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ROAD SIGN SYMBOL DETECTION AND RECOGNITION

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ABSTRACT

Road sign recognition plays an important role in driver assistant systems and intelligent autonomous vehicles. This paper proposes a novel system for road sign detection and classification. This proposed system detects traffic signs by using color information and shape analysis and further classification is done by using PCA (principal component analysis). The proposed system approach is robust enough to detect and the recognize road signs.

Keywords: traffic sign detection(TSD),traffic sign recognition(TSR).

I. INTRODUCTION

The proposed system helps driver about the road sign detection to avoid road accidents. The automatic road-signs recognition is an important part of Driver Assisting Systems which helps driver to increase safety and driving comfort. This system is an efficient approach for the detection and recognition of the road sign in the road and acquiring the traffic scene images from a moving vehicle.

In this dissertation work, the road sign recognition system is to be divided into two parts, the first part is detection module which is used to detect the signs from a whole image, and the second part is classification module that classifies the detected sign in the first part into one of the reference signs which are presents in the dataset.

The detection module segments, the input image in a YCBCR colour space, and then by using the shape filtering method it detects road signs. The classification module present determines the type of detected road signs by using Principle Component Analysis (PCA).

II. RELATED WORK

A notable Number of papers that deals with traffic sign detection and recognition have been published. The most common approach for traffic sign recognition consists of two main stages Detection and Recognition. Detection stage identifies the region of interest is mostly performed by using color probability model and detected candidates are either accepted or rejected in recognition stage by using some form of classifier like SVM[2][3][4] or neural network[1][6][9] or by using template matching[5].

The most of system uses color information for segmenting the image. The majority of system uses shape information. For example Kai Li, Weiyao Lan proposed a system that uses edge of interested regions is traced to get their contours after morphologic operations. Then to find the target region, a circle transform is applied. Some methods uses HOG features to features of road sign.[7]and [8].

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III. OVERVIEW OF SYSTEM

Figure 1 shows the general framework of road sign detection and recognition system. In first step we detect the road sign i.e. road sign extraction. This extraction is done using color information obtained. Then after the extraction the geometric feature extraction of image is done. This is carried out by its shape information. i.e. the road sign shape such as round, square, hexagonal shape.

After that, further road sign classification and recognition is done based on its contents. Depending upon which feature of image is used for classification, we classify traffic signs and then recognize.

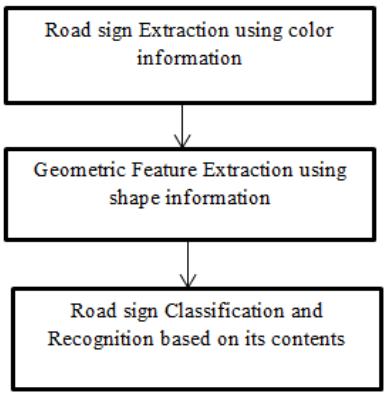

Fig.1. General Framework of Road Sign Detection and Recognition

IV. DETECTION MODULE

The captured images are given to the detection module. The main work of the detection module is to segment the input captured image and extract out the areas and contain road sign patterns and then passed to the classification module. The proposed algorithm uses the color properties of the road sign in order to identify the interested region that is actual road sign.

In the detection part of the algorithm, colour properties of the signs have been used. Most of the road signs are made from the red colour, therefore if the red colour is extracted from this road sign then the corresponding logo sign is to be detected. In this dissertation work the red colour is detected by using the red colour analysis. For this purpose the threshold value of the gray scale is set to 140. Red pixels are identified using MAP colour matching. The RGB values of each pixel are compared to training data. The training data base is the standard database which can be compared with captured images. Pixels that fall within the region in RGB space identified by the training data are kept and all others are rejected. In this way, the red colour is extracted from the road sign.

At the second step, several constraints on the shape properties are used to remove some of the candidates which cannot be a sign. The success of the detection algorithm often depends on the initial segmentation of the relevant colors of the image. In order to ensure that illumination has the smallest effect on the method, the colour space that has been studied in this project for the RSR application is YCBCR.

In the YCBCR space , the colour value of a pixel is determined by the planes CB (blue chroma) and CR (red chroma). As their names indicate, CB determines how close is the colour of a pixel to blue, and CR to red. In this colour space, the Y component represents the luma (brightness). Shape detection based on a similarity measure between the grey-level image of the unknown road sign and the objects of the database has been

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selected. This method assumes that both sample and segmented image have the same dimensions. First, the road sign is normalized to a size of 100x100 pixels by linear interpolation of the grey levels. Secondly, the normalized cross-correlation between the road sign and the templates of the database related to the proper shape is computed.

