e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:04/Issue:11/November-2022 Impact Factor- 6.752 www.irjmets.com

A SURVEY ON TRAFFIC SIGN RECOGNITION AND VOICE ALERT SYSTEM

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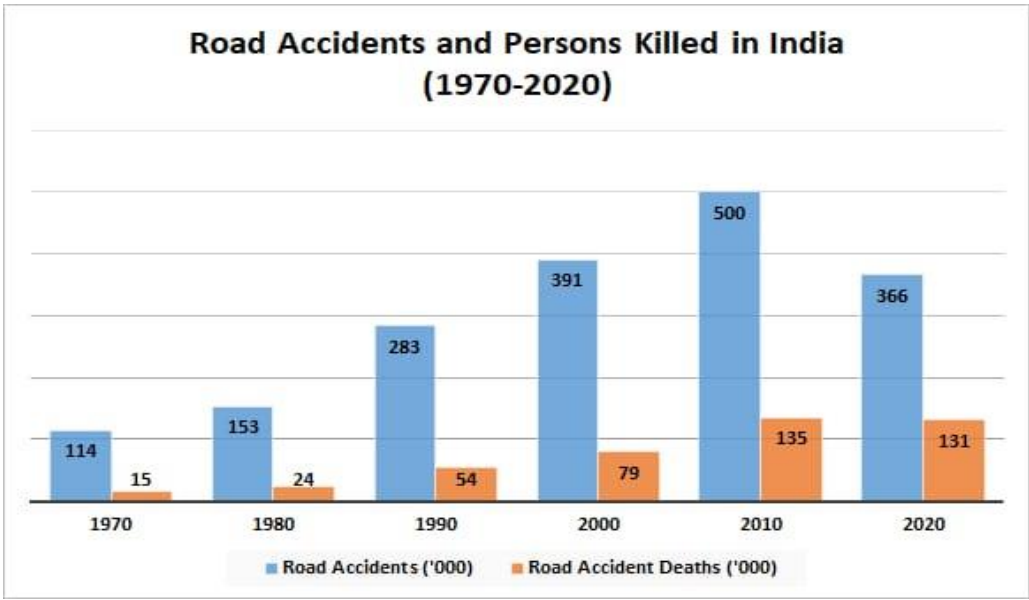
ABSTRACT

Road traffic accidents are the primary cause of fatalities in India and the rest of the world.. These accidents not only lead to serious injuries but also lead to death. So, nowadays, awareness towards road signs is necessary in order to have a safe and smooth circulation of transportation. Number of accidents are increased due to insufficient knowledge about the road sign which are there to guide drivers about upcoming directions, surrounding and construction works. This survey paper focuses on various algorithms and techniques that have high efficiency of detection and recognition. The proposed systems discussed in all the papers will aid all the drivers to identify the road signs and send voice alert to driver to take appropriate decision while driving. A model is built with a dataset which may contains number of traffic signs under various conditions such as weather- foggy weather, rainy day, bright light and etc. with number of categories in it such as color and shape of sign board. This dataset can be used to train and test the model for its proper working which may give more accurate result. Many methods are discussed below to achieve the same from different papers.

Keywords: Traffic Sign Recognition, Convolution Neural Network, Voice Alert System, Image Processing, Yolo.

I. INTRODUCTION

Traffic signs are one of the most important things that driver needs to be aware of while on road. Recognizing and obeying traffic signs is crucial to safe driving. Unfortunately, not all drivers obey or even see traffic signs which may lead them to meet an accident. There are various traffic sign types, and each one has a distinct significance. For example, the STOP sign tells the driver to come to a complete stop before proceeding while, the YIELD sign tells the driver to yield the right-of-way to oncoming traffic. There are many traffic signs that driver must be aware of. However, it can be challenging to recall every single sign and its significance. This is where Traffic Sign Recognition and Voice Alert System comes in. Here's statistics of road accidents in recent years :



The details of road accident related deaths on different categories of National Highways because of traffic rule violations is presented in the table below :

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Road Accidents and Road Accident deaths on different categories of NH by Traffic rule violations during 2019

S. No	Traffic rules violation	NH under NHAI		NH under State PWD		NH under other departments	
		Accidents	Fatalities	Accidents	Fatalities	Accidents	Fatalities
i	Over-speeding	64,680	25,054	26,743	8,530	6,871	2,982
	% share of total	73.5	70.4	69.7	63.2	63.2	62.5
ii	Drunken driving/consumption of alcohol & drug	3,053	1,550	1,321	584	748	242
	% share of total	3.5	4.4	3.4	4.3	6.9	5.1
iii	Driving on wrong side/ Lane indiscipline	4,464	1,825	1,878	657	734	244
	% share of total	5.1	5.1	4.9	4.9	6.8	5.1
iv	Jumping red light	543	139	298	93	143	34
	% share of total	0.6	0.4	0.8	0.7	1.3	0.7
v	Use of mobile phone	2,311	1,009	942	423	407	153
	% share of total	2.6	2.8	2.5	3.1	3.7	3.2
vi	others	12,915	6,028	7,170	3,208	1,970	1,117
	% share of total	14.7	16.9	18.7	23.8	18.1	23.4
vii	Total	**87,966**	**35,605**	**38,352**	**13,495**	**10,873**	**4,772**

