, the HOG is calculated by matching the Gradient Direction and Magnitude. The article ended with a discussion of the future potential for identifying license plate characters, which is now being incorporated into my project. In the following part, we'll look at how a lightweight Neural Network model called MobileNet may be used to identify helmets and license plates.

- Prasad et al. (2020)[3] examine five key elements that have a major impact on the accuracy and detection of time. Data significance, If traffic surveillance videos are recorded, Vehicle perception, Changes in climatic conditions and their consequences, video quality. For this, a Support Vector Machine (SVM) classifier was utilized. Since the construction of an edge histogram, the SVM classifier was chosen for this purpose because classification performed better in low light circumstances. The model for this study was created in two phases. First, the YOLOv3 object identification technique was utilized to recognize helmets in mono and dual motorbike riders. If the helmet is present, the frames are evaluated and measurements are taken with precision. A modest computational setting with GPU support is selected because the research does not require a lot of computer resources. When employing the SVM classifier, the accuracy is determined to be 92.6 percentage

- Linu Shine and Jiji (2020)[4] emphasises the use of a two-stage classifier to recognise motorcyclists who are not wearinga helmet. HOG and Local Binary Pattern (LBP) are used in the first stage, while unique CNN architecture is used in thesecond. 7 convolution layers, 2 max-pooling layers, and 2 completely linked layers make up the custom-made CNN. Themotorcycle categorization module consists of a boundary detection module, parameter separation, parametric classifying

(stage I), and feature extraction using HOG and LBP, with the result given to the SMO classifier (stage II) to determineif it is a motorbike or not. The Region of Interest (ROI) was further extracted, and features are extracted using the HOG,LBP, and Haralick methods. This classifier's result is sent into the Logistic decoder, which makes the ultimate judgementon whether or not the person should wear a helmet.

III. PROBLEM STATEMENT

The risks associated with driving a motorcycle is comparatively higher than other modes of transportation. This problem could be overcome over time by penalizing the riders without helmets by identifying them using their vehicle's license plate.

IV. PROPOSED SOLUTION

The proposed methodology for feature extraction using LBP based hybrid descriptor, HOG and Hough transform descriptors. Whereasabsorbed grey level co-occurrence matrix along with LBP for feature extraction. YOLOv2 and COCO dataset can be worked to detectdifferent types of objects and classify them accordingly The intended object are motorcycle, motorcyclists, pedestrians and workers. Helmet and tyre colour exhibits different characteristics, this can be used to detect motorbikes. Introduced a method to identify twowheeler accidents using a microcontroller and accelerometer. Most of the time pedestrians are the real victims of road accidents, their safety is essential. Introduce a method to classify pedestrians using SVM based on the histogram of oriented gradient features (HOG). The last step involves helmet detection. Colour based and circles Hough transform is used to recognize helmet and HOG descriptors can also be used for helmet detection. Colour feature recognition is another option. Exploit colour space transformation andcolour feature discrimination for detecting the helmet. GLCM statistical features and Back-Propagation artificial neural network is usedto detect helmet more effectively.

V. PROPOSED OBJECTIVES

- To detect and classify the helmeted motorcyclists from the non-helmeted motorcyclists from a pre-defined dataset using the YoloV2(You Only Look Once)-Darknet algorithm.
- To display output as the person is wearing the helmet or not.
- To perform License plate detection of non-helmeted motorcyclists images using YoloV2 model.
- To perform OCR(Optical Character Recognition) to extract the Alphanumeric characters from the license plate.

VI. SYSTEM DESIGN

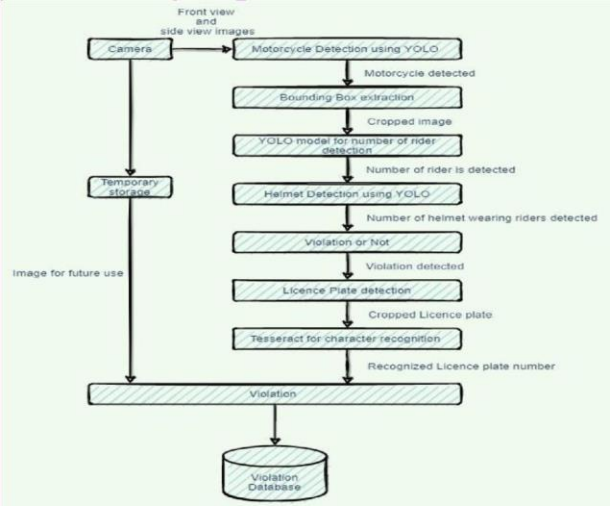


Fig 1: System Architecture

Architecture diagram of the system is shown in Fig.1, Motorcycle and rider detection using YOLOv3. In this system a pretrained Yolov3 model is used for detecting motorcycles with riders. To get better results the model is trained again using a dataset containing 835 images. Bounding boxes are drawn to localize the area of interest which here is the motorcycle with the riders. Number of riders detection using YOLOv3 Basic YOLO v3 weights are pre trained using coco datasets for 80 classes of objects like umbrella, bus, boat etc. Among these 80 classes, person is also one of the pre-trained classes. So used this class to find the number of persons riding in themotorcycle. The bounding box of the motorcycle detected in the previous model is cropped and that image is passed as input to this present model to detect the number of riders. This model returns the number of riders detected. Helmet detection using YOLOv3 Helmet detection is again implemented using YOLO v3. Similar to the first model here,

