Indian Sign Board Detection and Classification Using Image Processing Techniques

G.Revathi

Department of Computer Science &Engineering
Indra Ganesan College Of Engineering
Trichy Manikandam-12
revathi.mca04@gmail.com

Dr.G.Balakrishnan

Department of Computer Science &Engineering
Indra Ganesan College Of Engineering
Trichy Manikandam-12

***Abstract*- The aim of this project is to identify and recognize a traffic sign boards in various backgrounds and lighting conditions from static digital images. Automatic detection and recognition of road traffic signs is an important work for regulating the traffic, guiding and warning drivers. This processing could then output information to a theoretical autonomous vehicle, heads-up display, or other driver assistance device in the future. The software first uses color processing techniques to isolate relevant color data from the image. A variety of Image Processing Techniques are used to threshold, filter, detect edges, and further process the image. Morphological processing algorithms are applied in order to remove non pertinent data and isolate the sign boards. Shape detection is used to determine if a sign is present in the current image. If present the sign will be resized and classified. The data which obtained by neural network training is used to classify the road sign.This proposed work not only recognizes the traffic sign but also provides information about its condition or state. Finally Recognized Traffic sign Boards are delivered as Text Message and Voice.**

***Index Terms*- Road sign detection and recognition, edgedetection, mathematical morphology, Classification.**

I. INTRODUCTION

Identification of traffic signs correctly at the right time and at the right place is very important for car drivers to insure themselves and their passengers' safe journey. However, sometimes, due to the change of weather conditions or viewing angles, traffic signs are difficult to be seen until it is too late. Recent increases in computing power have brought computer vision to applications. On the other hand, the increase in traffic accidents accompanying the increasing amount of traffic has become a serious problem for society. The occurrence of traffic accidents is particularly high under special road conditions, such as at the entrance to a one-way street, sharp curves, and intersections without traffic signals. One possible countermeasure is to install "STOP", "NO LEFT TURN" and other traffic signs in order to notify the driver of the road conditions and other traffic information. However, there remains the possibility that the driver will depending on his/her state of mind, fail to notice the sign while driving, a serious accident is possible if the driver fails to notice a sign such as "DO NOT ENTER", "STOP", or "ONLY DESIGNATED DIRECTION PERMITTED". It is said that a driver who is operating a vehicle is relying 80-90% on visual information to understand the environment outside the vehicle. Predictions state that approximately 40% of traffic accidents could be prevented by reducing forward inattention among the drivers. It is possible that accidents can be prevented by utilizing an automatic road sign recognition system to provide traffic information to the driver, including information about the road in front of the vehicle. Traffic signs have also distinct shapes like circles, triangles, rectangles and octagons. These systems assist drivers to drive safely. While driving in the vehicle the driver gets the alert message like Go Slow, Pedestrian Crossing Reduce drivers 'burden of making decisions and Increase drivers' awareness about safe driving.

II. LITERATURE SURVEY

Many algorithms and methodologies have been proposed for road traffic sign detection. Reza Azad proposes the system with Iranian Traffic signs with detection and recognition and the letters are segmented with SVM classifier. Another method has also been proposed by Gauri Tagunde based on Color and Shape Features by Detection and Recognition [2]. Mohamad Ameen proposes the system with YCbCr colour space and shape based filtering the detected traffic signs are tracked and recognized using interest point descriptors. The algorithm is robust and can detect signs even when the traffic sign board is rotated. The traffic sign template database can be updated easily. The method is aimed at achieving high accuracy in recognizing traffic signs at real-time, with a low computational cost. Reduced computational complexity of the algorithm enables the implementation of the proposed method in embedded systems for driver assistance [3]. S.Sathiya,M. Balasubramanian , S. Palanivel Proposes with system from Pattern Recognition Based Detection,Recognition of Traffic Sign Using SVM which detect the traffic sign, if it has sufficient contrast from the background then we use sobel edge detection technique and morphological dilation. Second, extract the detected traffic sign from the board using row count and column count. Third, to extract the feature using DCT,

