ISSN: 2321-7782 (Online)
Volume 3, Issue 8, August 2015
International Journal of Advance Research in Computer Science and Management Studies
Research Article / Survey Paper / Case Study
Available online at: www.ijarcsms.com

Multiple Traffic Sign Detection and Recognition using SVM

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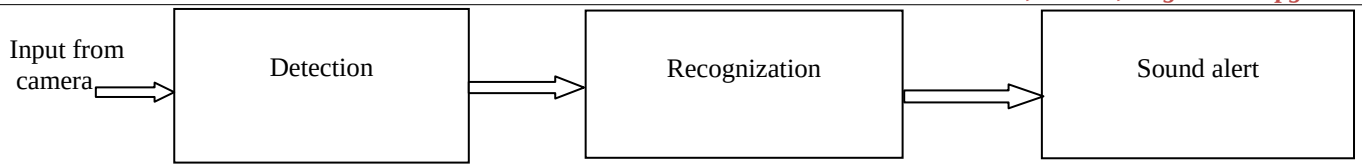
Abstract: ***Detection and recognition of traffic signs and information text in natural scenes is one of the challenging problems. This paper presents an algorithm to recognize and classify traffic signs and information text based signs, which could assist the drivers while driving. The system consists of two different stages: detection stage to localise signs and information text from a whole image, and recognition stage that classifies the detected sign or text into reference sign and information text. The detection module segments the input image in the RGB colour space. The recognition module determines the type of road sign using Neural Network, and determines the information text using OCR. Then the recognised sign or text is produced as an alert to warn the driver.***

Keywords: Road sign; detection; recognition; Neural Network; OCR.

I. INTRODUCTION

Detection and recognition of traffic signals have a great impact on the safety of the driver. During the past years road transportation systems has been subjected to a large amount of traffic congestion and accidents. With the rapid growth in number of vehicles in road, increases a greater complexity in road. Road signs as well as text are used to assist the drivers and also it provides information about the road condition. This road signs and text carry much of the information necessary for traffic monitoring in order to provide accident free driving and enhances road safety. They prevent the driver doing inappropriate actions such as driving above speed limit, going in a wrong direction, entering to forbidden area etc. But during adverse road conditions, a driver may not notice it. Failure to notice it, may lead to accidents. The occurrence of these accidents can be reduced by using an automatic road sign and information text recognition system with an alert providing more concentration to the driver.

The objective of this paper is to develop a driver aiding system that provide more safety in such conditions and to prevent accidents to occur. It is also used to notify a human driver the presence and nature of road signs and also the texts containing information. The objective of recognising traffic signs and the information texts are described as a distinct stage process using image processing algorithms. Traffic signs and the text are designed easily with the background in order to be easily detected by the driver. The areas containing the signs are searched for and these areas are known as Region of Interest. If that areas exact location is available, then it must be compared to the database containing sign and also text. As a first step, it is required to know where the sign appears in the image. The work done relies that colour information to successfully detect signs and text on the images. But objects having the same colour is also identified as possible sign or text. For this shape is also considered here. If both these colour and shape is known and by combining these both features can able to reduce the sign comparisons. These on forwarding to a classifier reduces further false positive results. The basic block diagram of the system is shown below:

