Road Sign Detection and Recognition System Using LBP and SVM

[1]Meenakumari.V.Umarani, [2]Raghavendra. F.Sheddi
[1]Assistant Professor, [2]Assistant Professor
Rural Engineering College,Hulkoti

***Abstract* - Traffic road sign detection and recognition is important to transport system with a robotic eye or camera while driving on the road. The main objective of this paper is to design and construct a computer based system which can automatically detect the road sign. We developed and implemented the procedure to extract the road sign from a natural complex image. Then the image is preprocessed and LBP features of the image are extracted, and given to PCA for further reduction. These reduced features are processed by the SVM classifier. The results show that our system can obtain the expected results effectively.**

***keywords* - LBP, SVM, DAS, PCA**

I. INTRODUCTION

The sign which is placed at the side of roads to impart information to road users is known as road signs or traffic signs. The four types of traffic signs that are shown in the traffic code are warning, prohibition, obligation and informative. Depending on the form and the color, the warning signs are equilateral triangles with one vertex upwards. They have a white background and are surrounded by a red border. Prohibition signs are circles with a white or blue background and a red border. Both warning signs and prohibition signs have a yellow background if they are located in an area where the public work is under progress. To indicate obligation, the signs are circles with a blue background and informative signs have the same color. Finally, there are two exceptions: the yield sign, an inverted triangle; and the stop sign, a hexagon. To detect the position of the sign in the image, we must know the two properties i.e., color and shape.

The road sign detection is an interesting problem. So far, the researchers have mainly focused on the road sign recognition problem, in which the task of finding a road sign in an arbitrary background is usually avoided by either manual segmentation of the input image, or by capturing faces against a known uniform background. In the last decade, road sign detection has attracted great attention, as the road sign recognition system requires automatic road sign detection as a first step, especially for images with cluttered background. Road sign detection also has potential applications in human computer interface and surveillance systems.

Road sign detection is difficult due to three main reasons.

1. There is a large component of non-rigid and textural differences among the road signs.
2. Road sign detection is difficult because of additional features, such as dust, which can either be present or totally absent from a road sign. All these additional features increase the variability of the road sign patterns that a road sign detection system should handle.
3. The presence of unpredictable imaging conditions in an unconstrained environment increases the difficulty of the task. A change in light source distribution can cause a significant change in the appearance of the road sign image. All these things should be taken into consideration when designing a road sign detection system.

II. LITERATURE SURVEY

A substantial amount of research has been carried out in Road Sign Detection And Recognition. Some of the related work has been summarized below,

[1] Faming Shao, Xinqing Wang, Fanjie Meng, Ting Rui, Dong Wang, and Jian Tang "Real-Time Traffic Sign Detection and Recognition Method Based on Simplified Gabor Wavelets and CNNs" 2018 Oct; 18(10): 3192. Published online 2018 Sep 21. doi: 10.3390/s18103192 PMCID: PMC6210476.

In this paper, First, the images of the road scene were converted to grayscale images, and parameters are optimized with simplified Gabor wavelets (SGW). Then, the edges of the traffic signs were strengthened. Second, extracted the region of interest using the maximally stable external regions algorithm and classified the superclass of traffic signs using the support vector machine (SVM). Finally, it uses convolution neural networks with input by simplified Gabor feature maps, to classify the traffic signs into their subclasses.

[6] Arturo de la Escalera, Luis E. Moreno, Miguel Ángel Salichs and José María Armingol "Road Traffic Signs Detection and Classification," CICYT Project TAP94- 0711-C03-02, jul. 1996

The authors have concentrated on two main parts. The first one, for the detection, uses color thresholding to segment the image and shape analysis to detect the signs. The second one, for the classification, uses a neural network.

[8] D. Kellmeyer and H. Zwahlen. "Detection of highway warning signs in natural video images using color image processing and neural networks." In IEEE Proc.Int.Conf. Neural Networks 1994, volume 7, pages 4226–4231, 1994.

