TRAFFIC RULES VIOLATION RECOGNITION FOR TWO-WHEELER USING YOLO ALGORITHM

[1]Rithesha G, [2]Rithvik N Swamy, [3]Sanjay N B, [4]Sanjaya S K

[1]ECE-UG Students, DSCE, Shavige Malleshwara Hills, 91st Main Rd, 1st Stage, Kumaraswamy Layout, Bengaluru, Karnataka 560078
E-mail id : ritheshaganesha@gmail.com, rithviknswamy@gmail.com, sanjayknv99@gmail.com, sanjaysanjusk1999@gmail.com

[2]Prof. VIBHA T G, Dept.Of ECE, DSCE, Shavige Malleshwara Hills, 91st Main Rd, 1st Stage, Kumaraswamy Layout, Bengaluru, Karnataka - 560078
E-mail id: vibha-ece@dayanandasagar.edu

Abstract----We usually prefer motorbikes over other vehicles as it is significantly less expensive to run, less demanding to park and adaptable in rush hour gridlock. In India, in excess of 118 million individuals are utilizing bikes. Since lot of bikes travel along with other vehicles wearing headgear is critical to decrease the danger of injuries. we propose an approach where we identify the motorcycle riders without headgear and who are triple riding utilizing surveillance videos in real-time. Our approach also proposes a system where a message will be sent to the concerned authority about the vehicle details of the person who violates the above-mentioned rules.

I. INTRODUCTION

Bike is an extremely mainstream method of transportation in India. However, there is a high risk involved due to lack of protection. It is very important to be aware that road traffic injuries remain an important public health problem. When road safety products are utilized correctly or efficiently, they can help saves lives, prevent accidents and injuries, and keep a society functioning in the most optimal way. Motorcycles being one of the most convenient modes of transport have led to increasing use and thus accounts for the highest share of road accidents. In countries like India, Brazil, Thailand, majority of population uses motorcycles for daily commute. During the last decade, amongst identified natural causes of accidental deaths, lightning seems most significant accounting for about 10% of deaths due to natural causes whereas amongst unnatural causes, traffic accident caused maximum unnatural deaths.

To decrease the involved risk, it is highly desirable for motorcycle riders to use helmet. That's why the government has made it a punishable offense to ride a bike without helmet. The drawback of the current method where human intervention is required can be solved by our proposed method. Automation of this procedure is exceptionally attractive for vigorous observing of these infringements and additionally it likewise altogether lessens the measure of human resource required. Also, many countries are adopting systems involving surveillance cameras at public places. So, the solution for detecting violators using the existing infrastructure is also cost-effective. However, in order to adopt such automatic solutions certain challenges, need to be addressed.

II. EXISTING WORK

A. **Silva et al**. proposed an approach which starts with detection of bike-riders. Then it locates the head of bike-riders by applying Hough transform and then classifies it as head or helmet. However, Hough transform for locating head of bike-rider can be computationally expensive. Also, in "Helmet detection on motorcyclists using image descriptors and classifiers" experiments are performed on static images only

B. **Duan et al.** suggest a robust approach for tracking of vehicles in real-time from single camera. In order to accelerate the computation, it used integrated memory array processor (IMAP). However, it is not an efficient solution due to its requirement of dedicated hardware.

C. **Chen et al**. proposed an efficient approach to detect and track vehicles in urban traffic. It uses Gaussian mixture model along with a strategy to refine foreground blob in order to extract foreground. It tracks a vehicle using Kalman filter and refines classification using majority voting.

PROPOSED WORK

A. Vehicle Detection

We are using YOLO (You Only Look Once) for this purpose. It was developed in 2015 by Joseph Redmon, Santosh Divvala, Ross Girshick, and Ali Farhadi. It's popular because it achieves high accuracy while running in real time. This algorithm is called so because it requires only one forward propagation pass through the network to make the predictions.

