International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 08 | Aug 2020 www.irjet.net p-ISSN: 2395-0072

Real Time Object Detection for Autonomous Vehicles

Ganesh V.N[1], K Aishwarya Shetty[2], Melrine Aquila Saldanha[3], Muzna Nazhath[4], Namrata Arun[5]

[1]Senior Assistant Professor, Dept. of ECE, Mangalore Institute of Technology and Engineering, Karnataka, India
[2,3,4,5] UG students, Dept. of ECE, Mangalore Institute of Technology and Engineering, Karnataka, India

---

Abstract - *The number of road accidents has been enormously increasing with the number of vehicles on road. Road accidents occur for a variety of reasons. Often, drivers are distracted while behind the wheel, taking their focus away from the road. In other cases, drivers can become tired after spending multiple hours at the wheel, resulting in preventable errors. Sometimes, accidents occur for a combination of reasons, from bad visibility to unsafe road design, or other drivers lack caution. While the causes of accidents can vary, the consequences are often the same, resulting in everything from vehicular and property damage to serious injuries. The project implements an efficient means to detect the object using haar cascade classifiers and python programming.*

***Key Words*: Accidents, Haar, Python, Object detection, Autonomous vehicle**

1. INTRODUCTION

Vehicle accidents are unfortunately very common in India and the majority of these road crashes are caused by human error. While some are relatively minor, thousands of lives are taken every year by these horrible car crashes. A serious road accident happens every minute in India and almost 16 people die every hour.

Automation is very much into use and the process of automation is being used in different fields including vehicle automation. There is always a scope to make human efforts put into to be reduced and the same is the case with the autonomous vehicle. With the increase in the number of vehicles on the road, the rate of accidents is also increasing every passing day. The project intends to develop an algorithm for autonomous vehicle which helps detect traffic sign boards, pedestrians and other vehicles. The autonomous vehicles present today have features such as obstacle detection but by making use of lidar, radar, and ultrasonic sensors to track objects in the environment. The objective is to create Haar feature-based cascade classifiers by training the system with an appropriate amount of traffic related information in order to detect vehicles, pedestrians and traffic signs in real-time. Thus the system in addition to driving assistance/collision avoidance, could further find its application in tracking and recognition. The algorithm is highly efficient and quick since haar classifier makes use of the concept of integral image creation which reduces the computations involved in calculating haar features. The higher granularity filters can be used for an efficiency of up to 98%.

1.1 Objective of Work

This paper aims to develop an algorithm to detect traffic sign boards, pedestrians and other vehicles on the road to ensure that the driver can have a smooth and comfortable drive. The project here intends to effectively detect the same by using modern tool of deep learning called haar and the programming language used here is python.

1.2 Advantages of Real Time Object Detection

1) The system will help in identifying the traffic sign boards and alert the driver about the same. This helps in following the basic traffic rules.
2) The pedestrian detection algorithm will alert the driver of any pedestrians and avoid unnecessary collisions.
3) Vehicle detection algorithm provides navigation assistance and also helps in avoiding collision with other vehicles by alerting the driver at the earliest.

2. LITERATURE SURVEY

This study describes a novel system for the automatic detection and recognition of text and symbol in traffic signs. Search regions with in the image must be defined. In this particular region locate a large number of candidates, which are then reduced by applying constraints based on temporal and structural information. This problem can be divided in two stages. First stage will be detection of region and second will be character recognition. The detection stage exploits knowledge of the structure of the scene, the size and location of the road in the frame. Once a potential traffic panels has been located, the next stage attempts to recognize text and symbols within the region. For the purpose of text detection MSER is used and for recognition purpose optical Character Recognition method is used. Automatic testing using XML files provide better accuracy [1].

This study describes a novel concept of a trainable similarity measure which alleviates these shortcomings. The similarity is based on individual matches in a set of

local image regions. The set of regions that are relevant for a particular similarity assessment is refined by the training process. It is illustrated on a set of experiments with road-sign-classification problems that the trainable similarity yields high-performance data representations and classifiers. Apart from a multi-class classification accuracy, non-sign rejection capability and computational demands in execution are also discussed. It appears that the trainable similarity representation alleviates some difficulties of other algorithms that are currently used in road-sign classification [3].

This study mainly focuses on Raspberry Pi ARM-11 based processor utilization, image processing. Here the webcam is interfaced to it using the USB ports available on board. Images captured by the webcam are sent to the Raspberry pi board where the processing of the image will be done. After this, the code gets executed and the dc motors are rotated in accordance to the written code and rotate as left, right, forward and backwards depends upon the object movement. It maintains the constant distance between the object and the robot. This robot can be used in both military and commercial applications like in hostage situations which can reduce risk of damage to human life, The Haar-like feature and AdaBoost classifier was applied, and reported to have high accuracy. The color image changes the color space from the RGB to HSV color space because the RGB color space represents the color of the R, G, and B channels [4].

3. METHODLOGY

The basic block diagram of the system is as shown in the Fig. 1. The system consists of the three main phases. They are as follows: 1. Image Acquisition 2. Haar Classifier3. Machine Control.