Presented a system that incorporates color image processing and neural networks to detect and locate highway warning signs in natural roadway images. The basic approach is to digitize a roadway image and segment this image, using a back-propagation

neural network, into eight colors that are important to highway sign detection. Next, the system scans the image for color regions that may possibly represent highway warning signs.

[12] M. de Saint Blancard. "Road sign recognition: A study of vision-based decision making for road environment recognition." In Vision-based Vehicle Guidance, Springer Series in Perception Engineering. Springer Verlag, 1992.

This study is based on an application of vertical road sign recognition by vision. Three types of danger, warning signs are recognized. Octagonal stop signs and triangular danger warning signs are distinguished from round forbidding signs on the basis of their outside shape. This recognition is made in "quasi-real-time" in a running vehicle.

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

This paper describes a general framework for traffic sign detection and their subsystems. They proposed a system based on the framework to detect circular and triangular road traffic signs, making use of artificial intelligence techniques such as heuristic functions for detecting shapes.

From the above survey, it shows that authors have implemented software to detect and recognise the road signs. This is helpful for vehicle driver to have safe and enjoyable driving by recognising the signs.

III. PROPOSED METHOD

In the literature survey relevant work has been discussed. Based on the survey, we proposed a system, Road Sign Detection and Recognition using LBP and SVM for Driving Assistance. This system presents an intelligent agent for detecting and tracking road signs for vision based Driver Assistance System (DAS) and Intelligent Autonomous Vehicles, to take some decisions about their speed, trajectory and send a warning signal indicating over speed.

1.1 System Architectural Design

User requirements are written in natural language, collected from road users. However, more detailed system requirements may be expressed in a more technical way. One widely used technique is to document the system specification, as a set of system models. These models are graphical representations that describe business processes, the problem to be solved and the system that is to be developed. Because of the graphical representations used, models are often more understandable than detailed natural language descriptions of the system requirements. They are also an important bridge between the analysis and design processes. The Flow chart of system is as shown in fig 3.1.

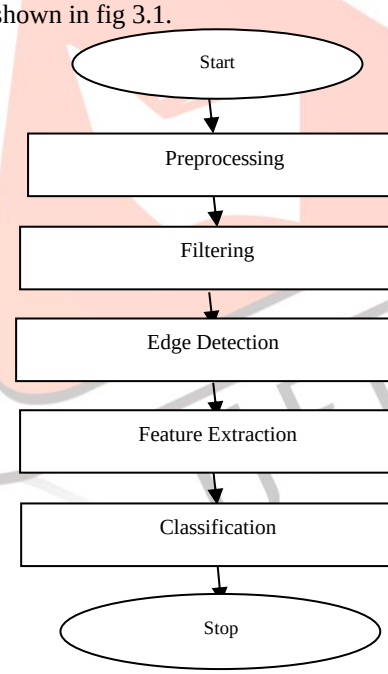

Fig 3.1 Flow chart of the road sign recognition

Figure 3.1 shows the flow of road sign recognition, first the input image is converted into gray scale image, then it is filtered to remove any noises and image edge is detected using the canny edge detector. Finally, the LBP features are calculated and given as input to the SVM classifier.

Figure 3.2 shows the architectural design of the system. First, the LBP features of the preprocessed image are extracted and stored in the database. Further, these features are reduced using PCA and are given as input to the SVM classifier.

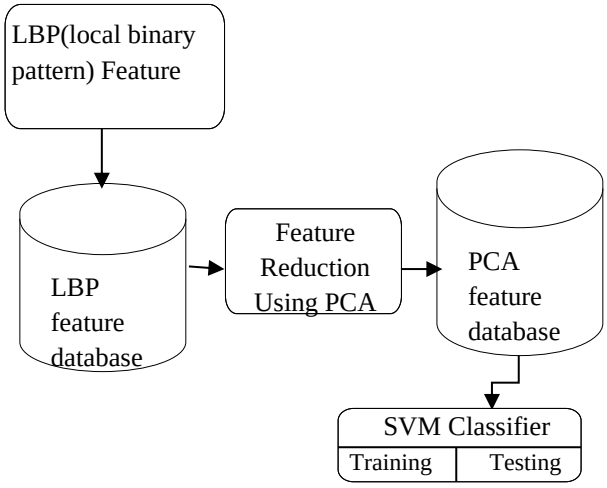

Fig 3.2 Architectural design of proposed system.