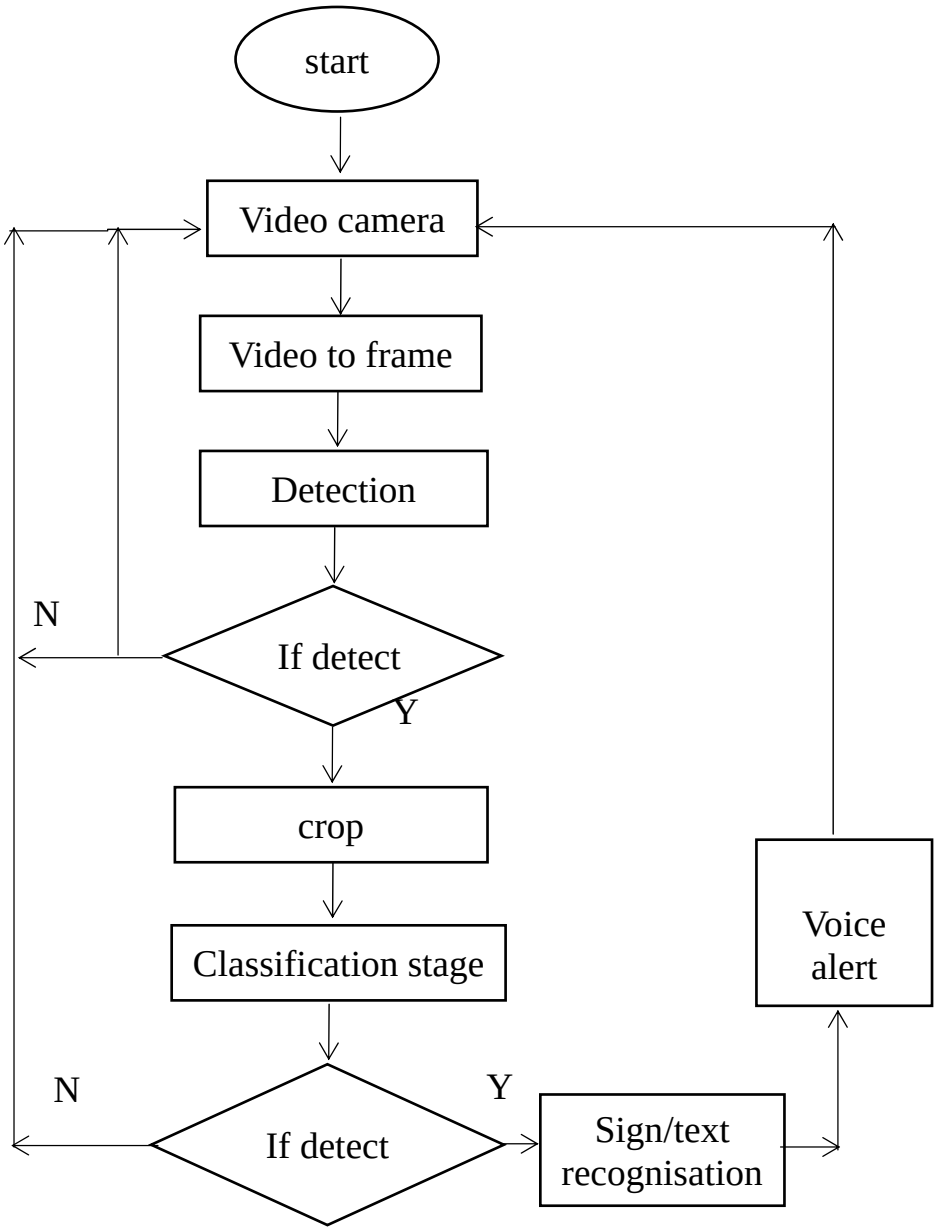


Basic block diagram

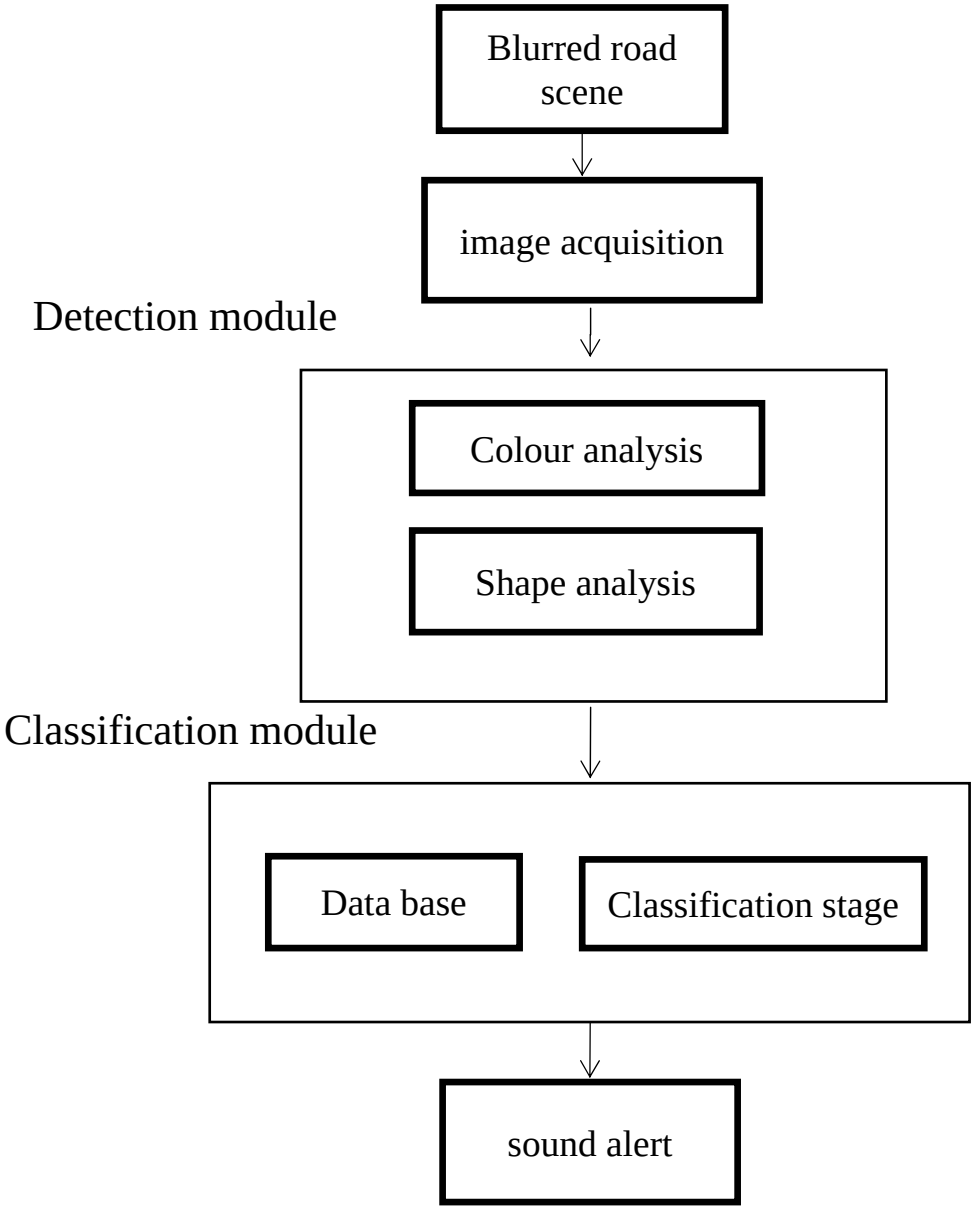
II. System Model

In this proposed system the system is divided into two modules. One is the detection module and other is the recognition module. The input is been captured from a video camera. The detection module is responsible for detecting traffic signs from the frames obtained after converting from a video capturing device for finding regions that contain traffic signs and text. It detects each frame separately, and if it is been detected it is been forwarded to the classification stage. If not detected it goes to the next frame. In the classification stage a secondary detection takes place. If there also it is been detected a sign or information text is been recognized. The recognized text or sign is been produced as an alert to warn the driver. If not detected it checks the other frame and the process continues. The recognition results depend on the detection module for each specific images. The work flow of the proposed algorithm is shown below:

Flowchart of the proposed method



III. BLOCK DIAGRAM



Block diagram of the proposed model

Figure shows the block diagram of the proposed system. The input to the system is a blurred road scene image. This is been fed into the detection module. The region of the image having the road sign and information text pattern are been extracted and they are forwarded to the classification module. The detected pattern is been further processed in the classification module and identifies the type of road sign and texts they represent. The identified pattern is given as a sound alert.

A. Detection Module

In this module detection based on colour criteria and detection based on shape criteria is used. That is, since road signs mainly depends on colour and the shape the proposed algorithm uses both the colour and shape properties. Based on the properties, analysis is been done for finding the candidate region. Colour spaces are for locating regions of the image that contains colour of interest. In this work, RGB colour space is used for locating the ROI. To this colour space detection is performed by applying colour thresholding.

Colour thresholding is applied in order to get the red edge areas. The red edge areas is obtained by creating a binary image, pixels above the threshold level is assigned as 1, and all others are set as 0.The global thresholds used are 160>R<90 for red colour. For computing the thresholds, signs and information text are segmented from multiple views under different conditions.

A mask is applied to this binary image for eliminating noise. Then convolution of the image with this mask discards the pixels that are wrongly detected as regions of interest.

To this binary image, connected component algorithm is applied for blobs and to form ROIs. For each ROI a bounding box is obtained using 8 neighbour connectivity. The ROIs with high and small area are eliminated because high areas are not depict signs or information texts. Also small ROIs results in unsuccessful recognition even though the sign or the text is correctly detected. The value of the bounding box containing a single sign is 1. Then the area between the new and original bounding box gives the new ROI. Thus shape is been analysed. By using this method it will reduce the search for road signs and text regions from a whole image to a small number of pixels.