YOLO is an object detection algorithm. YOLO predicts the coordinates of bounding boxes directly using fully connected layers on top of the convolutional feature extractor. Predicting offsets instead of coordinates simplifies the problem and makes it easier for the network to learn. YOLO is better than other object detection algorithms like R-CNN, fast R-CNN, and faster R-CNN as they use pipelines to perform the detection of objects which incorporates multiple steps. Hence these algorithms are slow to run and hard to optimize as each individual component should be trained separately. YOLO can do this task with a single

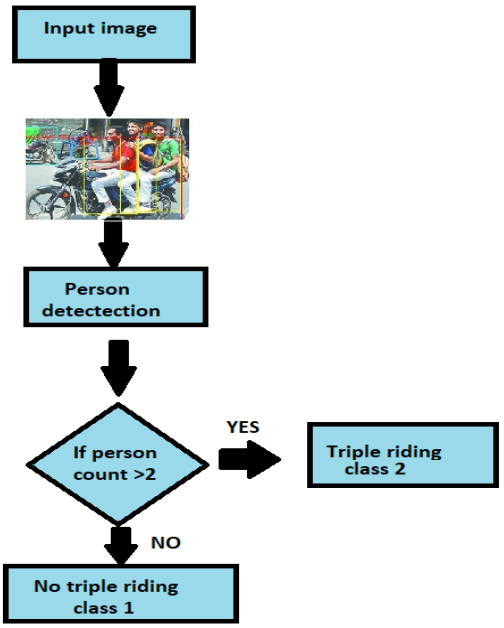
Tkinter is a Python binding to the Tk GUI toolkit. It is the standard Python interface to the Tk GUI toolkit,[1] and is Python's de facto standard GUI.[2] Tkinter is included with standard Linux, Microsoft Windows and Mac OS X installs of Python.

B. Helmet Classification

After the objects i.e. the vehicles are detected, the next important task is to identify whether riders are wearing a helmet. Here the approximate region of the head of the rider is isolated, which is used as a feature that is derived from the histogram operations applied to the region.

C. Triple riding

The process of detecting triple riding is same as helmet detection. It uses bounding box to detect person and motorcycle. If three persons are detected on the motorcycle the count is increased and it sends the number plate of the motorcycle to OCR. The video fed to test triple riding runs at 35-45 FPS (Frames per Second) it depends on the system processor.



D. License Plate Recognition

After detecting the vehicles using object detection, and classifying them according to the violations, the number plate of the corresponding vehicle has to be recognized for storing violations and further processing.

Here we come up with an innovative system where characters are extracted from input number plate image. We used many image preprocessing steps in order to extract only text from number plate image. Since images are more susceptible to noise and with many other unwanted objects. Noise is removed from image using effective noise removal method. Before image preprocessing steps, RGB image is converted to gray scale image and image is resized keeping aspect ratio same. Morphological processing is used which helps to detect text more accurately. Image is converted to double. Edge detection method is used to detect edges and image intensity level is increased. Objects which have gaps are filled.

After Edge detection, image might contain many horizontal and vertical lines. These lines should be removed from image which helps to extract only text from image. After applying these image preprocessing steps, image is left with few smaller unwanted objects. These unwanted objects are removed. Bounding boxes is applied to text extracted. These texts are in image format. These images are converted to characters. System uses optical character recognition to extract characters from image. Character and number images are stored in directory.

The extracted text image is separated by bounding box. Each bounding box will contain each character or number. Each character or number is resized to image stored in directory. Extracted image and existing character image feature is compared. After comparison characters are detected. Finally detected characters are shown in text format

.

E. SMS

Twilio Messaging is an API to send and receive SMS, MMS, OTT messages globally. It uses intelligent sending features to ensure messages reliably reach end users wherever

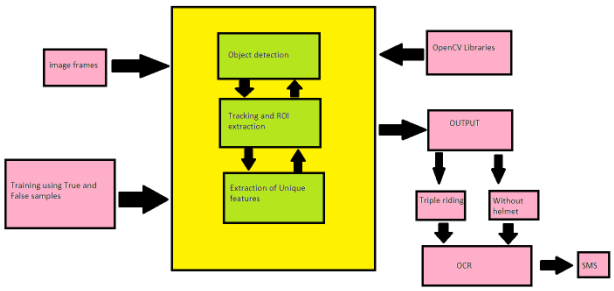
they are. Twilio has SMS-enabled phone numbers available in more than 180 countries

F. DATASET

The dataset used was prepared from Kaggle dataset and cctv footage of various signals obtained from traffic police department and our own dataset. The images consisted of both sparse and dense traffic conditions, in order to include diversity in data.

III. BLOCK DIAGRAM

.



Block Diagram of Proposed Method

Object Recognition: We propose a methodology for full helmet detection where we are going to use YOLO for object detection(bike) and YOLO for detection of helmet.

Tracking and ROI extraction: Tracking is done based on the centroid position of the moving object. Next the ROI (Region of Interest) is extracted which only the portion is having the moving object from the frame.

