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DETECTING AND RECOGNIZING TRAFFIC LIGHTS BY GENETIC APPROXIMATE ELLIPSE DETECTION AND SPATIAL TEXTURE LAYOUTS

Cheng-Chin Chiang*, Ming-Che Ho, Hong-Sheng Liao
Andi Pratama and Wei-Cheng Syu

Department of Computer Science and Information Engineering
National Dong Hwa University
No. 1, Section 2, Dashiue Road, Hualien 97401, Taiwan
*Corresponding author: ccchiang@mail.ndhu.edu.tw

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Abstract. *Traffic light detection is usually treated as a circle detection problem in computer vision. To handle more challenging cases in traffic light detection, this paper extends the circle detection problem to an approximate ellipse detection problem. For tackling the approximate ellipse detection problem, we propose a novel genetic approach which is more robust in handling appearance changes caused by perspective shape deformations and partial occlusions. To deal with the color recognition of each detected traffic light, we propose the design of a spatial texture layout feature which is more effective in handling illumination variations under different weather conditions and eliminating false alarms from irrelevant scene backgrounds. The experimental results show that the proposed method achieves an average recognition rate of 95.01%, with a false alarm rate below 2% based on 763 3-color traffic lights over 714 testing images, and demonstrates superior performance compared with an existing method.*
Keywords: Traffic light recognition, Color segmentation, Genetic algorithm, Approximate ellipse detection, Local binary pattern (LBP), Support vector machine

1. **Introduction.** The incidence of car accidents has been rising in recent years due to the increased use of car transport. According to statistics, a large fraction of car accidents result from driver's running red lights at crossroads. In view of this, more and more local governments have installed video cameras at every crossroad to monitor the road traffic and log the occurrence of car accidents. Lawmakers have also written strict laws to penalize undisciplined drivers. Even though strict punitive laws may be effective in deterring drivers from intentionally disobeying the traffic lights, drivers still may run red lights unintentionally. Therefore, it would be more advantageous for the driver to have an in-car driver assistance system which can give timely warning to prevent running a red light.

Many researchers have explored novel vision-based driver assistance systems. Some systems have been proposed for detecting pedestrians and vehicles [1, 2, 3, 4, 5] and others for recognizing road signs and traffic lights [6, 7, 8, 9, 10, 11]. The work presented in this paper focuses on the development of an in-car system for detecting and recognizing traffic lights. In developing such a system, the researchers face many technical challenges which may significantly affect the reliability of the developed systems. Particularly, the most difficult challenges are usually due to various kinds of appearance changes caused by perspective shape deformations, partial occlusions and weather conditions. Figure 1(a) shows a red light with an ambiguous color tone shifted towards yellow under a bad weather condition. The color ambiguity may lead to improper recognition of the