Guest Editorial

Special Issue on Models and Technologies for Intelligent Transportation Systems

This Special Issue collects selected contributions presented at the 5th IEEE International Conference on Models and Technologies for Intelligent Transportation Systems (MT-ITS) held in Naples, Italy in 2017. MT-ITS 2017 brought together researchers and practitioners from across Europe and the rest of the world to discuss emerging trends and developments in modeling and technology for Intelligent Transportation Systems, to present state-of-the-art updates and to facilitate cross-fertilization between these two key areas of transportation systems. Consistently, papers published in the special issue encompass timely and emerging research topics in modeling, optimization and assessment of transportation systems, as well as relevant technological issues.

The paper, “The impact of electric mobility scenarios in large urban areas: The Rome case study,” illustrates the impact of electric mobility scenarios in large urban areas, with an application to the city of Rome (Italy). Specifically, a Well-To-Wheel (WTW) analysis is presented under two alternative hypotheses for the vehicles fleet renewal up to 2025. A data-driven approach is followed and specific energy consumption models for electric vehicles have been calibrated, based on real driving cycles. Finally, the economic benefit resulting from the reduction of externalities has been assessed.

The next paper, “PCNN: Deep convolutional networks for short-term traffic congestion prediction,” focuses on a novel method named PCNN, based on deep Convolutional Neural Network to model periodic traffic data for short-term traffic congestion prediction. Experimental results of the real-world urban traffic dataset are presented and confirm that folding time series data into a two-dimensional matrix is effective and PCNN outperforms the baselines significantly for the task of short-term congestion prediction.

The third work, “Analytical method for the precise and fast prediction of railway running times and its applications,” shows a new analytical method for the precise and fast prediction of railway running times. Real train and track data are used to achieve a realistic driving behavior. The new method is compared to real train trajectories. Based on the results, different possible applications for this new approach are given. This includes the calculation of minimum headway times and the calculation of the energy consumption of trains.

In the fourth contribution, “Railway system energy management optimization demonstrated at offline and online case studies;” a two level optimization algorithms, a centralized day-ahead and decentralized minute-ahead algorithm for energy management in an integrated mainline railway system is presented. All energy players like trains, infrastructure facilities, wayside storages and distributed energy resources are considered in the simulation. The algorithms are developed to demonstrate the REM-S (Railway Energy Management System) architecture. The work demonstrates the validity of the algorithms and analyses the simulation results in offline and online real case studies.

The fifth paper, “A novel resection-intersection algorithm with fast triangulation applied to monocular visual odometry,” proposes a technique for two-view camera pose estimation applied to vehicular localization. The algorithm uses coordinates of scene details detected in one image and tracked in another to calculate both the 3D position of points and the relative camera translation and rotation. The proposed method is based on the resection-intersection concept using Gauss-Newton non-linear regression to minimize projection residuals. Different from other solutions, the proposed method does not suppose fixed positions of points during resection. Achieved results presented a high accuracy when tested in the KITTI benchmark (Karlsruhe Institute of Technology and Toyota Technological Institute at Chicago), in a simple solution using only two consecutive frames for camera pose estimation.

In the sixth work, “Capability of current car-following models to reproduce vehicle free-flow acceleration dynamics,” a series of driving experiments in the Vehicle Emission Laboratories of the European Commission Joint Research Centre are presented to provide empirical evidence on the limitation of the existing vehicle acceleration models. In fact, existing car-following models do not correctly reproduce vehicle dynamics. It is important to understand these limitations especially in an era where it is crucial to understand the impact on traffic of all the advanced driving assistance systems that are progressively introduced in the pathway towards full vehicle automation.

The seventh paper, “A Kalman filter for quasi-dynamic o-d flow estimation/updating,” proposes an extended Kalman filter for quasi-dynamic estimation/updating of o-d flows from traffic counts. The quasi-dynamic assumption – that is considering constant o-d shares across a reference period, whilst total flows leaving each origin may vary for each sub-period within the reference period – has already been proven realistic and effective in offline o-d flows estimation using Generalized Least Squares estimators. The specification of the state variables and
of the corresponding transition and measurement equations of a quasi-dynamic extended Kalman filter are illustrated, and a closed-form linearization is presented under the assumption of uncongested network and error-free assignment matrix. Results show satisfactory performance and parsimonious computational burden on real-size networks.

The final contribution, “Optimal control for reducing congestion and improving safety in freeway systems,” provides the development of a global safety index that quantifies the expected number of crashes as a function of the current traffic state in the freeway system. On the basis of this new index and the performance indicator generally adopted to evaluate the traffic delay, a coordinated ramp metering scheme is proposed jointly considering the reduction of travel times for the drivers and the improvement of safety in the freeway system.

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Vincenzo Punzo was a Senior Researcher with the European Commission Joint Research Centre from 2011 to 2013. He is currently an Associate Professor with the University of Naples Federico II. He has joined several research projects on these topics, among which he has chaired the EU COST Action TU0903—MULTITUDE. In 2016, he co-founded Inputspace, a spin-off at University of Naples Federico II, which delivers smart mobility solutions. His research interests include road traffic flow modeling under uncertainty, railway simulation and optimization, driving simulation, intelligent transportation systems, and shared mobility. He was a recipient of the 2012 TRB’s Greenshields Prize, among others. He is an Associate Editor for the IEEE TRANSACTIONS ON INTELLIGENT TRANSPORTATION SYSTEMS, a member of the Editorial Board of the Transportation Research Part C, and a member of the U.S. TRB’s Traffic Flow Theory and Characteristics Committee.

Vittorio Marzano received the Ph.D. degree in transport engineering from the University of Naples in 2006. He is currently an Assistant Professor with the University of Naples Federico II, Italy. He has collaborated with many universities and research centers worldwide, including the Institute for Transport Studies, University of Leeds, U.K., the ITS Laboratory, Massachusetts Institute of Technology, USA, and the Singapore University of Technology and Design, Singapore. He has participated in over 20 national/international research projects. He is also a consultant engineer in various transport projects in Italy and abroad. His research interests cover various areas of transport engineering: freight modeling and policy making, discrete choice modeling, o-d flow estimation/updating, network sensors location, and city logistics.

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