Preprocessing steps are applied to both training database as well as test database shown in Fig.2. Captured image is RGB image, that image is converted to YCbCr. Then RED color is extracted and then cropped image is obtained. After performing morphological operations segmented gray image output is achieved.

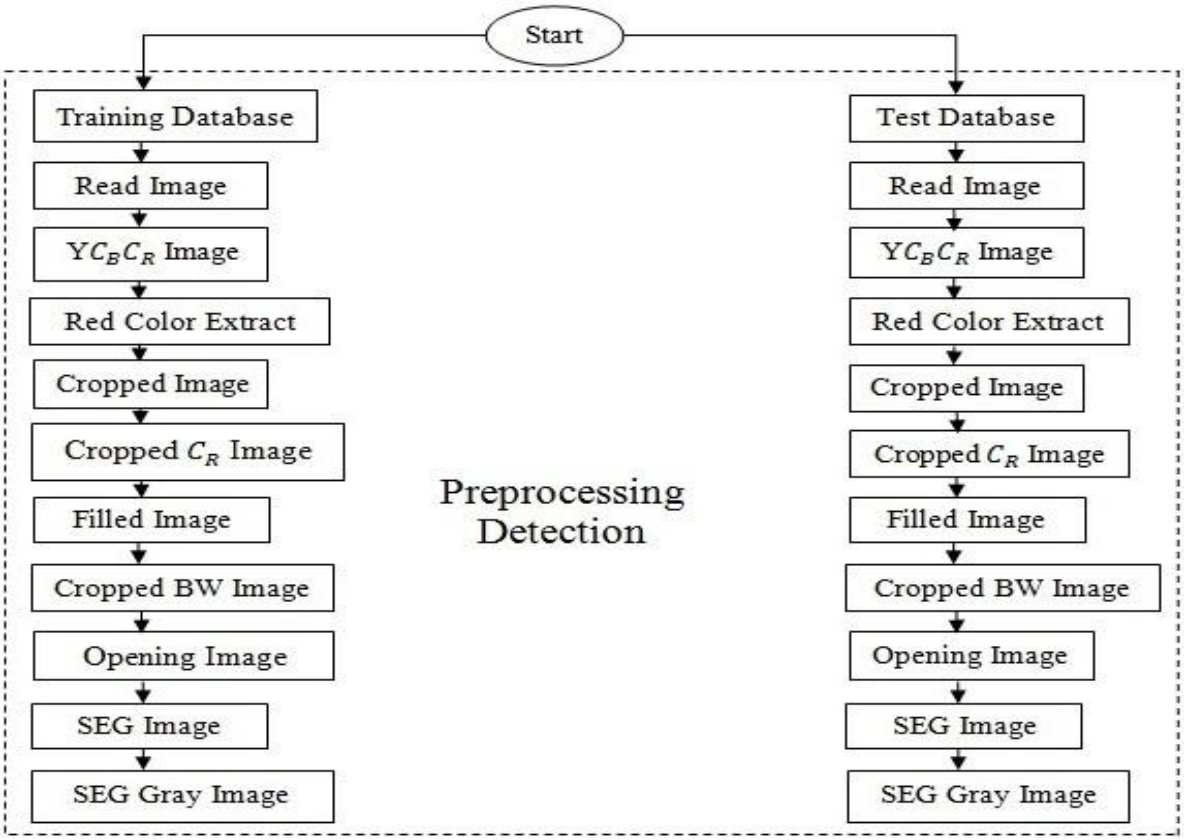

Fig.2. Preprocessing Steps of Road sign

V. RECOGNITION MODULE

The recognition module consists of two blocks viz. classification stage and data base. 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 belongs. The output of the detection stage is a list of candidate objects that could be probable road signs. For further evaluation this list is forwarded to the recognizer, and then to the classifier to decide whether the objects in the list are either rejected objects or road signs, and in this case the classifier responds with a sign code.

In this dissertation work the Principal component analysis (PCA) is used for the classification. In this stage the extracted road sign image is compared with the database image and according to that it shows the output. after doing PCA classification the detected test image and trained image are converted to projected test image and projected trained image. The test image is compared with all the projected trained images and minimum distance is calculated which is equivalent image and that is the final output shown in Fig.3.