pretrained model weights are trained again to get betterresults. Here open dataset v6 is used. It has 5000 images of motorcyclists and out of which 1000 are wearing helmets. Here 900 imagesare used for training, and 100 for testing. A bounding box is drawn across the helmet detected. This model gives the number of helmets detected. License plate detection using YOLOv3 to get the license plate number, firstly the license plate must be detected. Here it is done using another pre-trained YOLOv3 model. This model has 8 classes for different license plates like truck, car et cetera. Out of eight classes motorcycle license plates are also one. Since most of the image contains multiple motorcycles to get one particular motorcycle, the first model is used and the motorcycle is cropped according to the bounding box. This is passed through the license plate model. Once the license plate is detected it is cropped again and passed through a series of pre-processing steps. Preprocessed image is passed through tesseract to get the license plate number. The detected license plate number is stored in a violation database.

Algorithm 1: YOLO - You Only Look Once

YOLO is an abbreviation for the term 'You Only Look Once'. This is an algorithm that detects and recognizes various objects in a picture (in real-time). This algorithm is popular because of its speed and accuracy. It has been used in various applications to detect traffic signals, people and parking meters. Object detection in YOLO is done as a regression problem and provides the class probabilitiesof the detected images.

YOLO algorithm 1 as shown below employs convolutional neural networks (CNN) to detect objects in real-time. This meansthat prediction in the entire image is done in a single algorithm run. The CNN is used to predict various class probabilities and boundingboxes simultaneously.

Detection of Bike:

The image is taken as input. The Yolo algorithm recognizes various objects in an image and creates a bounding boxes around the objects to detect the pair of bike and person as shown in Fig.(1) and Fig.(2)

Input: Image of person with bike

Output: Pair of bike and person is detecteddef detectBike():

global optionoption = 0

indexno = 0

label_colors = (0,255,0)try:

image = cv.imread(filename)
image_height,image_width = image.shape[:2]

except:

raise 'Invalid image path'finally:

image, ops = detectObject(cnn_model, cnn_layer_names, image_height, image_width, image, label_colors,class_labels,indexno)

if ops == 1:

displayImage(image,0)#display image with detected objects labeloption = 1

else:

displayImage(image,0)

(1)

(2)

Fig.(1) and (2) Pair of bike and person detected

Helmet Detection:

Once the pair of bike and person is detected then the image is cropped to get head region as shown in Fig.(3) to detect whether thehelmet is present or not as shown in Fig.(4)

Input: Cropped image of head region

Output: Helmet detected or helmet not detected defdetectHelmet():

textarea.delete('1.0', END)if option == 1:

frame=cv.imread(filename)frame_count = 0

blob=cv.dnn.blobFromImage(frame,1/255,(inp Width,inpHeight), [0,0,0], 1, crop=False) net.setInput(blob)

outs = net.forward(getOutputsNames(net)) postprocess(frame, outs)

t,_= net.getPerfProfile()

label = 'Inference time: %.2f ms' % (t * 1000.0 / cv.getTickFrequency())print(label)

cv.putText(frame, label, (0, 15), cv.FONT_HERSHEY_SIMPLEX, 0.5, (0, 0, 255)) print(label)

else:

messagebox.showinfo("Person & Motor bike not detected in uploaded image", "Person & Motor bike not detected in uploadedimage")

(3) (4)

Fig (3) Cropped Images of Head region and (4) Helmet detected

Algorithm 2: OCR – Optical Character Recognition

Optical character recognition (OCR) technology is a business solution for automating data extraction from printed or written text froma scanned document or image file and then converting the text into a machine-readable form to be used for data processing like editinor searching.
It also eliminates the need for manual data entry. OCR systems use a combination of hardware and software to convert

physical, printed documents into machine-readable text. Hardware — such as an optical scanner or specialized circuit board — copiesor reads text; then, software typically handles the advanced processing.

OCR software can take advantage of artificial intelligence (AI) to implement more advanced methods of intelligent characterrecognition (ICR), like identifying languages or styles of handwriting.

