Research Article

AN EFFCIENT SYSTEM FOR DETECTING TRAFFIC VIOLATIONS SUCH AS OVER SPEED, DISREGARDING SIGNALS, AND INSTANCES OF TRIPLE RIDING

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Abstract: In recent time surveys, the deaths and injuries due to traffic violations have increased chiefly in Indian roads. So, this needed the assistance of an automated computer vision-based object detection model, as manually identifying the vehicles violating traffic is hectic. The principle of this paper is to detect multiple violations using single video frames. The input video stream obtained from the surveillance camera is processed and annotated to carry out multiple processes. The dataset used for red-light jumping is COCO and the dataset for over boarding is created by annotating the images obtained from google. The model is trained, and the output is visualized using tensor board. The accuracy for red light skipping is 93% and the mAP value for over boarding is 0.5:0.95. This system utilizes the video stream at its maximum to detect various violations.

Key words: Traffic System, Traffic Violations, Traffic Detection, Violation Detection, Traffic Detection System, Object Detection, Red Light, Value Of Map, Surveillance Cameras, Object Detection Model

1. INTRODUCTION

The traffic on the roads have been complex nowadays. Sometimes this leads to traffic jams and pollution. Amidst these side effects the violation of traffic rules has been getting worse on Indian roads due to increased population and constantly changing world. To overcome this innumerable traffic detection systems are being developed. The preeminent traffic violations in India are red light skipping, rash driving and over boarding pillion riding. The breaking of these traffic rules leads to various road accidents and other crises in both rural and urban areas of Indian roads [1]. The government has taken immense efforts to reduce this, but checking the vehicles manually is tedious and mistakes are associated due to blackouts and carelessness.

In consequence, there is always a necessity for a traffic violation detection system to deal with this issue. This can detect violations such as, signal jump, rash driving and vehicle count [2]. The primitive way to avoid traffic violations is to manually appoint administrators who check the vehicles. This process is troublesome and requires enormous human resources. When things become automated the next method used to detect traffic violation is Automated Traffic Monitoring System Using Computer Vision [3]. This system used cameras to monitor vehicles instead of regular cops.

The primary objective of this work is detecting multiple vehicle traffic violation detection and it gives a detailed view of theories and technologies involved in creation of traffic violation detection systems using image processing and object detection. It also focuses on some of the latest developments made in various fields and throws light on various applications, one among which is multiple vehicle violation detection.

2. LITERATURE SURVEY

TITLE:" **Real-Time Implementation of Object Detection and Tracking on DSP for Video Surveillance Applications"**

In the recent years, object detection and tracking has become an integral part of various applications such as Surveillance system, Vehicle navigation, and autonomous robot navigation. Especially in the field of surveillance system it has gained greater significance than ever before due to the recent terror activities taking place all over the world. Many efforts have been made to make the system automated in order to decrease the complexity and to increase the ease with which it can be implemented. The paper describes the implementation of Object Detection and Tracking for the surveillance system on DSP board Embest Dev Kit 8500D using Modified Background Subtraction algorithm. The camera used in the system, Microsoft LifeCam HD 3000 camera, operates at a speed of 30fps. The DSP board acts as a standalone system with Linux based Angstrom Operating System (OS) installed in it and it is programmed in C++ language integrated with Open CV library. Contrary to the conventional Background Subtraction algorithm where a fixed reference frame is

subtracted from incoming frame, Frame Differencing technique is used in this paper in which two consecutive frames are subtracted from one another to remove the stationary background. The design is successfully implemented to detect and track the object with a minimum time delay.

3. SYSTEM ANALYSIS

3.1 EXISTING SYSTEM

In the paper, the object detection for traffic violation is implemented using object detection algorithm YOLOv3[5] and neural network which is used for grading of vehicles deviating the traffic rules. This tool is dexterous in reducing the violations by tracking and chastising. The red light skipping is detected when the captured object is on the direct line. The video is shot and fed into the model and classified using neural network [6]. The object detection and tracking can also be done by system DSP board Embest Dev Kit 8500D using MBS algorithm for object detection [7] as preferred by Suraj K Mankani in the paper. In the model proposed by Krishna [3], "Automated Traffic Monitoring System Using Computer Vision", the video stream is received from the surveillance camera and it measures the vehicle count and vehicles violating the speed limit.

In the work proposed by Mohana [8], the performance and efficiency of the object detection model is evaluated using algorithms such as GMM(Gaussian Mixture Model) and SOBS (Self organizing Background Subtraction), implemented in MATLAB. They have used false positive rate, Percentage of Wrong Classification (PWC), Recall, specificity, false negative rate, and F-measure as parameters. The paper [9], presents the juxtaposition of capsule neural networks in various applications.