DWT and Hybrid DWT-DCT. In training phase, DCT 20 highest energy coefficients are extracted, In DWT 300 features extracted from each traffic sign and in Hybrid DWT-DCT 20 features are extracted. Finally recognition are performed through SVM. The application is to improve the efficiency of transportation networks through applications of communication visually impaired person wear the camera to identify the traffic destination board. Md. Safaet Hossain, Zakir Hyder Proposed with system Traffic Road Sign Detection and Recognition for Automotive Vehicles developed and implemented the procedure to extract the road sign from a natural complex image. The main objective of this paper is to design and construct a computer based system which can automatically detect the direction of the road sign. This paper is based upon a major approach to detect the direction. In this paper, we will demonstrate the basic idea of how detect the area and extract it. This system will play an important role for the detection purpose of specific domains like island, schools, traffic sign, universities, hospitals, offices etc.

III. METHODOLOGY

General diagram of the proposed method is shown in Figure 1. In the proposed method, the input image is pre-processed at the first time and then traffic sign location is specified by edge detection and morphology operation and finally traffic sign location is extracted and their characters are recognized.

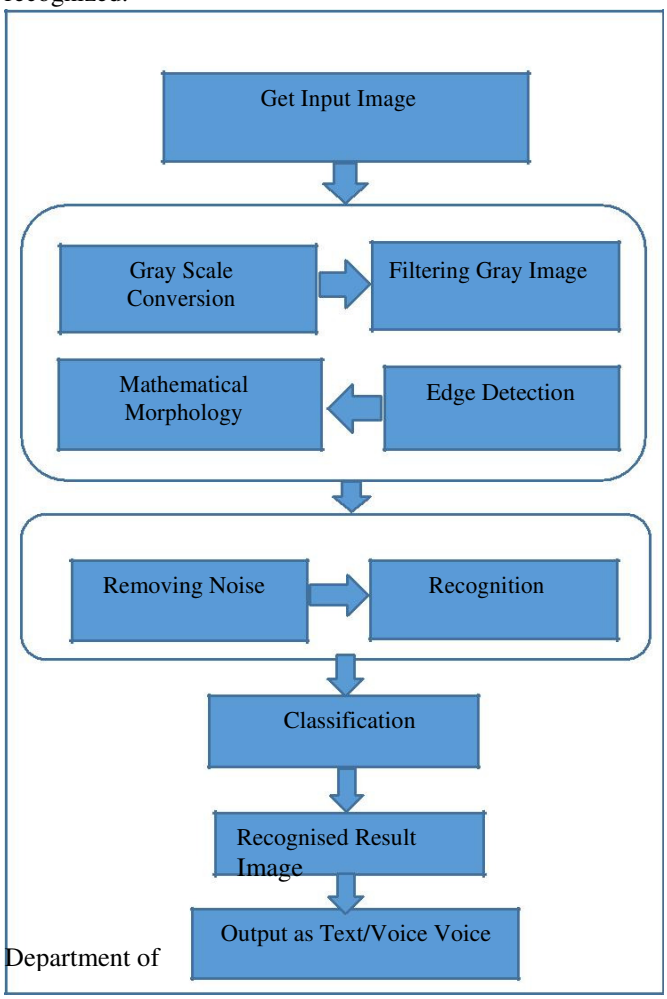


Figure 1: Block Diagram of the proposed method

1. Pre Processing

Pre-processing is carried out on the image to improve the quality of the image so that the main Processing on the image becomes easier. This step involves image converting to grey scale, edge Detection, noise removing by mathematical morphology and extracting connected component.