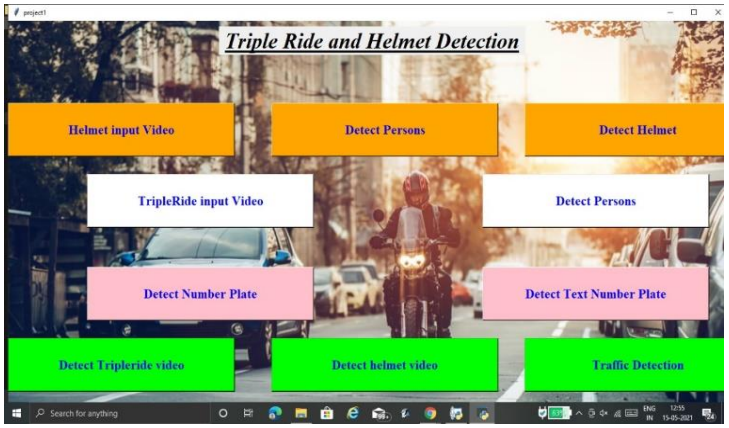
Extraction of unique features: Feature Extraction involves extracting unique features of the provided samples images. The classifier is trained such that it detects objects similar to provided positive samples and rejects objects similar to negative samples.

OpenCV: It is the Library which is used along with the detection system which contains the predefined functions and data members used for processing images such as morphological operations, feature extraction.

OCR (Optical character recognition): This is a method that helps machines recognize texts. Traditional OCR uses patterns to differentiate words from other elements.

SMS: An SMS will be sent to the authorized person about the details of the person vehicle (Bike) who violates the mentioned rules.

IV. IMPLEMENTATION



GUI (graphical user interface)-IT is a system of interactive visual components for computer software. A GUI displays objects that convey information, and represent actions that can be taken by the user. Tkinter -It is the standard GUI library for Python. Python when combined with Tkinter provides a fast and easy way to create GUI applications. Hence, we use Tkinter in our project for user interface for different applications. We create buttons in the GUI page for each application.

YOLO- YOLO used a custom deep architecture darknet-19, an originally 19-layer network supplemented with 11 more layers for object detection. With a 30-layer architecture, YOLO often struggled with small object detections. This was attributed to loss of fine-grained features as the layers down sampled the input. To remedy this, YOLO used an identity mapping, concatenating feature maps from from a previous layer to capture low level features.

However, YOLO's architecture was still lacking some of the most important elements that are now staple in most of state-of-the art algorithms. No residual blocks, no skip connections and no up sampling. First, YOLO uses a variant of Darknet, which originally has 53-layer network trained on ImageNet. For the task of detection, 53 more layers are stacked onto it, giving us a 106 layer fully convolutional underlying architecture for YOLO. This is the reason behind the slowness of YOLO compared to YOLO. Here is how the architecture of YOLO now looks like.

YOLO makes prediction at three scales, which are precisely given by down sampling the dimensions of the input image by 32, 16 and 8 respectively. The first detection is made by the 82nd layer. For the first 81 layers, the image is down sampled by the network, such that the 81st layer has a stride of 32. If we have an image of 416 x 416, the resultant feature map would be of size 13 x 13. One detection is made here using the 1 x 1 detection kernel, giving us a detection feature map of 13 x 13 x 255. Then, the feature map from layer 79 is subjected to a few convolutional layers before being up sampled by 2x to dimensions of 26 x 26.

This feature map is then depth concatenated with the feature map from layer 61. Then the combined feature maps are again subjected a few 1 x 1 convolutional layers to fuse the features from the earlier layer (61). Then, the second detection is made by the 94th layer, yielding a detection feature map of 26 x 26 x 255.

Blob image: Input Video will be converted into frames and the number of frames per second depends on the processor. YOLO architecture needs blob images and hence normal images are converted into blob images for processing. When compared to the phase 1 now we are able to get better efficiency because we used YOLO V3 algorithm.

Non-max suppression and threshold filtering: The first step, quite naturally, is to get rid of all the boxes which have a low probability of an object being detected. Non-max suppression makes use of a concept called "intersection over union" or IoU.
It takes as input two boxes, and calculates the ratio of the intersection and union of the two boxes**.**

OCR: Optical character recognition or optical character reader (OCR) is the electronic or mechanical conversion of images of typed, handwritten or printed text into machine-encoded text, whether from a scanned document, a photo of a document, a scene-photo (for example the text on signs and billboards in a landscape photo) or from subtitle text superimposed on an image

IMAGE FILTERING

- filtered using median filter.
- remove gaussian noise.