LIMITATIONS OF EXISTING SYSTEM

Real-time Processing Challenges: Depending on the hardware and computational resources available, real-time processing of video streams for traffic violation detection may pose challenges. Delays in detection could affect the system's effectiveness.

Weather and Lighting Conditions: Environmental factors such as adverse weather conditions or varying lighting can impact the performance of computer vision systems. Existing systems may struggle to maintain accuracy under such conditions.

3.2 PROPOSED SYSTEM

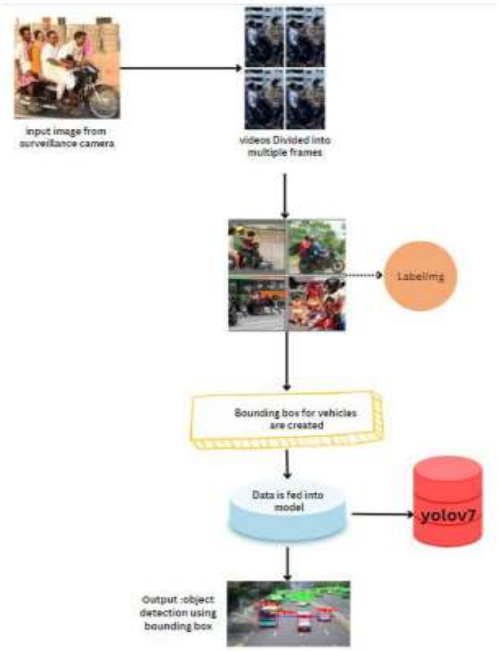
The work is proposed as an appendage of the existing object detection model for traffic violation using computer vision and YoloV3.The main objective of this work is to detect multiple traffic violations of vehicles using the same video stream. The techstack used in the proposed work is YoloV7 for object detection and Open CV for real-time computer-vision.

The traffic violation detection using has two sub modules:

- To detect the red light jumping
- To detect over boarding pillion riding on vehicles

The object detection algorithm used is YoloV7.The overview of the whole process is that the video streams obtained from the surveillance camera are divided into multiple frames using Open CV so that multiple operations can be performed over the frames. The frames are then evaluated by creating bounding boxes over the object of appraisal. The coordinates are marked as the threshold line, if the coordinate of the object is greater than that of the threshold line the object violates the signal.

4.SYSTEM ARCHITECTURE



5.MODULES

The COCO dataset is used for red light skipping. The same bounding box is used to detect over boarding and is trained using the dataset created from annotated google images. The parameters used are Precision, Recall, P-measure and F-measure.

MODULE 1:

Red Light Jumping the COCO dataset is used to detect red light skipping. The dataset is mounted over the Yolov7 model which is cloned from the original model. Every vehicle in the lane is identified and the bounding box is created over the vehicles. The bounding boxes are marked using logistic regression or bounding box regression. In which the overlap of the bounding boxes represents true objects. The threshold line is marked by defining the position or coordinates of the line on the image video frame. If the object crosses the line, then it is marked as violated. It is also refined that the model even detects the vehicles on and above the marked line unlike the previous solutions which detects only the objects on the line.

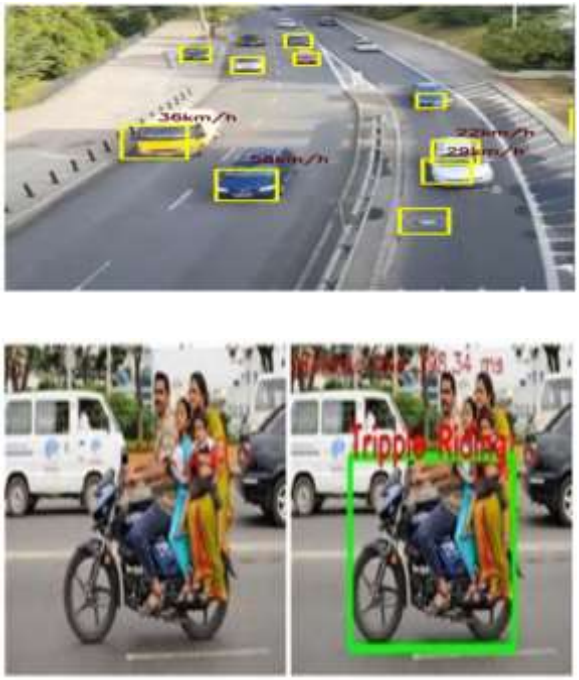
The assumptions are:

- The object is static and is the video streams of particular time interval is processed
- The vehicle violating at a particular time can only be detected.

