Scanning the Issue

Estimated Time of Arrival Using Historical Vessel Tracking Data

A. Alessandrini, F. Mazzarella, and M. Vespe

This paper presents a novel methodology to estimate the vessel times of arrival in port areas. The presented approach is based on a data-driven path-finding algorithm that exploits historical ship reporting systems data. In particular, both historical Automatic Identification System and Long Range Identification and Tracking maritime traffic data over a desired area of interest have been used. The methodology has been applied to a real scenario with real data sets and has been compared with other two strategies: the first one is based on the well-known Haversine formula to approximate the great circle distance between two geographical positions; the other one connects the source to the destination by avoiding the land. The experimental results show that making use of the data-driven algorithm allows the system to achieve higher accuracy in terms of time of arrival estimation error.

Efficient Freeway MPC by Parameterization of ALINEA and a Speed-Limited Area

G. S. van de Weg, A. Hegyi, S. P. Hoogendoorn, and B. De Schutter

Freeway congestion can reduce the freeway throughput due to the capacity drop or due to blocking caused by spillback to upstream ramps. Research has shown that congestion can be reduced by the application of ramp metering and variable speed limits. However, it is difficult to determine the ramp metering rates and variable speed limit settings over time, which optimizes the throughput by reducing congestion. This paper proposes an approach to optimize the control signals in a time efficient way. As a side effect of the optimization approach, the optimized control signal is more efficient than standard model predictive control optimization approaches. It is shown using a simulation study that parameterization realizes improved throughput when compared with a non-parameterized strategy when using the same amount of computation time.

Eco-Approach and Departure (EAD) Application for Actuated Signals in Real-World Traffic

P. Hao, G. Wu, K. Boriboonsomsin, and M. J. Barth

The connected vehicle eco-approach and departure (EAD) application for signalized intersections has been widely studied and is deemed to be effective in terms of reducing energy consumption and both greenhouse gas and other criteria pollutant emissions. Prior studies have shown that tangible environmental benefits can be gained by communicating the signal phase and timing information of the upcoming traffic signals with fixed time control to the driver. However, similar applications to actuated signals pose a significant challenge due to their randomness to some extent caused by vehicle actuation. Based on the framework previously developed by the authors, a real-world testing has been conducted along the El Camino Real corridor in Palo Alto, CA, USA, to evaluate the system performance in terms of energy savings and emissions reduction. Strategies and algorithms are designed to be adaptive to the dynamic uncertainty for actuated signal and real-world traffic. It turns out that the proposed EAD system can save 6% energy for the trip segments when activated within dedicated short-range communication ranges and 2% energy for all trips. The proposed system can also reduce 7% of CO, 18% of HC, and 13% of NOx for all trips. Those results are compatible with the simulation results and validate the previously developed EAD framework.

Modeling of Driver Behavior on Trajectory–Speed Decision Making in Minor Traffic Roadways With Complex Features

J. Xu, H.-B. Shu, and Y.-M. Shao

A path planning strategy named as "selecting trajectory point on a preview cross section", as well as, a speed planning strategy based on the curvature of the target path, is proposed. Following the strategies, objective functions are established to describe the behavior of "path–speed" selection for drivers with different driving styles. Constraints are designed on a compromise of roadway geometry, pavement condition, car performance, and ride comfort. And a rolling-horizon algorithm for "path–speed" simultaneously solving is also developed. Using the proposed models, target path-speed for a driving style of a passenger car driver can be planned for minor traffic roadways with complex geometric features, such as circuits and mountain roads.

Real-Time Traffic Flow Parameter Estimation From UAV Video Based on Ensemble Classifier and Optical Flow

R. Ke, Z. Li, J. Tang, Z. Pan, and Y. Wang

Recently, the availability of unmanned aerial vehicle (UAV) opens up new opportunities for smart transportation applications, such as automatic traffic data collection. In such a trend, detecting vehicles and extracting traffic parameters from UAV video in a fast and accurate manner is becoming crucial in many prospective applications. However, from the methodological perspective, several limitations have to be addressed before the actual implementation of UAV. This paper proposes a new and complete analysis framework for traffic flow parameter estimation from UAV video. This framework

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addresses the well-concerned issues on UAV's irregular ego-motion, low estimation accuracy in a dense traffic situation, and high computational complexity by designing and integrating four stages. In the first two stages, an ensemble classifier (Haar cascade + convolutional neural network) is developed for vehicle detection, and in the last two stages, a robust traffic flow parameter estimation method is developed based on optical flow and traffic flow theory. The proposed ensemble classifier is demonstrated to outperform the state-of-the-art vehicle detectors that are designed for UAV-based vehicle detection. Traffic flow parameter estimations in both free flow and congested traffic conditions are evaluated, and the results turn out to be very encouraging. The data set with 20 000 image samples used in this paper is publicly accessible for benchmarking at http://www.uwstarlab.org/research.html.

