International Journal of Science and Research (IJSR)
ISSN (Online): 2319-7064
Index Copernicus Value (2016): 79.57 | Impact Factor (2017): 7.296

Automatic Road Side Traffic Sign Detection for Drivers using Image Processing

Ramesh Admane

Professor, Devendra Patole

Abstract: ***In India road accidents are increasing day by day. Many peoples are injured and lost their life in accidents. One of the main reason of road accidents is unawareness about meaning of road sign boards. Moreover, people are unable to visualize the traffic sign boards placed at the road side. This paper deals with the camera-based driver alert system of automatic traffic sign board identification which uses image processing techniques. Proposed system uses a camera, mounted on top of vehicle and interfaced to the processor. Camera captures real time road sign images, processor processes these images using image processing techniques and gives the audio information about road sign to the driver. Main advantage of proposed system is driver need not to concentrate on the road signs while driving and due to which accidents can be avoided.***

Keywords: Image processing, traffic sign, Edge detection, Thresholding Method, SURF Features, Support vector machine

1. Introduction

Many systems are developed for transportation safety. Automatic traffic sign detection and recognition (TSDR) system has been introduced for solving road accident problems. Continuous changes in environment, lighting conditions, multiple traffic signs appearing at same time and blurring traffic signs is difficult for Automatic TSDR system to detect correct meaning of road sign [1]. Navigation system can be developed for road sign board identification. Drawback of this system is it requires an internet connection [2]. This paper explains the image processing technique to solve problem of road sign identification. It does not require an internet connection. System consists of camera, processor and audio player. Camera should be mounted on the top of the vehicle and captures the images of road sign boards while driver is driving a vehicle. The captured road sign image will be processes by the processor. Image will first go through the pre-processing stage, then segmentation and feature extraction stages. Extracted features will be compared with the features of the road sign images stored in the database. Classifier such as support vector machine will classify the the input image as a one of the road sign image stored in the database. The audio player will play the pre-recorded sound related to identified road sign image such as its name and meaning [3]

2. System Block Diagram

Block diagram of proposed system is shown in figure 1. The captured image is first pre-processed to enhance the image quality. The pre-processed image is then segmented using thresholding image segmentation. Edges of objects are then detected using Sobel edge detection method. SURF algorithm is used to extract the features of segmented object. These features are stored in memory. The road sign images are stored in the database. All database images are also gone through the above processing steps and features are also stored in the database. Classification is done using support vector machine.

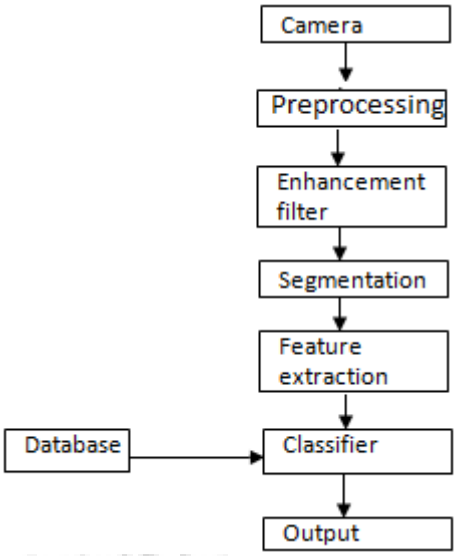

Figure 1: Block diagram

3. Image pre-processing

Image pre-processing is used improve the quality of image by suppressing undesired distortions as well as to enhance some image features which are important for further processing and analysis task. It includes conversion of colour image to grey scale image, resizing of image, cropping of image, histogram equalization and noise removal.

4. Image Segmentation

A process of dividing image into multiple parts is called Image Segmentation. Image segmentation is used to simplify the representation of an image into something that is more meaningful object of interest and easier to analyse. It is typically used to locate objects in images. Methods of Image segmentation are included like Edge based, Region based, Thresholding, Clustering and watershed method. Thresholding segmentation method is used here [6]. It is simplest method for image segmentation. It divides the image pixels with respect to their intensity level. It is generally used over images having lighter objects than

background. The purpose of thresholding is to extract those pixels from image which represent an object. It is process of converting input gray scale image into binary image [7]. A parameter ɵ called the brightness threshold is chosen and applied to the a [x, y] as follows:
If a[x, y] > ɵ a[x, y] = object= 1

Else a[x, y] = background=0

This algorithm assumes that we are interested in light objects on a dark background. For dark objects on a light background we would use:

If a[x, y] < ɵ a[x, y] = object =1
Else a[x, y] = background =0

There are basically three types of thresholding: Global thresholding, Variable thresholding and multiple thresholding. Here Global thresholding method is used. Global thresholding is done by using any appropriate threshold value T. This value of T will be constant for whole image [7]. On the basis of T the output image b (x, y) can be obtained from original image a (x, y) as:
b (x, y) =1, if a(x, y) T > 0
=0, if a(x, y) T ≤ 0

5. Edge Detection

A process of locating an edge of an image is called Edge Detection of an image. Detection of edges in an image is a very important step towards understanding image features. Edges consist of meaningful features and contain significant information. Edge detection is extensively used in image segmentation when images are divided into areas corresponding to different objects. Edge detection removes information that may be useless and reduces image size, thus preserving the important structural properties of an image. Sobel Edge detection method is used here [8]. The Sobel edge detection operation extracts all of edges in an image, regardless of direction. The resulting image appears as a unidirectional outline of the objects in the original image. The advantage of sobel operator is providing both a differencing and a smoothing effect. The smoothing effect is particularly attractive feature of the Sobel operators [8]. Sobel operators are shown in figure 2.

