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Detection And Recognition Of Indian Traffic Signs

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Abstract
Road traffic is very important in the modern society organization. For safety and harmony in the flow of traffic, certain rules are established by governments all over the world, known as traffic rules. Some of the traffic rules are displayed by means of traffic signs to the drivers. The traffic signs need to be paid attention to, and interpreted by the drivers, while driving. If the traffic sign is missed or misinterpreted by the driver, it may lead to an accident. So an automatic system installed on the car, which would detect, recognize and interpret the meaning of the traffic signs for the driver, would be a great help in reducing the road accidents and the deaths caused by it. This paper proposes a system for automatic detection and recognition of traffic signs from images captured by a camera installed on the car, to provide a driver alert system. Traffic signs are detected by analyzing the colors in the image, and then they are classified according to their shape. Several image processing techniques are used to enhance the efficiency and speed of the system. The system would not only disburden the drivers and reduce road accidents for a better and safe driving, but also it would be a great development for future use in autonomous vehicles.

Keywords - Traffic sign detection; Shape analysis; Pattern matching; Image processing; intelligent vehicle.

1. Introduction
The automatic system able to detect, recognize and interpret the traffic signs would be a great aid to the driver. Since it will disburden the driver from remembering and interpreting the traffic signs, this will lead to a stress free and comfortable driving. Also no traffic signs would go neglected or unnoticed, and thus it will greatly reduce the number of road accidents. India has the highest rate of road accidents in the world. In this scenario, an automatic

system to detect and recognize traffic signs, installed on vehicles in India, would greatly help.

Traffic signs are designed such that they are easily readable, with highly saturated and contrasting colors. But certain conditions such as environmental light; weather conditions- fog, rain, clouds; paint degradation; dirt; disorientation; shadows, make automatic traffic sign detection and recognition a challenging task. There might also be similar objects in the image resembling a traffic sign in color or shape, and/or the image captured by a moving car might be distorted or have a lot of noise in it. So there are many challenges in detecting and recognizing of traffic signs.

This paper aims to present a methodology to detect and recognize traffic signs in real time.The paper texts a system which not only would detect traffic signs in good conditions but also in more complex conditions. Also the speed of processing is enhanced by classifying the signs detected according to their shapes, in the database.

This paper is divided as follows:- in section 2 related work done in this field is given, in section 3 the implementation of the system is described and in section 4 conclusions are drawn.

2. Related Work
An approach for recognition of traffic sign involves pixel-based template matching. This technique is useful only when the objects in the tested image and template images are well aligned. It is difficult to achieve satisfactory alignment in automatic sign detection systems, especially when target is affected by geometrical distortion. On the other hand, for road sign classification feature-based approaches are more Appreciated. Benalla et. al. [1] proposed a color segmentation algorithm for segmenting Red, Green and Blue regions in the given image.

FOR all the pixels j in the candidate image
IF Rj > Gj && Rj − Gj > ΔRG; Rj − Bj > ΔRB
THEN pixel j is RED
ELSE IF Gj > Rj && Gj−Rj > ΔGR;Gj−Bj > ΔGB
THEN pixel j is GREEN
ELSE IF Bj > Gj &&Bj−Gj > ΔBG;Bj−Rj > ΔBR
THEN pixel j is BLUE
ELSE pixel j is WHITE (or BLACK)
ENDIF
ENDFOR

Unfortunately, this algorithm is well enough for segmenting traffic signs in ideal illumination condition. In non ideal illumination conditions, the performance becomes relatively poor. Fixed values for the thresholds

has been chosen. This is the main reason for its poor performance in non-ideal illumination conditions. Approaches for detection of traffic sign varies in use of color and geometric information. Various color-based approaches uses RGB,HSV or other color models.Intensity decoupling[2] color schemes are preferred for diverse lightning conditions usually faced in real life applications.With the help of Hough transform [3,4] geometric information can be extracted from traffic signs or template matching [7]. Based on Viola-Jones detector appreciable amount of work has been proposed in [5].Shape information has been extracted in grayscale images for most of the Viola-Jones based implementations whereas in [6] color based is used.