Learning Driver Braking Behavior Using Smartphones, Neural Networks and the Sliding Correlation Coefficient: Road Anomaly Case Study

S.-R. G. Christopoulos, S. Kanarachos, and A. Chroneos

A novel Deep Neural Network model is proposed for the spatiotemporal correlation between longitudinal driving behavior and discrete road anomalies. The model is built using smartphone-based vehicle motion measurements only and is easily calibrated without the requirement of any vehicle model knowledge. Controlled and naturalistic driving studies—conducted at a broad vehicle speed range, with different drivers and including various road anomaly types—validate the good performance of the method and prove its robustness as a tool for self-learning driver behavior.

Missing Data Estimation for Traffic Volume by Searching an Optimum Closed Cut in Urban Networks

S. Wang and G. Mao

A novel optimum closed cut (OCC)-based spatio-temporal imputation technique is presented to deal with the missing traffic data problem. The main advantage of the proposed technique is the ability to fully exploit the spatial-temporal correlation and road topological information in the urban traffic network. The technique is implemented in two stages: 1) employing graph theory to search the OCC in the road networks and 2) estimating the missing data on the target road using OCC-based Kriging estimator. The technique incorporates both the road topological information and flow conservation law to improve estimation accuracy. Experimental results using traffic data collected on real roads indicate that the proposed technique can effectively capture the optimum set of neighboring sensors and thus can provide more accurate imputation results.

Effect of Link-Level Variations of Connected Vehicles (CV) Proportions on the Accuracy and Reliability of Travel Time Estimation

M. S. Iqbal, M. Hadi, and Y. Xiao

This paper focuses on the assessment of the quality of the travel time estimation utilizing connected vehicles (CV) data compared with existing technology. It proposes a methodology to estimate the CV proportion on specific network links in a region considering the variations in the socioeconomic characteristics between the zones within the region and a method to assess the impact of CV proportions on the quality of travel time estimation. The result of this paper shows that the CV proportion will be sufficient for use in planning and real-time operations of the investigated high demand freeway segment in the first year after the expected mandate for installing CV technology on all new vehicles will become effective. However, for the investigated high demand and high intersection density urban street, it will take one to three years for the data quality to be sufficient for use for planning purposes and three to six years for use for operation purposes.

BoxCars: Improving Fine-Grained Recognition of Vehicles Using 3-D Bounding Boxes in Traffic Surveillance

J. Sochor, J. Špaňhel, and A. Herout

In this paper, the authors address the problem of vehicle fine-grained classification from images taken by surveillance cameras from an arbitrary viewpoint. The proposed approach is based on 3-D bounding boxes constructed around the vehicles automatically. The 3-D bounding box is used to normalize the image viewpoint by "unpacking" the image into a plane. They also propose to randomly alter the color of the image and add a rectangle with random noise to a random position in the image during the training of convolutional neural networks (CNNs). The experimental results on collected BoxCars116k data set show that the method significantly improves classification accuracy (the accuracy is increased by up to 12% and the error is reduced by up to 50% compared with CNNs without the proposed modifications).

Variable Signal Progression Bands for Transit Vehicles Under Dwell Time Uncertainty and Traffic Queues

H. Kim, Y. Cheng, and G.-L. Chang

Transit signal priority controls, one of the viable strategies to improve bus operation, may not be effective for arterials serving heavy bus flows due to frequent priority calls, which disrupt the arterial signal plan and incur excessive delays to general traffic. This paper proposed a bus-based signal progression model for arterials with heavy bus flows. It accounts for average bus dwell time, its variance, and the bus stop capacity. Traffic arrival patterns from an upstream intersection and its impacts on the available bus progression band have also been discussed. Results of extensive simulation experiments have confirmed the effectiveness of the proposed model under various traffic congestion levels and different bus dwell time variances.