-1	0	+1
-2	0	+2
-1	0	+1

Gx

+1	+2	+1
0	0	0
-1	-2	-1

Gy

Figure 2: Sobel operators

The operator consists of a pair of 3×3 convolution kernels as shown in Fig. 2. The kernels can be applied separately to the input image, to produce separate measurements of the gradient component in each orientation (Gx and Gy) [8]. An approximate magnitude is computed using:

$$|G| = |Gx| + |Gy|$$

6. Feature Extraction

In Image features usually include color, shape and texture characteristics. SURF Features are used in this paper. Interest point detection, local neighborhood description and matching are three main parts of SURF algorithm. To find points of interest SURF uses a BLOB detector which is based on the Hessian matrix. The surrounding region in digital images that differentiate in properties such as brightness or colour. SURF uses the wavelet responses for feature description. The key point is selected around neighborhood and divided into sub regions and then for each sub region the wavelet responses are taken and represented to get SURF feature descriptor. With the help of sign of Laplacian underlying interest points are detected.

7. Classification

Road sign images are saved in database. To classify a particular kind of feature vectors depending upon their characteristics a Support Vector Machine (SVM) classifier is used [10]. Support vector machine (SVM) constructs a set of hyper planes in a high dimensional space which is use for classification. SVM handles more input data efficiently because it uses non-parametric with binary classifier approach [11].

Using linearly separable classes is easiest way to train SVM. If training data with k number of samples then it is represented as

$$\{X_i, y_i\}, \quad i = 1, \ldots, k$$

where k is an N-dimensional space and is i class label then these classes are considered linearly separable if there exists a vector W perpendicular to the linear hyper-plane (which determines the direction of the discriminating plane) and a scalar b showing the offset of the discriminating hyper-plane from the origin. Class 1 represented as - 1 and class 2 represented as +1, two hyper-planes can be used to discriminate the data points in the respective two classes. Fig.3 shows optimal separating hyper plane between separable samples and non-separable data samples. The distances between two closest points called margin [11]. These are expressed as:

WXi+b ≥ +1 for all y = +1, i.e. a member of class 1.
WXi+b ≤ -1 for all y = -1, i.e. a member of class

Figure 3 The optimal separating hyper plane between

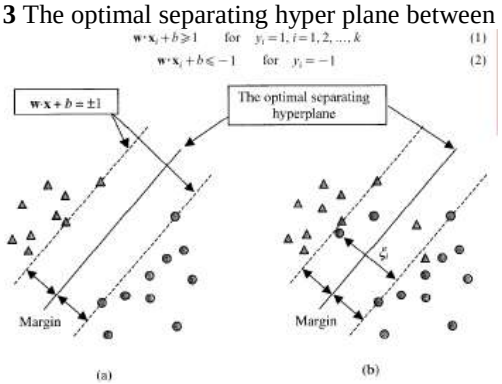

Figure 3: (a) separable samples and (b) non-separable data samples

8. Conclusion

The aim of this paper is to propose a system to identify the traffic road sign automatically and can reduce road accidents. Today, most of the people do not care about road sign when they drive or walk on road. Using road sign identification system, people can understand proper meaning of road sign board. Resizing of image is necessary for simplify operations such as Image segmentation and enhancement. We conclude that median image filtering is removed noise without actually blurring the object. Thresholding image segmentation is simplest method and Sobel Edge detection is useful for locating an edge of image. Speeded up robust features (SURF) are extracted image features. Support Vector Machine (SVM) is suitable method for image classification. Support Vector Machine (SVM) delivers unique solution and very efficient image classifier method.

References

[1] A. Mogelmose, M. M. Trivedi, and T. B. Moeslund, "Vision-based traffic sign detection and analysis for intelligent driver assistance systems: Perspectives and survey," *IEEE Trans. Intell. Transp. Syst.*, vol. 13, no. 4,pp. 1484–1497, Dec. 2012.
[2] S. Houben, J. Stallkamp, J. Salmen,M. Schlipsing, and C. Igel, "Detection of traffic signs in real-world images: The German traffic sign detection benchmark," in *Proc. IEEE IJCNN*, pp. 1–8,2013.
[3] Azuma, R., Baillot, Y., Behringer, R., Feiner, S., Julier, S., MacIntyre, B. Recent advances in augmented reality. IEEE Computer Graphics and Applications 21(6),pp.34–47, 2001.
[4] Jianxin Wu, "Efficient Hik SVM Learning For Image Classification", *IEEE Transactions On Image Processing*, Vol. 21, No. 10, October 2012.
[5] James C. Church, Yixin Chen, and Stephen V. Rice Department of
[6] Computer and Information Science, University of Mississippi, "*A Spatial Median Filter for Noise Removal in Digital Images*", pp 618 – 623, April 2008.
[7] G.N.Srinivasan, Dr. Shobha G, "Segmentation Techniques for Target Recognition", International Journal Of Computers And Communication, Issue 3, Volume 1, 2007.
[8] S. Inderpal and K. Dinesh, "A Review on Different Image Segmentation Techniques", IJAR, Vol. 4, April, 2014.
[9] Ehsan Nadernejad. Hamid Hassanpour, Sara Sharifzadeh,"Edge Detection Techniques: Evaluations and Comparisons" Applied Mathematical Sciences, Vol. 2, 2008, no. 31, 1507 – 1520.
[10] Erkan Bostanci," Spatial Statistics of Image Features for Performance Comparison", IEEE Transactions on Image Processing, Vol. 23.
[11] C.-T. Su and C.-H. Yang, 2008. Feature selection for the SVM: an application to hypertension diagnosis. Expert Systems with Applications, vol. 34, no. 1, pp. 754–763, 2008.
[12] Bi,K. P. Bennett, M. Embrechts, C. Breneman and M.Song, "Dimensionality Reduction via Sparse Support Vector Machines," Journal of Machine Learning Research, 3:1229–1243, 2003.