Traffic Sign Recognition and Voice Alert System can be extremely helpful for new and inexperienced drivers. By making drivers more aware of their surrounding and helping them obey traffic laws. This system aim towards making road safer for everyone and leads to safe driving. This system makes use of various algorithms to detect and recognize traffic signs which includes preprocessing of detected image, afterwards feature extraction is done the image which captures only important features and converts RGB image to grey scale in order to extract the actual meaning of the detected image. Then, it will classify the image by its category i.e. shape, mandatory signs, warning signs, cautionary signs and many more. After classification, the system recognizes the meaning of the sign and will give voice alert to driver through speakers in the car itself.

The remaining contents of paper are as follows: Section II, contains the related work in Traffic Sign Recognition i.e. Literature survey. In section III, conclusion is drawn. In section IV, acknowledgement is included and finally in section V, references are added.

II. LITERATURE SURVEY

1. Wenkao Yang, Wei Zhang* "Real-time Traffic Signs Detection Based on YOLO Network Model", 2020, IEEE

This paper proposes a model based on real-time traffic sign detection which uses YOLO. YOLO stands for “You Look Only Once”. It is a real-time object detection algorithm that identifies specific objects in video, live-feeds or images and process it very fast. YOLO applies the algorithm directly to input image, output the category and the corresponding location of images. The target detection can be solved as a regression task to improve the detection speed such that it can be applied to the actual scene. The detection speed of YOLOv1 is fast, but its detection accuracy is not as good as that of Fast-RCNN. As a result, the developers successively released the versions of YOLOv2, YOLO3 and YOLOv4. In this paper, author verified the superior performance of YOLOv4 in traffic sign detection. 4000 traffic signs were selected in China as the data set. Among them, 3600 pictures were used as training set and the remaining 400 ones were used as test set. The experimental results showed that

YOLOv4 is superior to YOLOv3 in target detection. Due to the small number of data sets, the improvement of accuracy not as high as expected. As a fast and efficient target detector, YOLOv4 can also get better development. It is expected of YOLOv4 to achieve better results in the upstream optimization of traffic sign detection and small target detection.

2. Huibai Wang, Hao Yu, "Traffic Sign Detection Algorithm based on improved YOLOv4", ITAIC 2020, IEEE, (ISSN 2693-2865)

This paper points on the improved YOLOv4 algorithm to solve the problem that the character of the traffic sign is not easy to be influenced by illumination, real road, and other complex factors. The structure of the network is optimized, and a layer of feature pyramid is added to detect the multi-scale feature, and the anchor box corresponding to the multi-scale is obtained by the K-means clustering method according to the characteristics of the marker scale, to improve the positioning accuracy. The experimental results in this paper show that the improved model based on YOLOv4 has a good effect on traffic sign recognition with better performance in accuracy and speed. It is also stated that, in the follow-up work, it will be necessary to refine more classification, can identify more types of signage, enhance the algorithm robustness, can make it recognize more adverse conditions of signage.

3. Tianyun Zhao, Qi Liu, Yunpeng Zhang, "A Traffic Sign Detection Method based on Saliency Detection", 2019, IEEE

This paper focuses on the detection method based on Minimum Barrier Distance algorithm is based on the priori of the image boundary. In order to speed up the image processing speed, this paper used the Fast MBD algorithm introduced faster scan algorithm to calculate the saliency map. The idea of the Minimum Directional Contrast algorithm is to divide the entire picture into four regions using the horizontal and vertical lines passing through the pixel, centering on the current pixel. After applying MBD and MDC to the detection of traffic signs, author found that the MBD method can clearly detect the target, has good robustness to noise, and can be free from the influence of complex environments. It can also predict the target position well when there is more traffic flow. Using the minimum direction contrast to calculate the saliency map can quickly highlight the location of the target area, while at the same time, it is more robust on the image edge at the target. The result shows effect has improved both accuracy and recall. This method can accurately determine the target position and better preserve the edge of the image. The difficulty of traffic sign detection lies in how to effectively extract the traffic sign from the complex background images. Future research directions will focus on solving different climate conditions, damaged signs, changed patterns, blurred images and many more problems.