Minimizing the Total Liner Shipping Route Service Costs via Application of an Efficient Collaborative Agreement

M. A. Dulebenets

A new type of collaborative agreement between liner shipping companies and marine container terminal operators is proposed, where multiple vessel arrival time windows, start and end times for each time window, and multiple handling rates during each time window are offered by the marine container terminal operator to the liner shipping company

at each port of the given liner shipping route. The vessel scheduling problem is formulated as a mixed integer nonlinear programing model, minimizing the total liner shipping route service cost. A set of linearization techniques are applied to the original model, and the linearized model is solved using CPLEX. The numerical experiments demonstrate that the proposed collaborative agreement outperforms the existing collaborative agreements, where either vessel arrival time windows or handling rates are offered to the liner shipping company at ports, in terms of the total route service cost on average by 10.9% and 6.6%, respectively.

Importance-Aware Semantic Segmentation for Autonomous Vehicles

B. Chen, C. Gong, and J. Yang

In this paper, the authors argue that the existing semantic segmentation methods cannot be reliably applied to the autonomous driving system as they ignore the different importance levels of distinct classes for safe-driving. For example, pedestrian, car, and bicyclist in the scene are much more important than sky and building when driving a car, so their segmentations should be as accurate as possible. To incorporate the importance information possessed by various object classes, this paper designs an "importance-aware loss" (IAL) that specifically emphasizes the critical objects for autonomous driving. The IAL operates under a hierarchical structure, and the classes with different importance are located in different levels so that they are assigned distinct weights. The experiments reveal that by employing the proposed loss function, the existing deep learning models are able to consistently obtain improved segmentation results on the pre-defined important classes for safe driving.

Multi-Vehicle Tracking Using Microscopic Traffic Models

D. Song, R. Tharmarasa, G. Zhou, M. C. Florea, N. Duclos-Hindie, and T. Kirubarajan

In this paper, the multi-vehicle tracking problem is revisited, with greater consideration being given to the interactions between vehicles. A novel multi-vehicle tracking algorithm that integrates the microscopic traffic models (MTM) for modeling interaction behaviors among vehicles in a 2-D road coordinate system is proposed. Due to the dependence between the longitudinal and lateral motions, their corresponding estimates are updated sequentially in a recursive manner. An adaptive deferred decision logic is proposed to improve the accuracy of lateral state estimates and thus improve overall performance. The simulation results show that the proposed MTM-based tracking algorithm can achieve better performance than a conventional multi-lane multi-vehicle tracking algorithm, which does not consider interactions among vehicles.

Measurement-Based Burst-Error Performance Modeling for Cooperative Intelligent Transport Systems

T. Blazek and C. F. Mecklenbräuker

In this paper, the authors introduce a packet error model that considers burst lengths through second-order statistics as well as mean packet errors. The model is based on the Gilbert–Elliot model and is modified to account for nonstationarities. Based on this, they formulate maximum likelihood expressions for the time-variant model fits and then proceed to fit the parameters to extensive recorded measurements. They consider the fading statistics of the measured channel as well as the signal-to-noise ratio and present how they influence the channel burstiness. Their analysis demonstrates that the communication shows strong bursts at the packet level, which is crucial knowledge for safety-critical applications. The approach they demonstrate here remains of low computational complexity, allowing future deployment in large-scale simulations.

Flexible Energy Management Protocol for Cooperative EV-to-EV Charging

R. Zhang, X. Cheng, and L. Yang

The concept of cooperative EV-to-EV (V2V) charging is introduced in this paper. Based on cooperative V2V charging, a flexible energy management protocol with different V2V matching algorithms is proposed, which can help the EVs achieve more flexible and smarter charging/discharging behaviors. For effective and efficient V2V matching, a max-weight V2V matching algorithm is proposed to optimize the network social welfare. Moreover, taking individual rationality into consideration, two stable V2V matching algorithms are further proposed, leading to the EV-consumer-optimal and EV-provider-optimal stable V2V matchings, respectively. The simulation results verify the efficiency of the proposed cooperative V2V charging based energy management protocol in improving the EV utilities and the network social welfare as well as reducing the energy consumption of the EVs.

Set-Membership Position Estimation With GNSS Pseudorange Error Mitigation Using Lane-Boundary Measurements

L. C. Bento, P. Bonnifait, and U. J. Nunes

An error bounded set membership algorithm that computes the absolute position of a road vehicle by using raw global navigation satellite systems (GNNSs) pseudoranges, lane boundary measurements, and a 2-D road network map as geometric constraints is presented in this paper. The algorithm is based on set inversion using interval analysis and bounds are set on the measurements by taking into account a chosen risk. The GNSS pseudoranges errors are modeled carefully, and road constraints are formalized to provide additional information on the data fusion process. The proposed algorithm, named lane boundary augmented set-membership GNSS positioning (LB-ASGP), provides a novel and inexpensive approach to improve position estimation performance for road vehicles guaranteeing the enclosure of the computed solution with high confidence. The results from simulations and field experiments show that LB-ASGP significantly reduces GNSS errors in the direction perpendicular to the lane, thanks to the lane boundary measurements.

