

Article

Real-Time (Vision-Based) Road Sign Recognition Using an Artificial Neural Network

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Abstract: Road sign recognition is a driver support function that can be used to notify and warn the driver by showing the restrictions that may be effective on the current stretch of road. Examples for such regulations are 'traffic light ahead' or 'pedestrian crossing' indications. The present investigation targets the recognition of Malaysian road and traffic signs in real-time. Real-time video is taken by a digital camera from a moving vehicle and real world road signs are then extracted using vision-only information. The system is based on two stages, one performs the detection and another one is for recognition. In the first stage, a hybrid color segmentation algorithm has been developed and tested. In the second stage, an introduced robust custom feature extraction method is used for the first time in a road sign recognition approach. Finally, a multilayer artificial neural network (ANN) has been created to recognize and interpret various road signs. It is robust because it has been tested on both standard and non-standard road signs with significant recognition accuracy. This proposed system achieved an average of 99.00% accuracy with 99.90% of sensitivity, 99.90% of specificity, 99.00% of f-measure, and 0.001 of false positive rate (FPR) with 0.3 s computational time. This low FPR can increase the system stability and dependability in real-time applications.

Keywords: intelligent transportation system; artificial intelligence; computer vision; road and traffic sign recognition

1. Introduction

A road sign recognition system can technically be developed as part of an intelligent transportation system that can continuously monitor the driver, the vehicle, and the road in order, for example, to inform the driver in time about upcoming decision points regarding navigation and potentially risky traffic situations. Road sign detection and recognition [1] is an essential part of the Autonomous Intelligence Vehicle Design (AIVD) [2]. It is widely used for intelligent driving assistance [3], self-directed vehicles, traffic rules and regulation awareness, disabled (blind) pedestrian awareness and so on. On the other hand, road sign detection and recognition can also be a part of self-driving car [4] technology to determine the road-traffic environment in real-time.

Detection and recognition is one of the most challenging tasks in the field of computer vision [5] and digital image processing to detect a specific object in a real-time environment [6]. Researchers are paying more attention in intelligent transportation systems [7]. Some of them have successfully implemented road sign recognition methods to detect and recognize red-colored road signs [8] only or single classes of road signs [9–13], and some of them have used specific country road signs [7,14–16]. In this field, a group of researchers has already shown distinguished performance based on annotated road signs [14,16,17]. Overall, for a standard road sign recognition approach, further improvements are needed.

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