PREFACE

Special section on

Big Data and Artificial Intelligence for Cooperative Vehicle-Infrastructure Systems

Cooperative vehicle-infrastructure systems (CVISs) strive to incorporate advanced sensor, edge computing and communication technologies into vehicles and road infrastructures. Recently, technological innovations of intelligent transportation systems have been flourishing CVISs. The generated big data have been applied to almost all aspects of CVISs, which can provide new perspectives and insight for researchers. It is important and promising to explore the application of big data driven and AI based analysis in transportation systems analysis, modeling and understanding.

This special section presents five papers related to recent advances in the analysis, modeling, and application merits of AI transportation systems. The authors focus on new aspects, algorithms and concepts related to the application of cooperative vehicle-infrastructure systems. Their papers include novel techniques, algorithms, and theoretical results oriented towards the modeling and analysis of intelligent transportation systems, including intelligent control, vehicle-to-vehicle communication and system simulation.

The paper entitled *A coordinated optimization of rewarded users and employees in relocating station-based shared electric vehicles* designs a shared electric vehicle (SEV) relocating optimization model based on a reward mechanism to solve the mismatch between shared SEV supply and demand in space and time. The aim of the model is to achieve a cost-minimized rebalancing of the SEV system. Users are guided to attend the relocating SEV by a reward mechanism, and employees can continuously relocate multiple SEVs before returning to the supply site. The optimization model is solved by a Shuffled Complex Evolution (SCE–UA) based heuristic column generation algorithm. The presented technique is supported by experimental research based on the implementation of the system in a real-life environment.

The paper entitled *A container ship traffic model for simulation studies* develops a container ship traffic model for port simulation studies to collect accurate information about the ship stream to build test scenarios and benchmark instances. A statistical model of ship traffic is developed on the basis of container ship arrivals in eight world ports. The model provides three parameters of the arriving ships: ship size, arrival time and service time. The stream of ships is divided into classes according to vessel sizes. For each class, service time distributions and mixtures of return time distributions are provided. A model of aperiodic arrivals is also proposed. The achieved results are essential for terminal design analyses and testing performance of optimization algorithms.

The paper entitled *A hybrid control strategy for a dynamic scheduling problem in transit networks* discusses the dynamic scheduling problem in the transit network to guarantee service reliability of transit networks. A two-layer control method is developed to minimize the total travel time of passengers in the transit network. Based on conventional strategies, the hybrid control strategy considers making full use of idle standby buses at the depot. Deep reinforcement learning (DRL) is adopted to solve the problem of continuous decision-making. The numerical results imply that the hybrid control strategy could reduce the average headway of bus fleet and improve the reliability of bus service.

The paper entitled *Analytical performance analysis of the M2M wireless link with an antenna selection system over interference limited dissimilar composite fading environments* considers direct mobile-to-mobile (M2M) communications with a dual antenna selection (AS) system at a destination mobile node (DMN) in interference limited, dissimilar composite fading environments. The dissimilar interference limited signals are modeled at the inputs of a dual branch AS system as (i) the ratio of two Nakagami-m (N) random variables (RVs) at the first branch and (ii) the ratio of two Rice RVs at the second branch, in order to account for non line-of-sight (NLOS) and line-of-sight (LOS) communications. The derived statistical results are presented graphically and evaluated for all statistical measures considered.

The paper entitled *Vision-based positioning of electric buses for assisted docking to charging stations* presents a novel approach to vision-based localization for assisted electric buses docking to a charging station. The method employs a monocular camera system for positioning upon carefully selected point features detected on the charging station. While the pose is estimated using a geometric method, the detection of keypoints themselves and the initial recognition of the charging station are accomplished using learned neural network models. Extensive experiments are presented in the paper and the results show that the proposed method offers the best performance with respect to the estimated translation and rotation of the bus with a low-cost hardware setup and minimal passive markers on the charging station.

Concluding, we would like to thank all the authors who submitted their papers to our special section. We highly appreciate the contribution of the reviewers with their constructive comments and suggestions. We also wish to acknowledge the journal's Editor-in-Chief, Professor Józef Korbicz, for his acceptance of this special section, as well as his cooperation, support and assistance throughout the publication process.

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