

Guest Editorial

Introduction to the Special Issue on Robust and Efficient Vision Techniques for Intelligent Vehicles

In recent years, intelligent vehicles have been a hot topic for both research and industry communities. Since the whole system is a comprehensive integration of many advanced techniques, their respective development and improvement become fundamentally important.

Among all these advanced techniques, a vision-based technique is the most critical one that has attracted wide attention. For these vision techniques, the primary concern is robustness and efficiency. The intelligent vehicles must be assured that they can handle all the expected and unexpected conditions robustly and efficiently when undergoing a variety of driving environments.

The purpose of this special issue is to explore the usage of traditional hand-designed and state-of-the-art machine learning techniques for tackling the vision tasks of intelligent vehicles.

We accepted eighteen papers including the following topics: 1) tracking; 2) detection; 3) segmentation; 4) classification; 5) feature engineering; and 6) assistance systems.

The first topic of this special issue is developing advanced tracking techniques for complex scenarios. Not only the accuracy and robustness of tracking in intelligent vehicles application needs to be considered, but also the time efficiency and computation efficiency. Taking time efficiency into consideration, Peng Chen *et al.* proposed a lightweight real-time object tracking approach for computations in restricted situations, such as drones and mobile phone applications. Guiguang Ding *et al.* presented quadrangle kernelized correlation filters (QKCF) to estimate the scale of the object based on the positions of its four corners detected using a new Gaussian training output matrix within one filtering process when scale variation occurs. Besides, Junying Liu *et al.* and Dajiang Yu *et al.* focused on fast multi-object tracking. Junying Liu *et al.* used a unified online multi-object tracking framework with hierarchical constraints for complex scenarios in intelligent vehicles application while Dajiang Yu *et al.* adaptively refined the detection results for tracking-by-detection framework. In addition, Weidong Min *et al.* combined robust detection and two classifiers to track multiple vehicles. Furthermore, point-to-set distance metric learning can be conducive to the visual tracking tasks according to Shengping Zhang *et al.*

The second topic of this special issue is detecting key object achieving vital information for a dynamic driving environment. Traffic light and text-based traffic signs are the most significant information in this topic. For traffic light detection, Xi Li *et al.* introduced a structure of fusion detectors to improving the accuracy. For text-based traffic signs, Yingying Zhu *et al.* performed a cascaded-segmentation-detection way to get the text information. Similarly, Chenggang Yan *et al.* designed a system for Uyghur language text detection.

The third topic of this special issue is understanding the scene for intelligent vehicles. The main components are road detection and scene analysis. Qi Wang *et al.* used a siamesed fully convolutional network (named as “s-FCN-loc”) which is able to consider RGB-channel images, semantic contours, and location priors simultaneously to segment road region elaborately. On the contrary, Jilin Mei *et al.* formulated road detection as a consecutive road type classification and road region segmentation to address the diversity of terrain surfaces. What’s more, since background plays an import role for video surveillance, Lu Yang *et al.* utilized a fully convolutional network to construct the deep background model. Besides, time efficiency is taken into consideration by Eduarto Romera Carmena *et al.*

The forth topic of this special issue is retrieving a target object from a complex environment. Mohsen Biglari *et al.* proposed a novel cascaded part-based system to overcome the occlusion and Chenggang Yan *et al.* obtained the high-quality binary codes for fast retrieval.

The fifth topic of this special issue is feature engineering. The normal vision information are images while Mauro Bellone *et al.* used point clouds from RGB-D cameras. Qingbo Wu *et al.* trained a generic proposal evaluator (GPE) to blind estimate the quality of each proposal without accessing its manual annotation,

Last but not least, an Advanced Driver Assistance System is proposed by Yi Gao *et al.* They proposed a more immersive 3-D surround view covering the automobile’s surround, helping the drivers to become aware of the driving environment and eliminate visual blind spots.

In summary, the development of robust and efficient vision techniques will lead to a more practical level of intelligent vehicles and a more in-depth cooperation of industry and academia. The Guest Editors would like to thank the reviewers.

The time and effort they have devoted to providing detailed comments, advice, and suggestions have significantly improved the technical and scientific level, as well as the presentation quality, of the accepted papers.

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He has authored about 60 papers in top journals and conferences, including IEEE T-ITS, IEEE T-NNLS, IEEE T-GRS, IEEE T-CYB, IEEE T-CSVT, PR, and CVIU. He received the IEEE Conference Best Paper Award and the Best Paper Candidate Award. He is a regular reviewer for over 40 distinguished journals and has served as a PC Member for over 100 international conferences and an Organizing Committee Member for two international conferences. He was/is an Associate Editor of several international journals, such as *Neurocomputing* (Elsevier), *IET Image Processing* (IET), IEEE GEOSCIENCE AND REMOTE SENSING LETTERS, and *Neural Processing Letters* (Springer). <http://crabwq.github.io/>.



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He is currently a Computer Vision Researcher with the Smart Vision Systems Group, Data61, CSIRO, Australia, where he is currently involved in large-scale dynamic scene understanding and deep learning. He was funded through research, teaching assistantships, and industrial projects. During his Ph.D. program, he visited the ISLA Group, University of Amsterdam from 2008 to 2009, and the Group Research Electronics, Volkswagen, in 2010. He received the best Ph.D. Thesis Award from the UAB in 2010. Subsequently, he was a Post-Doctoral Researcher with the Courant Institute of Mathematical Science, New York University. Since 2014, he has been serving as Associate Editor for IEEE TRANSACTIONS ON INTELLIGENT TRANSPORTATION SYSTEMS. <http://www.josemalvarez.net/>.