EDGE ENHANCEMENT

- Morphological processing

IMAGE ENHANCEMENT

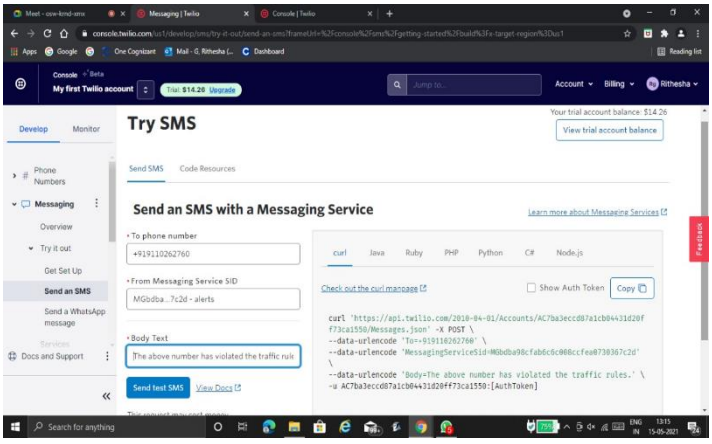
- Removal of stray pixels

CHRACTER SEPERATION

- BOUNDING BOXES

Vision API: Google Cloud's Vision API offers powerful pre-trained machine learning models through REST and RPC APIs. Assign labels to images and quickly classify them into millions of predefined categories. Detect objects and faces, read printed and handwritten text, and build valuable metadata into your image catalog.

TWILIO: Twilio Messaging is an API to send and receive SMS, MMS, OTT messages globally. It uses intelligent sending features to ensure messages reliably reach end users wherever they are. Twilio has SMS-enabled phone numbers available in more than 180 countries. By using this software an SMS will be sent to the authorized person about the details of the person vehicle (Bike) who violates the mentioned rules.

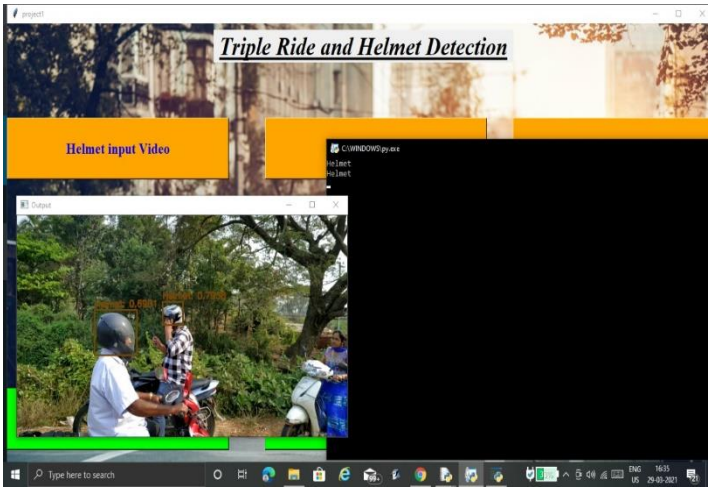


I. RESULTS

In this section, we present experimental results of our modules like vehicle detection, helmet detection, triple riding detection, OCR output and alert msg.

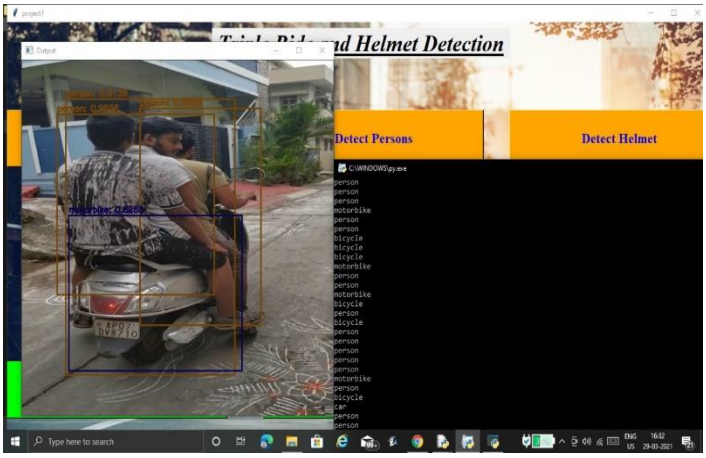
1. Helmet Detection:

Helmet detection is performed using YOLO algorithm which was trained on 900 images with an accuracy of 85%.