An Improved Augmented ε-Constraint and Branch-and-Cut Method to Solve the TSP With Profits

S. Ait Bouziaren and B. Aghezzaf

A novel method, AUGMECON2-BC, is developed to solve the traveling salesman problem with profits (TSPP). This method incorporates an improved version of the augmented ε-constraint and a Branch-and-Cut algorithm. It transforms a multi-objective problem into a mono-objective problem by optimizing one of the objective functions and converting the others into constraints. The efficiency of the proposed method is demonstrated based on experimental results. The simulation results show that the AUGMECON2-BC is capable of generating the exact Pareto front of the TSPP. Moreover, the AUGMECON2-BC method proved its performance in terms of CPU time compared with the previous works.

Composite $\alpha-\mu$ Based DSRC Channel Model Using Large Data Set of RSSI Measurements

H. N. Mahjoub, A. Tahmasbi-Sarvestani, S. M. Osman Gani, and Y. P. Fallah

Communication channel modeling problem in vehicular ad hoc networks (VANETs) under dedicated short-range communication standard has been targeted in this paper. More specifically, using a large data set of received signal strength indicator values measured in a measurement campaign conducted by the crash avoidance metrics partnership vehicle safety communications 3 consortium, in partnership with the United States Department of Transportation, two-ray path-loss and α-μ fading models are proposed for large- and small-scale physical layer channel models, respectively. Notable better performance of the proposed model in comparison with the current VANET state-of-the-art, i.e., Nakagami-m, is clearly demonstrated via appropriate distribution goodness-of-fit tests. Moreover, a novel approach is proposed in this paper to remove the biasing effect of the fading expected value on the path-loss parameters calculation. Finally, the model evaluation is taken one step further by testing its results under the presence of upper layer protocols in network simulator-3 (ns-3), which is a realistic simulation environment for network analysis.

Temporal Information Services in Large-Scale Vehicular Networks Through Evolutionary Multi-Objective Optimization

P. Dai, K. Liu, L. Feng, H. Zhang, V. C. S. Lee, S. H. Son, and X. Wu

Temporal information services are studied in large-scale vehicular networks. A problem called temporal data upload and dissemination (TDUD) is formulated to optimize two conflict objectives simultaneously, i.e., enhancing the data quality and improving the delivery ratio. An evolutionary multi-objective algorithm called MO-TDUD is proposed, which consists of a decomposition scheme for handling multiple objectives, a scalable chromosome representation for solution encoding, and an evolutionary operator for solution reproduction. A comprehensive performance evaluation demonstrates that the proposed MO-TDUD can be adaptive to dynamic requirements on data quality and the delivery ratio by selecting the most suitable solution from the derived Pareto solutions.

Traffic Volume Prediction With Segment-Based Regression Kriging and its Implementation in Assessing the Impact of Heavy Vehicles

Y. Song, X. Wang, G. Wright, D. Thatcher, P. Wu, and P. Felix

A segment-based regression kriging (SRK) method is proposed for traffic volume prediction with differentiation between heavy and light vehicles. Due to the consideration of spatial heterogeneity of segment-based observations, the SRK model can more accurately predict heavy vehicle volumes compared with traditional point-based interpolation methods. Cross validations are used to assess the prediction accuracy and uncertainty among both point-based and segment-based models. The implementation of the SRK model on assessing the impacts of heavy vehicles shows that the total impacts of heavy vehicles account for more than 82% of the road maintenance burden even though its volume only accounts for 21% of traffic.

Smartphone Transportation Mode Recognition Using a Hierarchical Machine Learning Classifier and Pooled Features From Time and Frequency Domains

H. I. Ashqar, M. H. Almannaa, M. Elhenawy, H. A. Rakha, and L. House

This paper develops a novel two-layer hierarchical classifier that increases the accuracy of traditional transportation mode classification algorithms. The authors' proposed two-layer framework differs from previous classification attempts in three distinct ways: 1) the outputs of the two layers are combined using Bayes' rule to choose the transportation mode with the largest posterior probability; 2) the proposed framework combines the newly extracted features with traditionally used time domain features to create a pool of features; and 3) a different subset of extracted features are used in each layer based on the classified modes. Several machine learning techniques were used, including a k-nearest neighbor, classification and regression tree, support vector machine, random forest, and a heterogeneous framework of random forest and support vector machine. The proposed two-layer classifier obtained a maximum classification accuracy of 97%.