IV. FEATURE EXTRACTION

Feature extraction is a type of dimensionality reduction that efficiently represents interesting parts of an image as a compact feature vector. This approach is useful when image sizes are large and a reduced feature representation is required to quickly complete tasks such as image matching and retrieval. The proposed method uses the LBP features and for reduction of the feature PCA is used.

LBP: Local Binary Pattern is a simple, very efficient texture operator which labels the pixels of an image by thresholding the neighborhood of each pixel and considers the result as a binary number. Due to its discriminative power and computational simplicity, the LBP texture operator has become a popular approach in various applications.

PCA: Principal Component Analysis belongs to linear transforms based on the statistical techniques. This method provides a powerful tool for data analysis and pattern recognition, which is often used in signal and image processing.

Fig 4.1 Feature extraction of the road signs

Figure 4.1 shows the feature extraction of the road sign image.

V. CLASSIFICATION

Classification is the systematic way of grouping of images according to the structural or evolutionary relationships among them. According to the survey, many researchers have used different classifier techniques for DAS, such as K-Nearest Neighbours (KNN), Artificial Neural Networks (ANN), Support Vector Machines (SVMs), Expectation Maximization (EM) and etc.

In the proposed method, SVM classifier is used for DAS, because of its good generalization and high precision capabilities. It is very specific and sensitive process because of the specific nature of the images. Images are normally classified based on their features. The aim of the proposed work is to classify the road sign images automatically, based on LBP features.

SVM is a function estimation technique based on Statistical Learning Theory, introduced by V. Vapnik since the early 1990s. The standard SVM is a supervised binary classifier based on statistical and optimizing theories, which has found widespread use in pattern recognition problems. The SVM is able to handle noise, large data set, input spaces and mapping of non-linear input data into a high dimensional feature space with minimum error on the training set. During this binary classification process, it constructs a hyperplane in the feature space that separates optimally two different classes of feature vectors. These feature vectors are mapped into a feature space by using the kernel function. The hyperplane formed by SVM is one that maximizes the separating margins between both binary classes

VI. RESULTS

This chapter describes the results of our system. Following are the some of the snapshots.

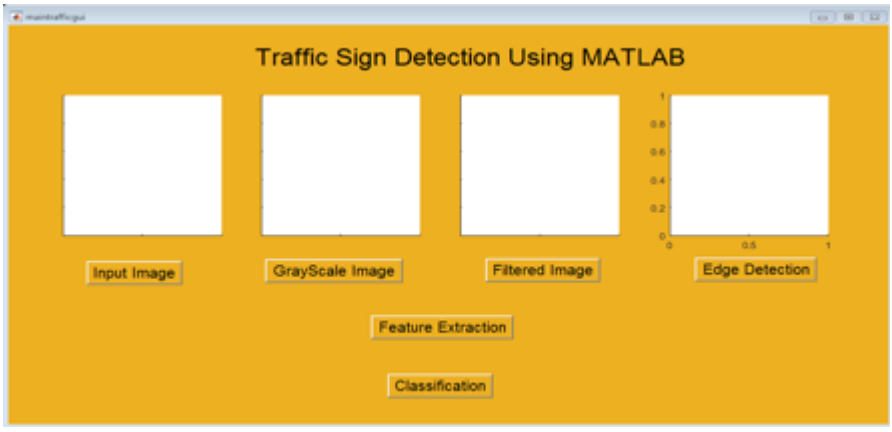

Fig.6.1 GUI for Road Sign Detection and Recognition.