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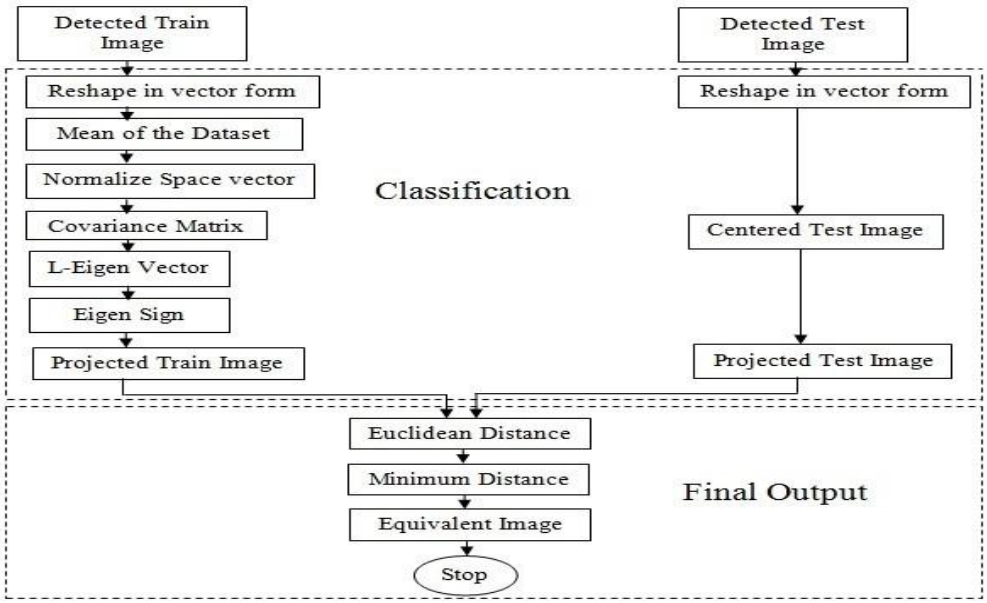

Fig.3.Classification and final output of road sign detection and recognition.

A. PRINCIPAL COMPONENT ANALYSIS(PCA)

PCA is known as Principal Component Analysis. It is a statistical analytical tool that is used to explore, sort and group data. What PCA does is take a large number of correlated (interrelated) variables and this data is transform into a smaller number of uncorrelated variables (principal components) while retaining maximal amount of variation, thus making it easier to operate the data and make predictions. Or *"PCA is a way of recognizing patterns in data, and expressing the data in such a way as to highlight their similarities and differences. Since patterns in data can be difficult to find in data of high dimension, where the luxury of graphical representation is not available, PCA is a powerful tool for analyzing data."*

VI. RESULT

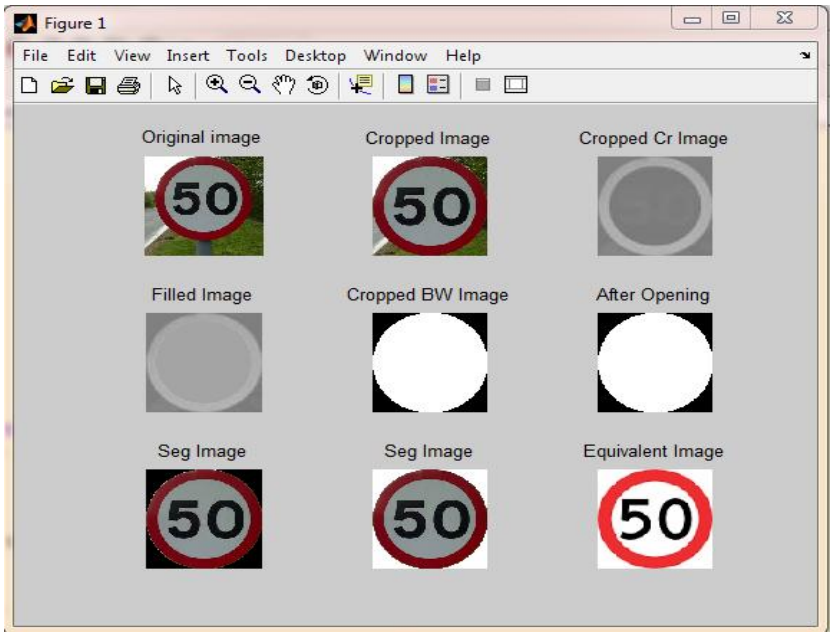

Fig.4. Detection and Recognition results of speed limit 50 Road sign

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VII. CONCLUSION

We have proposed a novel system for automatic detection and recognition of road sign symbol. detection module segments, the input image in a YCBCR colour space, and then by using the shape filtering method road signs are detected. road signs symbols recognized by using Principle Component Analysis (PCA). The system is efficient and robust enough to detect and recognize road sign symbol.

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