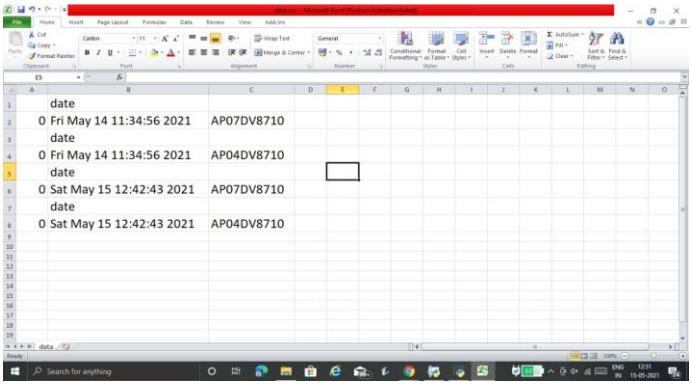
2. Triple riding Detection:

Helmet detection is performed using YOLO algorithm which was trained on 800 images with an accuracy of 90%-93%



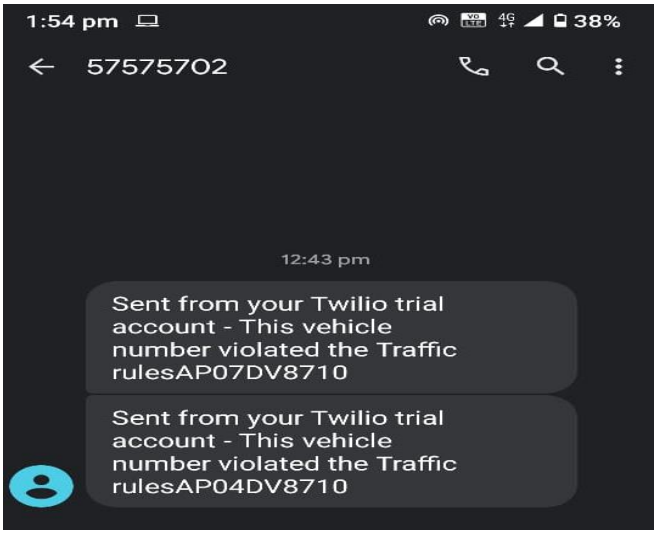
3. OCR:

Number plate detection is performed using YOLO again which was trained using images with an accuracy of 88% -92%.



4. VIOLATION ALERT THROUGH SMS:

Twilio Messaging software is used to send an SMS alert to the authorized person about the vehicle details.



I. Conclusion

Thus, in the methods discussed we have created a solution to the problem. The system is developed for detecting the motorcyclists without helmets and for motorcyclists who are triple riding. This system mainly consists of three parts – detection of motorcycle, detection of helmet and recognition of license plate of motorcyclists riding without helmet. The Same procedure applies for triple riding. It determines whether the captured image contains motorcycle or not and checks whether the motorcyclist is wearing a helmet by using YOLO algorithm. If the motorcyclist is identified without a helmet or the motorcyclist is triple riding, then the license plate of the motorcyclist is recognized using OCR. The accuracy can be improved by increasing the training data set and image quality.

II. Future Work

We are working on making this very own concept more advanced and diverse such that it can work without any human intervention. We will work on using this method on real-time Traffic signals applications by creating a larger prototype.

Future studies should focus on better image quality with accurate pixels and resolutions which are necessary to recognize the traffic rule violators as well as characters on the license plate for obtaining the improved results at the image capturing stage.

I. References

[1] https://ieeexplore.ieee.org/document/07960069

[2] https://www.sciencedirect.com/science/article/pii/S026322411830900X ,2019

[3] Digital image processing by William K Pratt

[4] J. Chiverton, "Helmet presence classification with motorcycle detection and tracking," Intelligent Transport Systems (IET), vol. 6, no. 3, pp. 259–269, September 2012

[5]https://www.youtube.com/playlist?list=PLS1QulWo1RIa7D1O6skqDQ- JZ1GGHKK-K

[6] https://ieeexplore.ieee.org/abstract/document/69151

[7] Extraction of image, https://ieeexplore.ieee.org/

[8] Amey Narkhede, et al, "Automatic Traffic Rule Violation Detection and Number Plate Recognition", IJSTE - International Journal of Science Technology & Engineering | Volume 3 | Issue 09 | March 2017

[9] Ana Riza, et al, "Localization of License Plates Using Optimized Edge and Contour Detection Technique ", 2017 IEEE Region 10 Conference (TENCON), Malaysia, November 5-8, 2017

[10] Prem Kumar Bhaskar, et al, "Image Processing Based Vehicle Detection and Tracking Method ", University Technology PETRONAS Seri Iskandar, 31750, Perak, Malaysia