MODULE 2:

Over boarding of pillion riding The over boarding of vehicles is detected by training the yoloV7 model using the dataset created by annotating the images. The images are annotated using the tool LabelImg and is divided into train, test and validation.70% of data is labeled as Training data, 20% as testing data and 10% for validation.

6.RESULT



7.CONCLUSION

The proposed work for the Traffic violation detection system using YoloV7 object detection model is highly feasible, efficient and fastest framework. As mentioned above in table 1, the comparison between the real time projects and our work is provided. The results are incurred from the video streams and the accuracy was about 93% and the map value gained is 0.5:0.95. The project has a huge scope of improvement in which the same video stream can also be used for detection of speed and other measures which can also avoid rash driving. The maximum utilization of the video stream is carried out by the model or by the scope of the process. A Non-Helmet Rider and Triple Riding Detection system is developed where a video file is taken as input. If the motorcycle rider in the video footage is not wearing helmet while riding the motorcycle, or riding with three members, then the license plate number of that motorcycle is extracted and displayed for above cases separately. Object detection principle with YOLO architecture is used for motorcycle, person, helmet and license plate detection. Google Spreadsheet is used for license plate number extraction if rider is not wearing helmet or triple riding. The characters are extracted from LP so that it can be used for other purposes. All the objectives of the project is achieved satisfactorily

FUTURE SCOPE: For sending the challan directly to offender's mobile numbers, the subscriptions for SMS are required, as of now it is sent through mail ids, but the motto to send the challan to their mails as well as through SMS along with their violation photo, time and date. Our system is developed to process the above-mentioned future.

REFERENCES

[1] Abdulrasheed A Nasir, Jibrin O Bello, Chima K P Ofoegbu, Lukman O Abdur-Rahman, Saheed Yakub, Babatunde A Solagberu, "Short report-Childhood motorcycle-related injuries in a Nigerian city – prevalence, spectrum and strategies for control", SAJCH JULY 2011

[2] Dr. S. Raj Anand, Dr. Naveen Kilari, Dr. D. Udaya Suriya Raj Kumar," Traffic Signal Violation Detection using Artificial Intelligence and Deep Learning ",International Journal Advanced Research Engineering and Technology (IJARET) of in Volume 12, Issue 2, February 2021

[3] Krishna, Madhav Poddar, Giridhar M K and Amit Suresh Prabhu," Automated Traffic Monitoring System Using Computer Vision",2016 IEEE

[4] Chien-Yao Wang1, Alexey Bochkovskiy, and HongYuan Mark Liao1 1 Institute of Information Science, Academia Sinica, Taiwan," YOLOv7: Trainable bag-of freebies sets new state-of-the-art for real-time object detectors",6 July 2022

[5] Ji-hun Won, Dong-hyun Lee, Kyung-min Lee, Chi-ho Lin," An Improved YOLOv3-based Neural Network for De-identification Technology

[6] Abhiraj Biswas, Arka Prava Jana, Mohana, Sai Tejas S," Classification of Objects in Video Records using Neural Network Framework", International Conference on Smart Systems and Inventive Technology (ICCSIT 2018) IEEE Xplore

[7] Suraj K Mankani, Naman S Kumar, Prasad R Dongrekar, Shreekant Sajjanar, Mohana, H V Ravish Aradhya," Real-Time Implementation of Object Detection and Tracking on DSP for Video Surveillance Applications", IEEE International Conference on Recent Trends in Electronics Information Communication Technology, May 20-21, 2016, India

[8] Mohana, HV Ravish Aradhya," Performance Evaluation of Background Modeling Methods for Object Detection and Tracking", Proceedings of the Fourth International Conference on Inventive Systems and Control (ICISC 2020) IEEE Xplore

[9] Dr. T. Vijayakumar," Comparative study of capsule neural network in various application", Journal of Artificial Intelligence and Capsule Networks (2019)

[10] Ehsan Ayazi and Abdolreza Sheikholeslami," Research article-A Data Mining Approach on Lorry Drivers Overloading in Tehran Urban Roads", Hindawi Journal of Advanced Transportation Volume 2020

[11] Yi-Hsin Lin, Suyu Gu, Wei-Sheng Wu, Rujun Wang, and Fan Wu," Research Article- Analysis and Prediction of Overloaded Extra-Heavy Vehicles for Highway Safety Using Machine Learning", Hindawi Mobile Information Systems Volume 2020.

[12] YOLOv7: The Fastest Object Detection Algorithm (2022) - viso.ai [13] GitHub - WongKinYiu/yolov7: Implementation of paper - YOLOv7: Trainable bag-offreebies sets new state-of-the-art for real-time object