Traffic Sign Identification System

Gaurav Mishra(201202057)
Aabhas Majumdar(201202038)
Sudarsh Rathi(201125172)
Group Number 18
International Institute Of Information Technology Hyderabad

***Abstract*—Traffic Sign Identification System (TSIS) is used to regulate traffic signs, warn a driver, and command or prohibit certain actions. Fast real-time and robust automatic traffic sign detection and recognition can support and disburden the driver and significantly increase driving safety and comfort. Automatic recognition of traffic signs is also important for an automated intelligent driving vehicle or for driver assistance systems. This paper presents a study to recognize traffic sign patterns using Neural Network technique.Whole process consists of two phases Detection and Recognition Of Traffic Signs.**

I. Introduction

In today's world with people having many work to do it is becoming extremely difficult to focus on the roads, Most of the people talk while driving or they sometimes loose concentration and cannot focus on roads because of which bad things might happen. TSIS is, therefore important for automated intelligent driving vehicle or for driver assistance system. However, identification of traffic signs with respect to various natural background viewing conditions still remains a challenging task.

II. Approach

TSIS that we have worked upon consists of two main phases: Detection Phase(Where a Region of interest is extracted from an image that contains a traffic sign.) and Recognition Phase(Where the detected traffic sign is recognised using Neural Networks.) The whole box diagram for our approach is shown here.

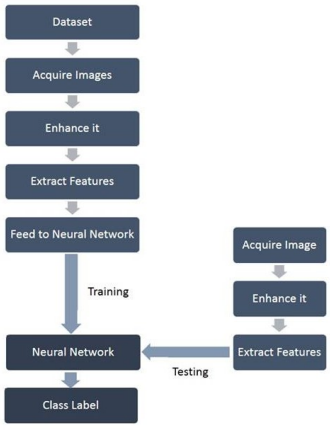


Fig. 1. Model Of Approach

III. Image Acquisition

This is the phase where we intend to aquire images for further working in TSIS this can be implemented by mounting a camera on vehicle that captures its front view.For our classification purposes we have just taken the images but the same algorithm will work on direct camera feed also.

IV. Image Enhancement

The captured image is subjected to noise,blur etc.So we have applied some basic image enhancement operations such as Histogram Equalization, Illumination correction and Noise removal.Median Filtering suited the best because in real world most of the noise is because of dust that comes in captured image.

V. Training Phase

For training Phase we have taken the images of traffic sign directly, for the sake of accuracy we have worked on dataset for identifying 7 basic traffic signs that are extremely important.Our Dataset contains various images of following Traffic signs.

A. *Left/Right Turn*

B. *No Left/Right/U Turn*

C. *Yield and Stop*

The Feature vector that we have defined for our approach is build by taking the image resize it to 100 * 100 and then divide it in 5 * 5 blocks, concatenate the mean of R,G,B planes of all such blocks to build the feature vector.The target vector is defined as an array Target such that Target[i]=1 if 'i' is the class label of the image else Target[i]=0.Once we have Input and Target vectors for all the above classes we have trained the Neural Network ('patternnet' NN in matlab) with it.

VI. Identification Phase

The Identification phase consists of two main phases.The detection phase where we detect the region of interest in a given image and the recognition phase where we feed the feature vector of the extracted region for further classification.

A. Detection Of Traffic Sign

As traffic signs are of utmost importance on road and should be captured by our eyes immediately they are made up of **Highly saturated** Red, Blue and Yellow colors.We have exploited this information to detect 'region of interest' aka 'Traffic Sign' in the image.Our algorithm is:

- Convert the image to HSV space.
- Do a max thresholding on S.
- Do a max thresholding on H of the obtained image.
- Extract the Traffic Sign.

Along with above information we need to keep track of the fact that whether a R,Y or B traffic sign is identified by counting the number of pixels of that color and thwn we have to tune the thresholding part to give us the exact sign.The Implementation of above algorithm is there in TEST_ME.m file which we have made publicly available. Step by Step Results for above algorithm is shown below.

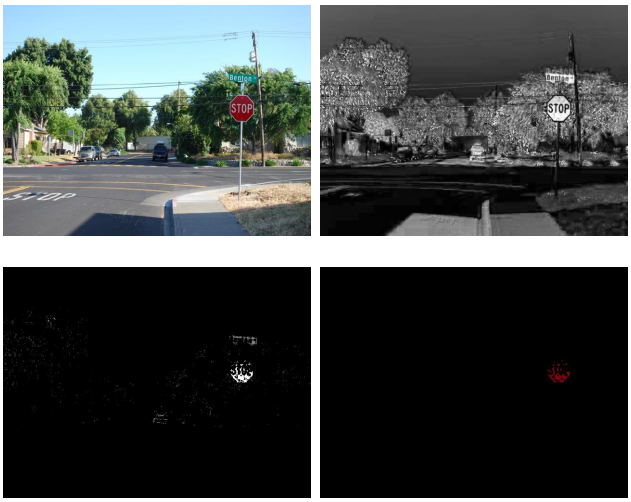


Fig. 2. From Top Left: Original Image,Saturation Image,Result After Thresholding on Saturation and Area after thresholding on Hue

After above operations we have segmented out the Region Of Interest which contains traffic sign.