Unlike some of the related work, which considers static images [2,4] , our system works on real time images.

3. Implementation

Since the system is embedded inside the car, the platform independent technology is preferred. The entire process can be divided into three sub processes – Detection, Classification and Recognition.

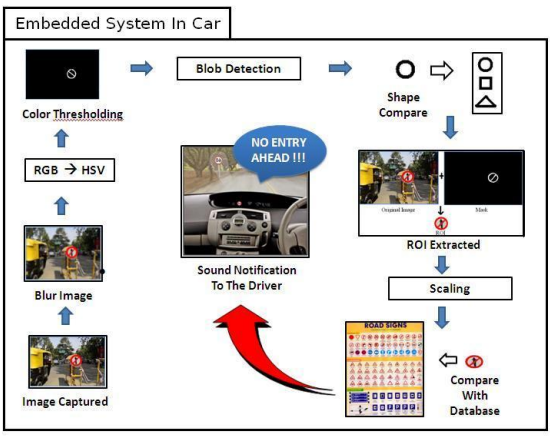

Fig. 1. Overview of the proposed system

The image is captured continuously by the camera which is installed on the car. The Camera used should be of high shutter speed (i.e. maximum number of images per second). Each image thus captured is then processed.

3.1 Sign Detection

Once, the image is captured, it is made blur. It is necessary so as to remove noise from the image, thus enhancing the shape recognition. Any blurring algorithm such as Gaussian filter can be used for the same.

Image in HSV form is more manipulative as compared to RGB. Operations can be easily performed if the image is in HSV form. Therefore, RGB to HSV conversion is essential [8].

The fact that Indian traffic signs uses only four colors - red, black, white and blue; is used in color thresholding. Color filtering is done for each of these colors keeping only the required color portion as white and rest everything as black [9].

Once, the background is removed, the image is scanned for shapes. Through blob detection all the shapes present in the candidate image are detected. These blobs are compared with the standard shapes – Circular, rectangular, or triangular using any pattern matching algorithm [10][11]. The blobs other than the standard shapes are discarded. If the image does not contain any standard shapes it is discarded from further proceedings. [12]

Then, the Region Of Interest (ROI) is extracted from the image by the process of Masking. Before the actual comparison of the ROI with the templates present in the file system, some preprocessing techniques like scaling is essential. The appropriate scaling factor has to be chosen according to the requirement. For illustration, if the candidate image is of 50 × 50 and the template in the file system is of 100 × 100 then the scaling factor of 2 is used.

Thus, the traffic sign is detected on the basis of its color and shape.

3.2 Sign Classification

Fig. 2.Shows the traffic signs currently present in India. Basically, the signs are divided into three classes based on its shapes - Circular, Rectangular and triangular. This enhances the processing speed limiting the search in only one of the classes based on the shape.

Fig. 2. Indian Traffic Signs

3.3 Sign Recognition

Once, the ROI is extracted it is then compared with the templates in the file system using pattern matching algorithms [10][11]. If the exact pattern is found sound notification is given to the driver, interpreting the meaning of the candidate sign If the pattern does not match with any of the templates in the file system, the Candidate image is discarded. But the false rate is less than 1 percent since the candidate image with no blobs are already discarded.

4. Conclusion

This paper describes the method of classifying and recognizing the traffic signs in real-time. The paper describes the system that is strictly used to differentiate Indian Traffic Signs that is subdivided in three classes according to the shapes.

The system works in three basic steps, it detects the traffic sign, classifies it and finally recognizes the traffic sign by giving a sound notification. We have used pattern matching for comparing the traffic signs. The method is fast as the system discards the images having signs of shapes other than the basic shape at the initial phase. We will improve the robustness of the system so that it can perform better in all kinds of atmospheres and luminance conditions. For future work, some modifications can make the system work for highly tilted signs.

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