License Plate Number Extraction:

After detection of helmet, if the person is wearing the helmet then no action is taken. If the person is not wearing the helmet then the license plate of that bike is detected as shown in Fig.(5) Then the license plate is cropped as shown in Fig. (6) which is then converted into text by OCR(Optical Character Recognition) as shown in Fig.(7)

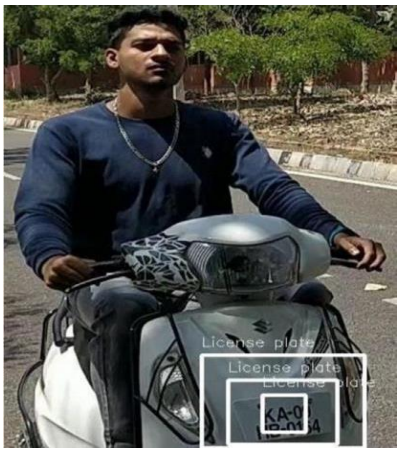
Input: Image of License Plate **Output:**

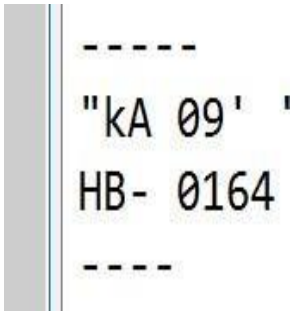
License plate number as textpredict = np.argmax(preds)

img = cv.imread('labels/'+str(predict)+".png") img = cv.resize(img,(500,500))

```
text = tess.image_to_string(img, lang='eng')text = text.replace("\n"," ")

#messagebox.showinfo("Number Plate Detection Result", "Number plate detected as "+text)
textarea.insert(END,filename+"\n\n")
textarea.insert(END,"Number plate detected as "+text)
```



(5) (6) (7)

Fig. (5) License Plate Detection and (6) Cropped License plate and (7) License plate number as text

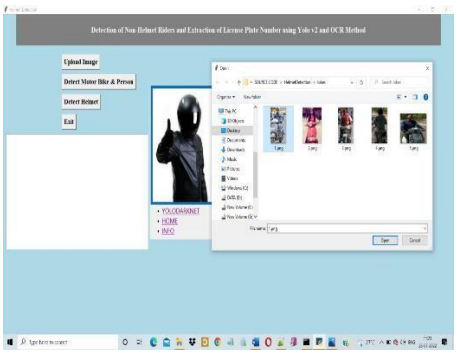
VII. RESULT

(8) (9)

Fig. (8) After setting path double click on 'run.bat' file to run project and to get above screen and(9) In above screen click onUpload Image' button and upload image.

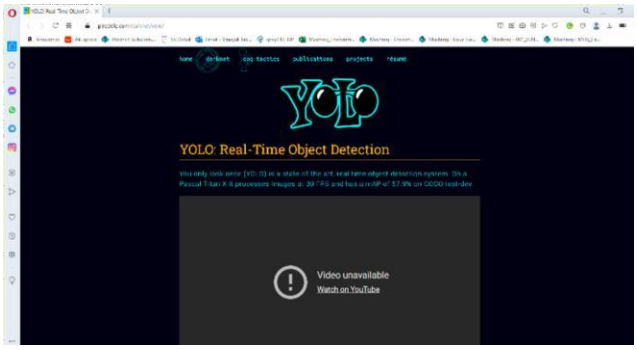

(10) (11) (12)

Fig.(11)In above screen I selected one image and click on 'Open' button to load image. Now click on 'Detect Motor Bike &Person' button to detect whether image contains person with motor bike or not and (11) In above screen yolo detected imagecontains person and bike and now click on 'Detect Helmet' button to detect whether he is wearing helmet or not and (12) In above screen application detected that person is not wearing helmet and its extracted number from vehicle and display in besidetext area. Now we will check with helmet image .




(13) (14) (15)

Fig. (13) In above screen I am uploading image in which is wearing helmet and now click on 'Detect Motor Bike & Person' buttonto get below result and (14) In above screen yolo detected person with motor bike and now click on 'Detect Helmet' button to getbelow result and (15) In above screen application detected person is wearing helmet and that label is displaying around his head and application stop there itself and not scanning number plate.



(16) (17)

Fig. (16) The three buttons YOLODARKNET, HOME and INFO gives the below result when clicked and (17) The aboveScreen is the page we get when the YOLODARKNET button is clicked.

(18) (19)

Fig.(18) The above screen is the page we get when the HOME button is clicked and (19) The above screen is the page we getwhen the INFO button is clicked.

VIII. CONCLUSION

Existing system monitors the traffic violations primarily through CCTV recordings, where the traffic police have to look into the frame where the traffic violation is happening, zoom into the license plate in case rider is not wearing helmet. But this requires lot of manpower and time as the traffic violations frequently and the number of people using motorcycles is increasing day-by-day. This project aims to automatically look for traffic violation of not wearing helmet while riding motorcycle/moped and if so, would automatically extract the vehicles' license plate number. In manual surveillance of traffic using CCTV so manyiterations have to be performed to attain the objective. Therefore, cites with millions of population having so many vehicles running on the roads cannot afford this inadequate manual method of helmet detection. Hence efficient and feasible techniques have to be created to overcome these problems. Even though the government has mandated the use of helmets for both rider andthe pillion rider, it is not feasible to monitor roads 24/7 by employing traffic police. The best possible solution is to build an artificially intelligent framework that can be mechanized to perceive this sort of issue without human cost.

IX. FUTURE SCOPE

In the future this project can be further developed as such to send the penalty notification to the authorised person if he/she is notwearing the helmet.

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