A. Color Thresholding

The most intuitive color space is the RGB system. The color of every pixel is defined by three components: red, green, and blue. Because of this, the color threshold has the following expression:

$$Ra \le fr(x,y) \le Gb \; g(x,y)=k1$$
$$Ga \le fg(x,y) \le Gb \; Ba \le fb(x,y) \le Gb$$

$g(x,y)=k2$ in any other case

where $fr(x,y)$, $fg(x,y)$ and $fb(x,y)$ are, respectively, the functions that give the red, green, and blue levels of each point of the image. One of the greatest inconveniences of the previous color space is that it is very sensitive to lighting changes.Figure 3.1 (a) and (b) shows the result for Thresholded image from original image.

Fig 3.1 a) Original Image b) Threshold Image

B.Gray Scale Conversion

The road sign location in this paper are based on gray image, so the main function of the pretreatment algorithm is to convert color images to gray scale images for the latter operation. A color bitmap is composed of R, G and B 3 components. If it is a 24-bit true color image, every point is made up of three bytes which respectively represent R, G and B. The below figure 3.2 (a, b) shows the result of preprocessing gray conversion.

3.2 a) Original Image b) Gray Conversion

C.Use of Median Filter

In signal processing it is necessary to perform some kind of noise reduction on an image or signal. The median filter is a nonlinear digital filtering technique, used to remove noise.Also used to remove the noise of sign boards outline or edges. It is pre-processing step to improve the result of later processing e.g:edge detection on an image. The main idea of the median filter is to run through the signal entry by entry, replacing each entry with the median of neighboring entries. The pattern of neighbors is called the "window", which slides, entry by entry, over the entire signal. For 1D signal, the most obvious window is just the first few preceding and following entries, whereas for 2D signals such as images, more complex window patterns are possible. If the window has an odd number of entries, then the median is simple to define: it is just the middle value after all the entries in the window are sorted numerically. For an even number of entries, there is more than one possible median.Figure 3.3 (a) shows the result for noise removing.

Fig 3.3(a) Noise Removing using Median Filter

D.Edge Detection

Edge detection is a type of image segmentation techniques which determines the presence of an edge or line in an image and outlines them in an appropriate way.The main purpose of edge detection is to simplify the image data in order to minimize the amount of data to be processed. Generally,an edge is defined as the boundary pixels that connect two separate regions with changing image amplitude attributes such as different constant luminance and tristimulus values in an image and.There are different approaches and algorithm to find out the edge in image processing that, in the meantime, canny operator due to high accuracy and low processing volume has a more favorable performance compared to other methods for our database.

E.Mathematical Morphology

Mathematical morphology is the branch of image processing that argues about shape and appearance of object in images. The erosion and dilation operators are basically operators of mathematical morphology that are used in this part to improve the edge detection image. At this step, first erosion action is applied in the edge detection image. After erosion action on image, the dilation action is done. Figure 3.4 (a) shows the result for erosion of object from sign board.

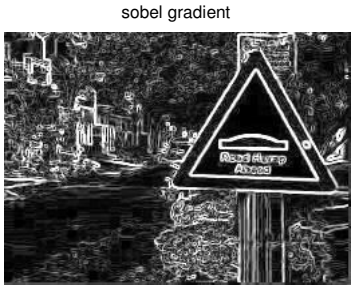
Fig 3.4 (a) Erode Elements

2. Traffic Sign Recognition

There are three steps in traffic signs recognition. Firstly, color is converted to grayscale. This function transforms a 24 -bit, three-channel, color image to an 8-bit, single-channel grayscale image by forming a weighted sum of the red, green and blue components. The formula used for the grayscale function is Y = 0.3R +0.59G + 0.11B. And then edge detection is done with Sobel edge detector to segment road sign. After that segmented road signs are matching with images stored in the database by using template matching method.

A.Sobel edge detector

Edge detection is a fundamental tool in image processing and computer vision, particularly in the areas of feature detection and feature extraction. An edge is the boundary between an object and the background and indicates the boundary between overlapping objects. This means that if the edges in an image can be identified accurately, all of the objects can be located and measured. The Sobel operator performs a 2-D spatial gradient measurement on an image and so emphasizes regions of high spatial frequency that correspond to edges. Typically it is used to find the approximate absolute gradient magnitude at each point in an input grayscale image. It looks for edges in both horizontal and vertical directions, and then combines the information into a single matrix. Figure 3.5 (a) and (b) shows the results for finding edge detection by canny and sobel operators.



