

# Traffic-Signs Recognition System Based on FCM and Content-Based Image Retrieval

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## ABSTRACT

*Artificial intelligent (AI) driving is an emerging technology, freeing the driver from driving. Some techniques for automatically driving have been developed; however, most can only recognize the traffic signs in particular groups, such as triangle signs for warning, circle signs for prohibition, and so forth, but cannot tell the exact meaning of every sign. In this paper, a framework for a traffic system recognition system is proposed. This system consists of two phases. The segmentation method, fuzzy c-means (FCM), is used to detect the traffic sign, whereas the Content-Based Image Retrieval (CBIR) method is used to match traffic signs to those in a database to find the exact meaning of every detected sign.*

*Keywords:* Artificial Intelligence (AI), Content-Based Image Retrieval (CBIR), Fuzzy C-Means (FCM), Multiple Feature Extraction, Traffic Sign Recognition

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## 1. INTRODUCTION

Currently, artificial intelligent (AI) driving has become a emerging technology, freeing the driver from the boring travels. More important, the AI system for automatically driving is supposed to be more secure in theory than the human drivers, because the system will never be too exhaustive to be response the accident in time (Wang, 2006). In automatically driving, Geographic Positioning System has become (GPS) is an essential component, which aids AI to find the correct route and drive to the destination along the route following the

directions predefined on the electronic map (Wang, Zeng, & Yang, 2006). In theory, AI system should be able to drive only depending on GPS, following the directions, such as speed limit, one way only, etc., on an electronic map. However, one inevitable situation may happen where the route may be updated due to the engineering request, route adjusting, etc., while the corresponding directions on the e-map will be are updated periodically in half a year. This asynchronization on directions on e-maps and the actual traffic signs fail the AI system from the real time driving unless the system could recognize the traffic signs in the real-time.

Some techniques for automatically driving have been developed in recent years (Blancard,

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1992; Kehtarnavaz, Griswold, & Kang, 1993; Kang, Griswold, & Kehtarnavaz, 1994; Kang, 1994; Aoyagi & Asakura, 1996); however, most of these developments can only recognize the traffic signs in particular groups, such as triangle signs for warning, circle signs for prohibition, etc., but could not tell the exact meaning of every sign. Without understanding the exact meaning of every sign, the AI system cannot drive automatically but need the driver to determine the route when it encounters any traffic signs. Subsequently, it is an essential work to design a system could recognize the exact meaning of every traffic sign. In this paper, we propose a framework on traffic system recognition system, which consist of two phrase that a segmentation method is used to detect the traffic sign while the Content-Based Image Retrieval (CBIR) method is used to match the detected traffic signs to the traffic signs in the database in order to find out the exact meaning of every detected sign. The rest of this paper is organized as follows: Section 2 reviews the relevant works on traffic sign recognition, Section 3 presents the proposed method for traffic sign recognition. Section 4 demonstrates the experimental results. Finally, conclusions are made in Section 5.

## 2. LITERATURE REVIEW

The works on traffic signs recognitions can be traced back to the 1990's. At the very beginning of the studies on traffic signs recognitions, most works were focusing on detecting the traffic signs from a images about real-scene on the street while those method left the contains of the traffic signs not recognized. For example, Blancard (1992) recognized the signs by their color and form. In order to classify the colors, he used a band-pass filter to filter out most color but the chosen red colors attached to a black and white background. Meanwhile, a Sobel filter is applied to the images in order to find the edges inside the images. Associating with the edges, some features, including perimeter, length, gravity center and compactness are calculated and sent to a neural-network to rec-

ognitions. The method is fast (about 0.7s ~1s) but quite limited since it can only recognize the red background sign "stop" or similar warning signs while leaving other signs not recognized. Similar method is proposed in (Kehtarnavaz, Griswold, & Kang, 1993; Kang, Griswold, & Kehtarnavaz, 1994; Kang, 1994), where the combination of color and shape processing are used as the feature of the traffic sign. Besides the "stop" sign, Aoyagi and Asakura (1996) present a genetic algorithm to detect speed limit signs. They only work with the bright image due to the limitation of the Hue variations used in their method. After obtaining the Laplacian of the original image, the pixels are thresholded for recognition. However, they method do not take into account different scales for the horizontal and vertical axes; thus they do a matching only with a circular pattern. However, these results still remain on recognize the "stop" or similar red sign only.

As the developing the computer techniques, the AI driving system requests the method to recognize the meaning of variety traffic signs instead of only detecting the sign from the image or only recognizing "stop". Then Kehtarnavaz and Ahmad (1995) suggest to use the Fourier descriptor as the feature of the traffic sign detected based on the color. The Fourier descriptor is then sent to a neural network for determine the meaning of the signs. However, the time consuming of Kehtarnavaz and Ahmad's method is 80s, which is far too expensive for a real-time driving system. In de la Escalera and Salichs (1997), in order to obtain a more detailed recognition result, the traffic signs are grouped to triangle, circle and square since these shapes represents warning, prohibition, and instruction respectively. The corners of the edge are extracted as the feature of the signs, then the signs are grouped according to the location of the corners. However, de la Escalera and Salichs (1997) can only recognize the traffic sign accurate to different shapes.

After 2000, more advanced methods are proposed to further assign the traffic signs to more detailed groups of meanings. In methods (de la Escalera & Salichs, 2003; Viola & Jones,

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