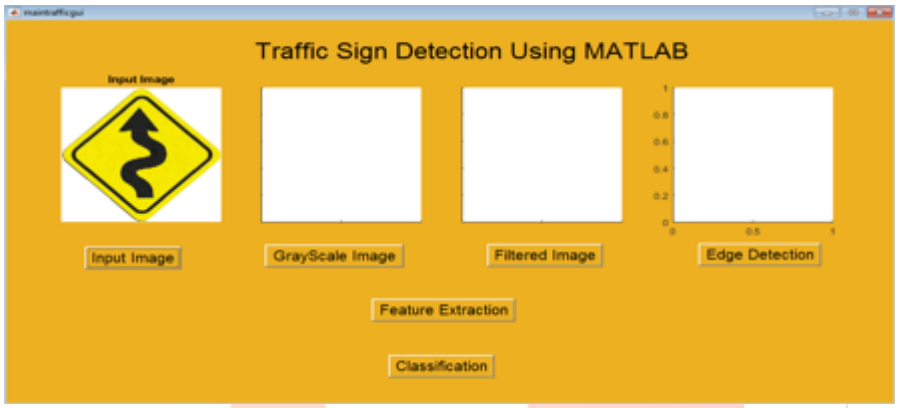

Fig 6.2 Selecting the Test image

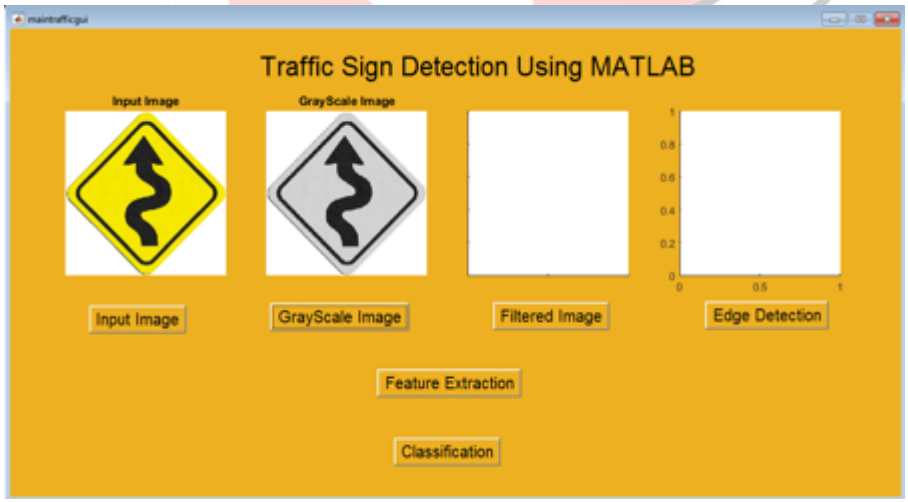

Fig 6.3 Conversion of input image to Gray scale image

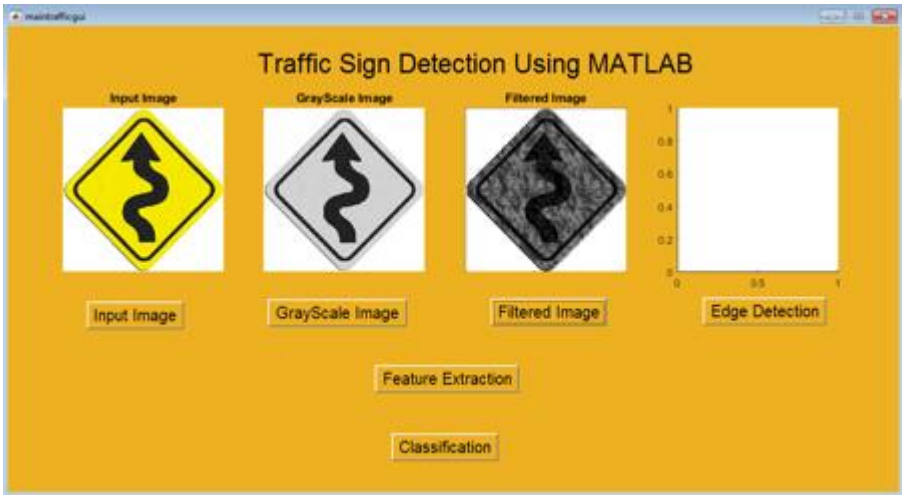

Fig 6.4 Filtering the Gray Scale image.