4. Liwei Jia[a], Xiaoming Shi[b], Li Wei[c], "Design of Traffic Sign Detection and Recognition Algorithm Based on Template Matching", 2020, IEEE (978-1-7281-9948-1)

This paper takes the accuracy and real-time problems of traffic sign detection and recognition as the main research objects, and conducts extensive and in-depth research on this issue from the aspects of traffic sign image preprocessing, detection and segmentation, feature extraction and recognition. Based on the above situation, this paper proposes a traffic sign detection and recognition algorithm based on template matching. Firstly, image tilt correction is carried out and segmentation is carried out in HSV color space to extract Region-of-Interest. The characters are identified by matching with the template characters and comparing their similarity. Template matching is a process in which firstly, the template in the library is judged for similarity with each part of an image. Secondly, it is judged whether the image has the same part as the templpate. Finally, the specific location of the region-of-interest in the input image is determined. The experimental results show that this method can effectively segment the characters of speed limit traffic signs and can accurately identify the signs. The result also shows that the accuracy rate of the 1380 test images selected by this method in the GTSRB test library is 97.8%, which is higher than the algorithms of deep learning and HOG+ random forest for extracting the whole feature training classifier.

5. Karthikeyan D, Enitha C, Bharathi S, Durkadevi K, "Traffic Sign Detection and Recognition using Image Processing", IJERT, 2020, ISSN: 2278-0181

In this paper, authors mentioned a traffic sign detection and recognition system for detecting a photo taken from the automobile camera. The photo evaluation normally includes 3 steps: detection, segmentation and classification. The sign is edge detected and segmentation is implemented to segregate the signal from

background. Author proposed an easy characteristic choice extraction wherein they've records units of GTSRB and GTSDB used for traffic sign detection and recognition. This datasets consist of many varieties of complicated traffic signs and unevent light including sign tilt, choppy lighting, traffic sign with distraction, occlusion and comparable background colors, in addition to real scene maps. Through a whole lot of complicated and hard to differentiate traffic signs and to check the ability of the algorithm. The notification will pop and is like commands to take every other direction with none injuries or delay. This system includes four fundamental steps as-

1. FILTERING (GABOR FILTER): Since the gabor filter is a linear filter used for texture analysis, it essentially examines if the image contains any certain frequency content in particular directions in a confined region close to the point or region of examination.

2. EDGE DETECTION: By applying an edge detector to an image, a set of connected curves that represent object borders, surface marking boundaries, and discontinuities in surface orientation may be produced.

3. DWT FEATURE SEGMENTATION: Discrete Wavelet Transformation is used in this segmentation. Image segmentation is the division of a digital image into several segments. Picture segmentation is the process of giving each pixel in an image a label such that pixels with the same label have specific image properties.

4. FEATURE EXTRACTION: Using the colour, size, and orientation of the segmented image, the system precisely extracts the traffic sign from the backdrop image. The datasets are then compared to this sign using correlation, homogeneity, homogeneity, variance, standard deviation, accuracy, and finally mean.

The goal of this work is to provide a strategy for filtering out the traffic sign from the backdrop image using various edge detection and filtering techniques. The detected image is compared with the datasets using the YCBCR conversion procedure, and the accurate symbol is extracted from the compared images using feature selection. The goal of this study is to create a system that is more accurate, robust, and capable of automatically detecting and recognising traffic signs in a variety of challenging environments and disruptions.

6. Suriya Prakash A, Vigneshwaran D, Seenivasaga Ayyalu R, Jayanthi Sree S, "Traffic Sign Recognition using Deep learning for Autonomous Driverless Vehicles", 2020, IEEE, (978-1-6654-0360-3)

This paper states that-, in the study conducted, smart cars can detect and recognize traffic signs by the proposed CNN algorithm, which consists 7 layers and other important steps that helps in preprocessing the captured image. Initially, spatial threshold segmentation is employed by the HSV color space, and traffic signs are effectively detected to support the features. Secondly, the classical LeNet-5 Conv.NN model is extended to improve the recognition rate. Finally, the detection, recognition, and classification of traffic signs are conducted to support the GTSRB. In Lenet-5 Conv.NN Model, more layers were used to check for the accuracy is improved. This is done by using a trained algorithm, the real-time data is processed to capture from a different environment. The performance of the model examines great when compared to other models. This algorithm has good efficiency so the recognition rate and average time interval are significantly improved. Accuracy for the reached 99.75% from the prediction, with the average frame processing rate 8 ms. Authors included that, in the future, the performance and further optimization of the algorithm will be error-free. It will be useful in driving the safety of autonomous vehicles.

III. CONCLUSION

Papers discussed above provides different strategies for recognition and classification of traffic signs. Detection module includes color and shape analysis. Classification module include YOLO, YOLOv2, YOLOv3, YOLOv4, Template Matching, Edge Detection, Image Processing and Saliency Detection which provides improved results. It is necessary to have best strategies and algorithms to provide the best result which will significantly improve driving safety and comfort. Pre-processing techniques are applied in order to improve the quality of the image frames and various algorithms for training and classification. This system will help drivers to track the traffic signs with ease by giving voice alert, and avoid accidents and in turn reduce the number of deaths.

ACKNOWLEDGEMENT

We would like to take this opportunity to thank Adapanwar A.N. our Guide and Assistant Professor, Faculty of Computer Science, Sinhgad Academy of Engineering Kondhwa, Pune for his valuable guidance and moral support in the process of preparing this survey paper.

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IV. REFERENCES

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