MINI PROJECT – II
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TRAFFIC SIGN CLASSIFICATION

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INTRODUCTION

This thesis presents a system to recognise and classify road and traffic signs for the purpose of developing an inventory of them which could assist the highway engineers' tasks of updating and maintaining them. It uses images taken by a camera from a moving vehicle. The system is based on three major stages: colour segmentation, recognition, and classification.

Four colour segmentation algorithms are developed and tested. They are a shadow and highlight invariant, a dynamic threshold, a modification of de la Escalera's algorithm and a Fuzzy colour segmentation algorithm. All algorithms are tested using hundreds of images and the shadow-highlight invariant algorithm is eventually chosen as the best performer. This is because it is immune to shadows and highlights. It is also robust as it was tested in different lighting conditions, weather conditions, and times of the day.

A type of sign that is NOT considered in this thesis is the direction sign, in which the upcoming directions for getting to named towns or on numbered routes are shown not symbolically but essentially by text.

This thesis aims to develop a system to recognise and classify road and traffic signs for the purpose of developing an inventory which could assist the highway authorities to update and maintain the traffic signs. It is based on taking images by a camera from a moving vehicle and invoking colour segmentation, shape recognition, and classification to detect the signs in these images.

EXISTING SYSTEM

There are various model present for Traffic Signal Classification with less accuracy. Their references are below:

1. US Department of Transportation, "Intelligent Transportation Systems, URL: http://www.its.dot.gov/its_overview.htm," 2006.
2. Swedish-Road-Administration,
    a. "URL: http://www.vv.se/templates/page3____15600.aspx," 2006.
3. C. Fang, C. Fuh, S. Chen, and P. Yen, "A road sign recognition system based on dynamic visual model," presented at The 2003 IEEE Computer Society Conf. Computer Vision and Pattern Recognition, Madison, Wisconsin, 2003.
4. C. Fang, S. Chen, and C. Fuh, "Road-sign detection and tracking," *IEEE Trans. on Vehicular Technology*, vol. 52, pp. 1329-1341, 2003.
5. N. Hoose, *Computer Image Processing in Traffic Engineering*. New York: John Wiley & sons Inc., 1991.
6. S. Vitabile and F. Sorbello, "Pictogram road signs detection and understanding in outdoor scenes," presented at Conf. Enhanced and Synthetic Vision, Orlando, Florida, 1998.
7. P. Parodi and G. Piccioli, "A feature-based recognition scheme for traffic scenes," presented at Intelligent Vehicles '95 Symposium, Detroit, USA, 1995.

USE OF THE PROJECT

- Traffic sign classification is the process of automatically recognizing traffic signs along the road, including speed limit signs, yield signs, merge signs, etc. Being able to automatically recognize traffic signs enables us to build “smarter cars”.

- Self-driving cars need traffic sign recognition in order to properly parse and understand the roadway. Similarly, “driver alert” systems inside cars need to understand the roadway around them to help aid and protect drivers.

FEASIBILITY OF THE PROJECT

All algorithms are tested using hundreds of images and the shadow-highlight invariant algorithm is eventually chosen as the best performer. This is because it is immune to shadows and highlights. It is also robust as it was tested in different lighting conditions, weather conditions, and times of the day. Approximately 97% successful segmentation rate was achieved using this algorithm.

Recognition of traffic signs is carried out using a fuzzy shape recogniser. Based on four shape measures - the rectangularity, triangularity, ellipticity, and octagonality, fuzzy rules were developed to determine the shape of the sign. Among these shape measures octangonality has been introduced in this research. The final decision of the recogniser is based on the combination of both the colour and shape of the sign. The recogniser was tested in a variety of testing conditions giving an overall performance of approximately 88%.

Classification was undertaken using a Support Vector Machine (SVM) classifier.

FUNCTIONAL SPECIFICATION

1. Pre-processing will check contrast, brightness, and clarity. This block will make sure the image is ready to have image processing done to it. After passing through this pre-processing block, the image shall be ready to have processing algorithms applied to it.
2. The application of processing algorithms shall take the pre-processed image and find colours of interest and look for shapes relating to the sign or signs we are searching for.
3. This block shall find regions of interest on the image and these will be further processed to obtain the type of sign. This is done in the following block.
4. The classify sign block shall take the regions of interest passed from the algorithms block. These regions will be analysed and used to compare to ‘templates’ of known signs.
5. This allows for the system to identify exactly what sign is contained in the image that was processed.
6. The highlight image subsystem shall create some sort of distinguishing box or highlight around the actual sign.

7. The recommend appropriate action subsystem shall give a recommended action as an output based on the type of sign encountered.

Software Requirements

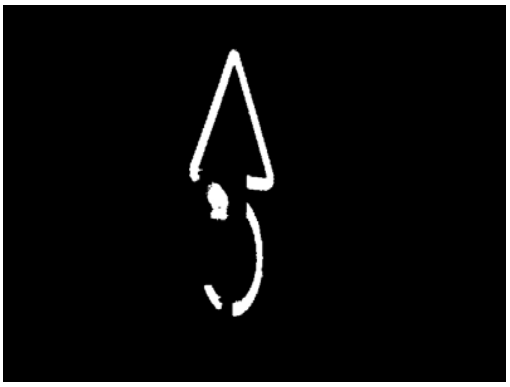
Technology Implemented	Deep Learning(CNN, pandas, matplotlib, keras)
Language Used	Python
Development Environment	Pycharm
Interface	GUI

Hardware Requirements

Processor	Intel core i5s/RYZEN 3
Operating System	Windows 10
RAM	4+ GB
Hard Disk	64 GB
Hardware Devices	Computer System

FUTURE SCOPE

- The main problem with these occlusions is that these signs are unpredictable and the shapes produced by them are also unpredictable. A number of researchers have already started to tackle this problem seriously, but the amount of work is still below what is necessary.



- Another direction for further research is to develop a real time traffic sign recognition system which captures a video by a camera mounted on the vehicle, detects and recognises the traffic signs in real time and gives the result to the driver within a sufficient time frame in order to take the right action.