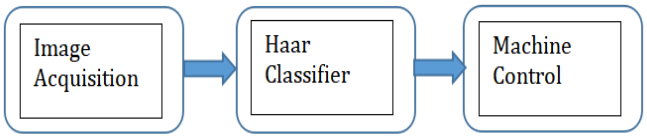

Fig. 1: Block diagram of the system

3.1 Image Acquisition

Image acquisition is the act of capturing images or the creation of a digitally encoded representation of the visual characteristics of an object, such as a physical scene or the interior structure of an object. The image acquisition is the first process that is done by means of a digital camera. The images captured in real time generally have intensity level of 8 which means it has 256 number of intensity levels. This image is then fed to the haar classifier to do analysis. The captured image is a colored image which is converted to gray scale. This is done because the haar cascade works faster with the gray scale images since the number of intensity levels are reduced.

3.2 Haar Classifier

The captured image is then analyzed for any object present in it. Separate Haar Classifiers are generated for each object i.e pedestrian, vehicle, traffic sign board.

The various steps involved in creation of a classifier is as follows:

1. Collection of Positive and Negative Image Set
2. Creating the info.txt, bg.txt and Vector file
3. Training the Haar Classifier
4. Creating XML file

The data set is made from positive and negative images. The positive images consists of the object and the negative images are background elements. The data set used here has 20 positive images for each object and 100 negative images. The higher the number of images in the data set the better is the performance of the classifier. Separate xml files are generated by training the classifier for each object.

3.3 Machine Control

The output from the haar cascade classifier is used for real time applications. The haar cascade algorithm will detect the object and alert the driver about the same. The alert can be given in terms of a voice command The autonomous vehicle can be controlled for it's speed with the help of the traffic speed limit boards.

4. EXPERIMENTAL RESULTS AND DISCUSSION

The proposed algorithm is developed using of haar classifier and coded using python programming language.The algorithm was tested for real time captured video. The results are as follows.

Fig. 2: Pedestrian detection

The pedestrian is detected and represented using a red rectangular bounding box. The vehicle is represented using a green rectangular bounding box and any traffic sign boards are represented using the yellow bounding box as shown.

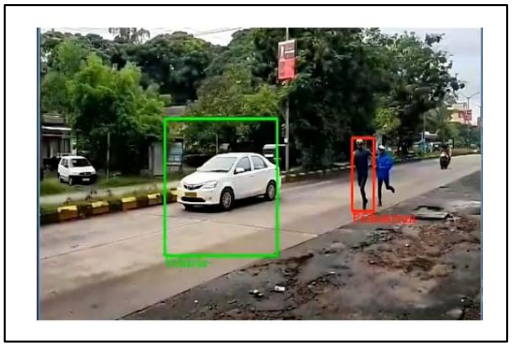

Fig. 3: Vehicle detection

Fig. 4: Traffic sign board detection

4.1 Overall Performance of Object Detection Algorithm

The performance of the system is calculated by using the following values:

- True Positive (TP): It is the number of objects correctly identified.
- True Negative (TN): It is the number of background elements correctly identified as a non object.
- False Negative (FN): It is the number of objects failed to be identified as an object.
- False Positive (FP): It is the number of background elements wrongly identified as an object.

These values are the basis to determining the overall performance of the object detection algorithm developed. The performance analysis of the algorithm developed for the real time captured video is as shown.

	True Positive	True Negative
Predicted Positive	14	3
Predicted Negative	0	20

Fig. 5: Values of TP, TN, FN and FP obtained

Performance parameters calculated using TP, TN, FN, FP :

Measure	Value
Sensitivity	1.0000
Specificity	0.8696
Precision	0.8235
Negative Predictive Value	1.0000
False Positive Rate	0.1304
False Discovery Rate	0.1765
False Negative Rate	0.0000
Accuracy	0.9189

Fig. 6: Performance measure of the system

The efficiency of the system developed is calculated as follows:

Efficiency = (Sensitivity + Specificity + Accuracy) / 3 = (1.000+0.8696+0.9189) / 3

Therefore Efficiency = 0.9295 or %Efficiency = 92.95%

5. CONCLUSIONS

The algorithm is developed to detect various objects like pedestrians, vehicles, traffic sign boards. The developed algorithm was successfully tested and verified for the objects detected by using the video input captured in real time. The algorithm detects any objects mentioned with an overall efficiency of 92.95% irrespective of it's size.

HAAR cascade is the one of the most effective method for object detection due to its efficiency and calculation speed which is very important for accident avoidance. As adoption and the performance of the technology increases, quick detection of upcoming obstacles could save thousands of lives every year. With over 100 pedestrians killed daily on our roadways, industries are moving towards computer vision technologies for various applications and most importantly to prevent road accidents.

REFERENCES

[1] Aparna A. Dalve, Sankirti S. Shiravale, "Real Time Traffic Signboard Detection and Recognition from Street Level Imagery for Smart Vehicle", International Journal of Computer Applications (0975 –8887) vol. 135 – No.1, February 2016.

[2] P. Viola, M. J. Jones, D. Snow, "Detecting Pedestrians using Patterns of Motion and Appearance", 9th IEEE International Conference on Computer Vision, vol. 2, pp. 734-741, October 2003.

[3] P. Paclík, J. Novovicova, and R. P. W. Duin, "Building Road-sign Classifiers using a Trainable Similarity Measure," IEEE Transactions on Intelligent Transportation Systems, vol. 7, no. 3, pp. 309–321, June 2006

[4] Pradeep Kumar, Suresh B Swetha, "Object Following Robot using Raspberry pi and Open", JEET, vol. 35, no. 4, May 2016.

[5] Safat B.Wali, Mahammad A. Hannan, Aini Hussain, and Salina A. Samad , "An Automatic Traffic Sign Detection and Recognition System Based on Colour Segmentation, Shape Matching, and SVM", University Kebangsaan Malaysia, 25 October 2015.