B.Canny Edge detector

The Canny operator was designed to be an optimal edge detector.It takes as input a gray scale image,and produces as output an image showing the positions of trackedintensity discontinuities.First of all the image is smoothed by gaussian convolution.Then a s simple 2-D first derivative operatoris applied to the smoothed image to highlight regions of the image with high first spatial derivatives.Edges give rise to ridges in the gradient magnitude image.The algorithm then tracks along the top of these ridges and sets to zero all pixels that are not actually on the ridge top so as to give a thin line in the output,a process known as non maximal suppression.The tracking process exhibits hysteresis controlled by two threshold.This hysteresis helps to ensure that noisy edges are not broken up into multiple edge fragments.

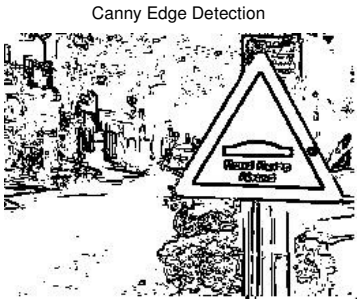


Fig 3.5 (a) and (b) Edge Detection by Sobel and Canny Operators

3. Image Classification Techniques

The main task of the detection module is to preprocess the input image and extract out the areas that contain road sign pattern. The detection module then forwards this ROI to the classification module for recognition. The main task of the classification module is to classify the extracted regions of interest presented to its input into the road-sign category they belong to. Different techniques in image classification like Artificial Neural Networks (ANN), Support Vector Machines (SVM), Fuzzy measures, Genetic Algorithms (GA), Fuzzy support Vector Machines (FSVM) and Genetic Algorithms with Neural Networks are being developed for road sign recognition and classification.Using neural networks the sign boards can be classified in the proposed work.

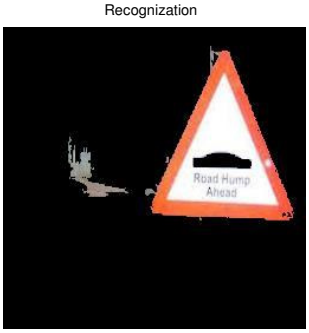


Fig 3.6 (a) Sign Board Recognised

IV. CONCLUSION

This paper deals with object detection in outdoor environments which are usefulness for Driver Support systems and Intelligent Autonomous Vehicles to take some decisions about their speed, trajectory and send a warning signal indicating over speed, warn or limit illegal ma-oeuvres. It works in identifying traffic sign boards detection and recognition.

REFERENCES

[1] Reza Azad, Babak Azad, Iman Tavakoli Kazerooni, "Optimized Method for Iranian Road Signs Detection and Recognition System". International Journal of Research in Computer Science, 4 (1): pp. 19-26, January 2014. doi: 10.7815/ijorcs.41.2014.077

[2] Gauri A. Tagunde,"Detection,Classification and Recognition of Road Traffic Signs Using Color and Shape Features". International Journal of Advanced Technology & Engineering Research, ISSN No: 2250-3536, Volume 2, Issue 4, July 2012.

[3]S.MohamedAmeen, .Ganapathy,"Recognition of Traffic sign for Driver Assistance Systems, International Journal of Engineering Development and research, ISSN: 2321-9939, Volume 2, Issue 1, 2014.

[4] S.Sathiya,M.Balasubramani,S.Palanivel." Pattern Recognition Based Detection Recognition of Traffic Sign Using SVM," International Journal of Engineering and Technology, ISSN: 0975-4024, Vol 6 No 2 Apr-May 2014.