Fig 6.5 Edge Detection using Canny Filter.

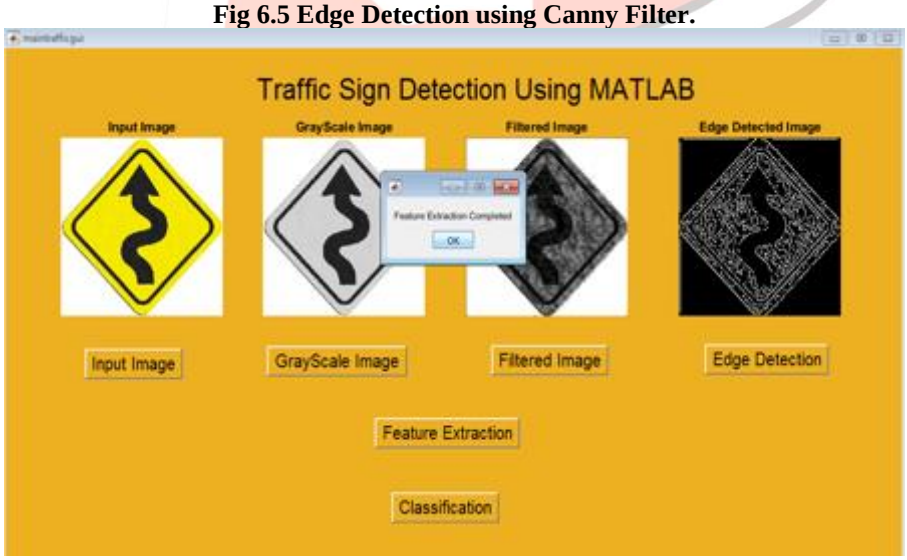

Fig 6.6 Feature Extraction Phase.

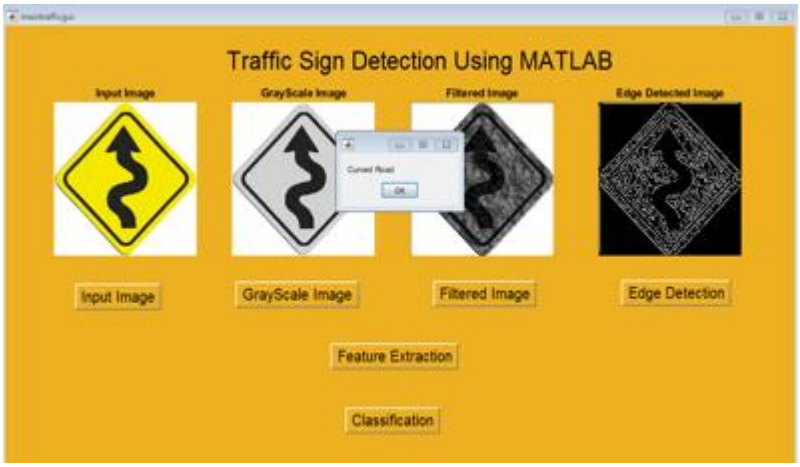

Fig 6.7 Classification of the image using SVM.

VII. CONCLUSION AND FUTUREWORK

Road sign recognition is important in the field of transport system. This paper presents a system for traffic sign detection and recognition. It deals with object detection in outdoor environments which are useful for Driver Support systems and Intelligent Autonomous Vehicles. This system will play an important role for the detection purpose of specific domains like island, schools, universities, hospitals etc.

For improving traffic safety, We hope the proposed computational model is helpful for designing various subsystems for functions such as the detection and recognition of lanes, traffic signals, viewing intersections, obstacles, as well as road and environmental change detection, etc. Developing and integrating these subsystems to collect significant information in driving environments is very important. This application can be modeled by extracting different kinds of features and with all colors.

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