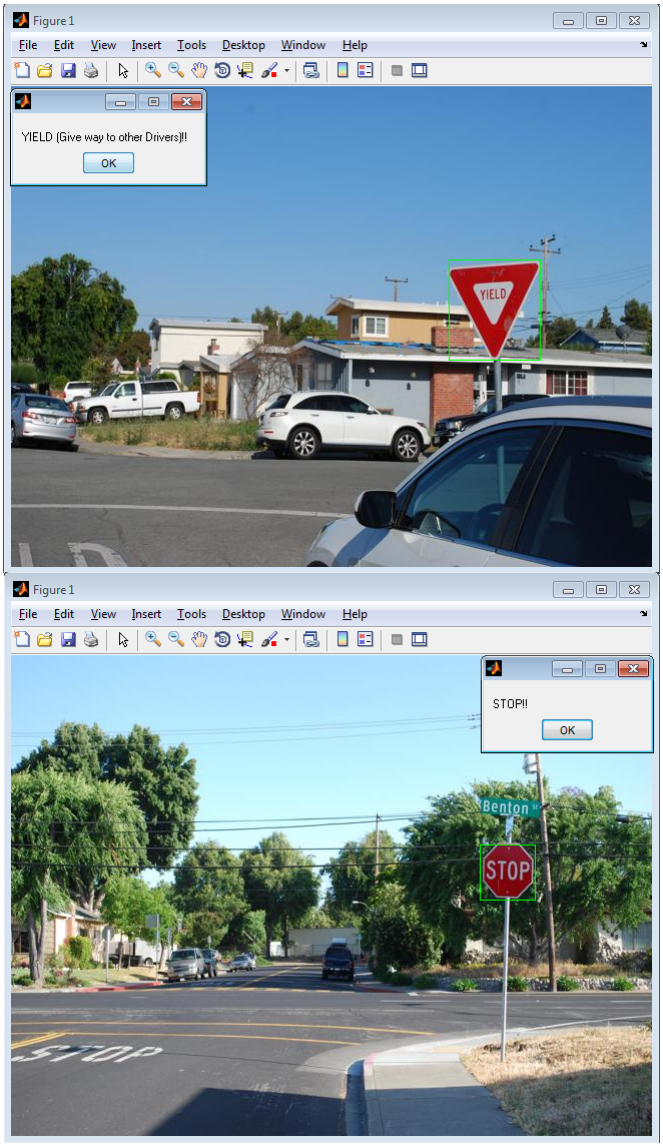
Fig. 3. Extracted Traffic Sign

B. Recognition Of Traffic Sign

We have got the traffic sign only from the given image and now we need to classify in one of the classes, For this fed the feature vector of the obtained image in the neural network and obtain the Output vector, the values of Output vector is from 0 to 1 for every index.The class corresponding to the image is the index with maximum value.Display the results accordingly.

VII. Results

Following are the some of the results that we have got in our experiments.Traffic sign is identified and some messages are displayed to alert the driver depending on the type of traffic sign.The TSIS system that we have built is giving an accuracy of 77% for a dataset of over 100 images.Along with the following results the system correctly tests the absence of these traffic signs also.



VIII. Discussion

It was not like that we have chosen the feature vector in first trial. We do have tried a lot of feature vectors which includes

- Manipulated SIFT vectors.
- Fourier descriptors of Harris corners

But in the end these Feature vectors didn't worked out so we have to go for creating Feature vector previously described as

- Resize the image to 100*100.
- Divide it into 5*5 blocks.
- Take the mean of R,G,B planes for these block.
- Concatenate it to form the feature vector.

As we can see that our algorithm works pretty well when we have traffic signs from the 7 classes specified, The algorithm also give the correct response if there is no such traffic sign. The overall accuracy of the system as measured was 77%.There are however some cases where our algorithm will fail like:

- Presence of multiple traffic sign in one image
- Presence of fully saturated Red , Blue or Yellow objects along with traffic signs.

To overcome these failures however one can apply shape based Recognition approaches.

References

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