[5] Md. Safaet Hossain, Zakir Hyder," Traffic Road Sign Detection and Recognition for Automotive Vehicles," International Journal of Computer Applications (0975 – 8887) Volume 120 – No.24, June 2015

[6] A. de la Escalera, J.Mª Armingol, M.A. Salich, "TRAFFIC SIGN DETECTION FOR DRIVER SUPPORT SYSTEMS," *Systems Enginnering and Automation Division*, Universidad Carlos III de Madrid, Leganés, Madrid, Spain.

[7] G. Piccioli, E. D. Michelli, and M. Campani. "A robust method for road sign detection and recognition." In *Proc. European Conference on Computer Vision 1994*, pages 495–500, 1994.

[8] G. Piccioli, E. D. Michelli, P. Parodi, and M. Campani. "Robust road sign detection and recognition from image sequences." In *Proc. Intelligent Vehicles'94*, pages 278–283, 1994.

[9] Yoav Freund and Robert E. Schapire. "A decision-theoretic generalization online learning and an application to boosting," *Computational Learning Theory: Eurocolt* '95, pages 23-37. Springer-Verlag, 1995.

[10] Paul Viola and Michael J. Jones, "Robust Real-time Object Detection," *Cambridge Research Laboratory, Technical Report Series*, CRL 2001/01. Feb. 2001.

[11] Jordi Vitrià and Xavier Baró, "Traffic Sign Detection on Greyscale image," *Computer Center Vision*, Spain.

[12] Arturo de la Escalera, *Member, IEEE,* Luis E. Moreno, *Member, IEEE,*Miguel Angel Salichs, *Member, IEEE,* and Jos´e Mar´i a Armingol

[13] Andrew Ditzgibbon, Maurizio Pilu, and Robert B. Fisher, "Direct Least Square Fitting of Ellipses," *Tern Analysis and Machine Intelligence*, vol. 21, no. 5, may. 1999.

[14] R. Brunelli and T. Poggio, "Face Recognition: Features vs. Templates," *IEEE Trans. Pattern Analysis and Machine Intelligence*, vol. 15, no. 10, pp. 1,042- 1,053, oct. 1993.

[15] Peter N. Belhumeur, Joao P. Hespanha, and David J. Kriegman, "Eigenfaces vs. Fisherfaces: Recognition Using Specific Linear Projection," *IEEE Transactions on Pattern Analysis and Machine Intelligence*, vol. 19, no. 7, jul. 1997.

[16] Gareth Loy and Alexander Zelinsky, "Fast Radial Symmetry for Detecting Points of Interest," *IEEE Transactions on Pattern Analysis and Machine Intelligence*, vol. 25, no. 8, Aug. 2003.

[17] L. Dreschler and H. Nagel, "Volumetric model and 3-D trajectory of a moving car derived from monocular TV-frame sequence of a streetscene," in *Proc. IJCAI,* 1981, pp. 692–697.

[18] M. Shah and R. Jain, "Detecting time-varying corners," *Comput. Vision, Graph., Image Processing,* vol. 28, no. 3, pp. 345–355, Dec. 1984.

[19] L. Kitchen and A. Rosenfeld, "Gray-level corner detection," *Pattern Recognit. Lett.,* vol. 1, pp. 95–102, 1982.

[20] O. A. Zuniga and R. Haralik, "Corner detection using the facet model," in *Proc. IEEE CVPR Conf.,* 1983, pp. 30–37.

[21] K. Rangarajan, M. Shah, and D. Van Brackle, "Optimal corner detector," *Comput. Vision, Graph., Image Processing,* vol. 48, no. 2, pp. 230–245,Nov. 1989.

[22] *A. de la Escalera, J.Mª Armingol, M.A. Salichs* Systems Enginnering and Automation Division, Universidad Carlos III de Madrid, Leganés, Madrid, Spain. Phone: +916249430, Fax: +916249431, E-mail: escalera@ing.uc3m.es

[23] *A. de la Escalera, J.Mª Armingol, M.A. Salichs* Systems Enginnering and Automation Division, Universidad Carlos III de Madrid, Leganés, Madrid, Spain. Phone: