Introduction to the Special Issue on the 16th IEEE International Conference on Intelligent Transportation Systems (ITSC'13)

THIS special issue contains a selection of papers originally presented at the 16th IEEE International Conference on Intelligent Transportation Systems (ITSC'13), which was held in The Hague, The Netherlands, on October 6–9, 2013. ITSC'13 aimed to continue the tradition of the ITSC conference series of presenting the most recent advances and state of the art in research related to intelligent transport systems (ITSs), ITS applications, and the interface between ITS technology and society. Coverage of ITSC'13 included key areas such as modeling and analysis, control and decision systems, information services, imaging, navigation and guidance, sensors and communication, driver assistance systems, and infrastructure development. ITSC'13 was very successful: it attracted about 550 participants and 635 papers from 52 countries, and the proceedings contain 392 papers.

For selecting papers for this special issue, we started with the reviewer evaluations and final scores obtained by the papers presented at the conference. Almost all of the selected papers had received a final score of B+ or more, or a final score of B with subscores of at least one B+ and no subscores lower than B.

We have also strived to cover a broad range of different topics to get good coverage of the main fields present at ITSC'13. We have invited 15 author teams to submit a revised and extended version of their conference paper to this special section of the IEEE TRANSACTIONS ON INTELLIGENT TRANSPORTATION SYSTEMS. The 15 papers received were subjected to the regular review process of this journal. Subsequently, nine papers were accepted after a minor or major revision and are now included in this special issue.

The following papers are included in this special issue.

A Distributed Framework for Coordinated Heavy-Duty Vehicle Platooning by J. Larson, K.-Y. Liang, and K. H. Johansson

Platooning heavy-duty vehicles saves fuel because trailing vehicles experience less aerodynamic drag. This paper presents an approach to maximize these fuel savings by using virtual controllers to coordinate the simultaneous arrival of vehicles at major intersections. A large-scale simulation of the German Autobahn network shows that the proposed approach can save 5% of the total fuel used, even when only a few thousand vehicles have platooning capabilities. The results are supported by real-world data.

Deduction of Passengers' Route Choices From Smart Card Data by E. van der Hurk, L. Kroon, G. Maróti, and P. Vervest

A method is proposed for deducing the chosen route of passengers in public transport systems with free route choice based on smart card data. A route represents the path in space and time of passengers. The method is validated on a real-life data set of railways in The Netherlands, including in-train ticket controls for a significant subset of journeys. The method is accurate for about 95% of the journeys in the validation sample, which includes days with disruptions.

Efficient Road Scene Understanding for Intelligent Vehicles Using Compositional Hierarchical Models by D. Töpfer, J. Spehr, J. Effertz, and C. Stiller

A new compositional approach for real-time multilane road detection is presented. Based on simple visual cues, it allows to reliably infer complex road topologies, including splitting and merging lanes. Thereby, the road model is generic and compositional in the sense that it does not impose any hard constraints on the lane geometry. Instead, prior expectations on the lane geometry are expressed through weak probabilistic constraints, and lanes are assembled from a large number of basic parts.

A Macroscopic Traffic Data-Assimilation Framework Based on the Fourier–Galerkin Method and Minimax Estimation by T. T. Tchrakian and S. Zhuk

A new framework for macroscopic traffic state estimation is proposed, which is based on the Fourier–Galerkin projection method and minimax state estimation. The method delivers continuous-in-space estimates of the traffic density and allows density measurements to be taken at any point on the roadway. The numerical results demonstrate the shock-capturing capability of the estimator only using the sparse measurements of the density and the high uncertainty in the initial traffic condition.

Online Data-Driven Adaptive Prediction of Train Event Times by P. Kecman and R. M. P. Goverde

A tool for the prediction of train event times is presented. The running and dwell times are dynamically obtained using historical track occupation data. An efficient algorithm quickly

Digital Object Identifier 10.1109/TITS.2015.2393172

computes the predictions of event times, even for large networks. The accuracy is increased online by incorporating the effects of predicted route conflicts on train running times. Moreover, the process time estimates are adapted in real time based on the observed values. A case study shows the high accuracy of predictions.

Powered Two-Wheelers Riding Patterns Recognition Using a Machine Learning Framework by F. Attal, A. Boubezoul, L. Oukhellou, and S. Espié

A machine learning framework is used for riding pattern recognition. The problem is formulated as a classification task to identify the class of riding patterns using the data collected from 3-D accelerometer/gyroscope sensors mounted on motorcycles. Several well-known machine learning techniques are investigated, including Gaussian mixture models, the k-nearest neighbor model, support vector machines, random forests, and hidden Markov models, for both discrete and continuous cases. Additionally, an approach for sensor selection is proposed to identify the significant measurements for improved riding pattern recognition. This paper shows the effectiveness of the proposed methodology and the effectiveness of the hidden Markov model approach in riding pattern recognition.

Graceful Degradation of Cooperative Adaptive Cruise Control by J. Ploeg, E. Semsar-Kazerooni, G. Lijster, N. van de Wouw, and H. Nijmeijer

Cooperative adaptive cruise control (CACC) is vulnerable to communication impairments such as latency and packet loss. In the latter case, it would effectively degrade to conventional adaptive cruise control, thereby increasing the minimal intervehicle distance needed for string-stable behavior. To partially maintain the favorable string stability properties of CACC, a control strategy for the graceful degradation of one-vehicle look-ahead CACC is proposed. The effectiveness of this strategy is shown through simulations and practical experiments.

Stereovision-Based Multiple Object Tracking in Traffic Scenarios Using Free-Form Obstacle Delimiters and Particle Filters by A. Vatavu, R. Danescu, and S. Nedevschi

This paper presents a stereovision-based approach for tracking multiple objects in crowded environments. The proposed technique relies on the measurement data provided by an intermediate occupancy grid, which was derived from processing a stereovision-based elevation map, and on free-form object delimiters extracted from this grid. Unlike other existing methods that track rigid objects also using rigid representations, the proposed particle-filter-based solution is able to track, at the same time, both the object's dynamic parameters and geometry.

Microsimulation Analysis of Practical Aspects of Traffic Control With Variable Speed Limits by E. R. Müller, R. C. Carlson, W. Kraus, and M. Papageorgiou

Local feedback mainstream traffic flow control is applied in microscopic simulation for an on-ramp merge bottleneck, revealing control aspects not previously captured in macroscopic simulation. Findings indicate that the application of variable speed limits at specific points instead of along an entire freeway section produces a slower traffic response; moreover, the capacity flow/speed limit relation observed is considerably nonlinear. A control law that takes into account the system's nonlinearity achieves significant improvements in traffic conditions.

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