B. Recognition Module:

In this module, its main task is to classify the extracted candidate region into the particular category they belongs. That is it is a procedure to assign each of the region of interest to the class they belongs. By doing this, false positives that have been detected as candidate region are eliminated.

In the recognition stage, after obtaining the detected RGB image converted into greyscale image. If detected one was a sign then it will be forwarded to an SVM classifier for training. SVM are a kind of machine learning method. To find the optimal hyper plane which can separate different classes in a feature space is the basic principle of SVM. That is between the classes the distance must be furthest. To a sequence of detected signs from a video frames this procedure is carried out. There it compares each of the detected signs with the already stored database signals. If any match is been found, then sign is been recognised. Matching is been performed using a set of feature vectors. The features used here are correlation, mean value, histogram values of red and black colour. For each frame, the classifier recognises sign as output.

If the detected one is a text, then it is been recognised using an OCR. An OCR is to classify the patterns to alphanumeric or other characters. For the printed text documents, segments this input into text line words. That is first, greyscale image is converted to a binary image based on a threshold. The image should be resized in order to fit with the text. A text file is been opened that contains templates. Matching is performed using correlation method to each input with the stored templates. If match is found, it is been recognised as a text file.

Both the sign and the information text which is been recognised is been produced as a sound alert to the driver for providing more concentration about the traffic signs and also the information texts on the side of the road.

IV. Conclusion

In this paper an efficient methodology for detection and recognition of traffic sign is developed, by taking into consideration existing difficulties. It is also tested in real life video. The algorithm also detects text from natural scenes that contains information is successfully developed. The search area for traffic signs and also information text was reduced, which aided in reducing the total number of false positives using structural information from the scene. The system proved that the system is fast and accurate and allows us to detect different geometric shapes, i.e., circular, triangular, octagonal, and rectangular and works correctly in difficult situations. And also after recognizing the detected result through an alert, thus improves the results.

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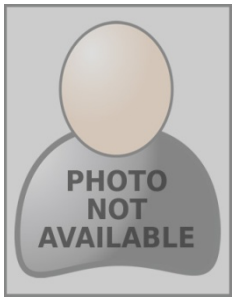

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