Combining the Matter-Element Model With the Associated Function of Performance Indices for Automatic Train Operation Algorithm

J. Meng, R. Xu, D. Li, and X. Chen

In this paper, the multi-objective optimization feature information is transformed into the association function first, and then the matter-element theory is introduced to establish models for the speed trajectory to achieve the multi-objective optimization to fuse knowledge-based safety requirement constrained condition. Performance indices weighting of different performance in different stages are determined with the Hierarchical Mahalanobis distance method, and the decision speeds are calculated with goodness evaluation method.

The simulation results show that the model has the advantage that it conveniently quantifies the qualitative indices, and it can integrate the data source information to improve the multi-objective performance indices so that it is very useful to apply multi-source data and prior knowledge to multi-objective optimization of the automatic train operation control system.

A Rear-End Collision Risk Evaluation and Control Scheme Using a Bayesian Network Model

C. Chen, X. Liu, H.-H. Chen, M. Li, and L. Zhao

A Bayesian network approach to evaluate collision risk during car-following is proposed, in which the impact of major collision-causing factors on the occurrence probability of possible accidents is modeled. The proper structure of the proposed Bayesian network model is learnt using the K2 algorithm with practical collected traffic data set. To provide an adequate response time for drivers, the collision probability in the next monitoring interval is predicted using a Kalman filter model. A simple active safety control strategy is also discussed in view of the estimated collision risk by the Bayesian network model. The numerical results verified the feasibility and efficiency of the proposed Bayesian network model on rear-end collision risk evaluation in the car-following scenario.

Online Algorithm for Opportunistic Handling of Received Packets in Vehicular Networks

A. Al-Fuqaha, A. Gharaibeh, I. Mohammed, S. J. Hussini, A. Khreishah, and I. Khalil

In vehicular ad-hoc networks, vehicles usually communicate for short periods of time with several vehicles and are required to process data fast. This urgency of data processing is further heightened in safety-critical scenarios. In this paper, the authors formulate the prioritized data processing problem as an integer linear program given a prior knowledge of the request sequence and prove that it is NP-complete. They also propose an online algorithm that does not require the prior knowledge of the request sequence and achieves an $\mathcal{O}(1)$ competitive ratio. The proposed online algorithm strives to accept higher severity packets for processing in order to maximize the cumulative severity given vehicular communications/computation capacity constraints. Using real traffic traces, they evaluate the performance of the online algorithm against three online algorithms. Their evaluation shows that their algorithm achieves up to 492% more cumulative severity compared with the three other baseline algorithms.

A Decision Support System for Proactive-Robust Traffic Network Management

K. Abdelghany, H. Hashemi, and M. E. Khodayar

Real-time traffic network management systems provide network operators with decision support capabilities to alleviate recurrent and non-recurrent congestion. However, traffic networks are subject to numerous sources of stochasticity that make it difficult to accurately predict their operational conditions and generate effective traffic management schemes to cope with these conditions. This paper presents a decision support system for proactive-robust traffic network management, which accounts for uncertainty in the network operational conditions. The objective is to develop robust traffic management schemes such that the network overall performance remains close to optimality under all possible future operational conditions. The modeling framework of the system is presented, which adopts a rolling horizon framework that integrates a meta-heuristic search algorithm and a dynamic traffic assignment simulation-based methodology. The system performance is examined through application to the traffic network of the US-75 corridor in Dallas, TX, USA.

A Partition-Enabled Multi-Mode Band Approach to Arterial Traffic Signal Optimization

W. Ma, L. Zou, K. An, N. H. Gartner, and M. Wang

Partition-enabled multi-mode band (PM-BAND) model is designed to solve the signal coordination problem for arterials with multiple modes, i.e., passenger cars and transit vehicles. The proposed method permits the progression bands to be broken if necessary and optimizes system partition and signal coordination in one unified framework. The impacts of traffic demand for passenger cars and transit vehicles, as well as the geometry characteristics of the arterials, are taken into account. Signal timings and waiting time of transit vehicles at stations are optimized simultaneously with the support of connected vehicles technologies. The numerical example results have demonstrated that the PM-BAND model can significantly reduce an average number of stops and delay.

GIS-Based Simulation Methodology for Evaluating Ship Encounters Probability to Improve Maritime Traffic Safety

M. Zhao, X. Yao, J. Sun, S. Zhang, and J. Bai

An agent-based simulation methodology framework for evaluating the probability of ships' encounter situations is developed. Individual ship's navigation behavior has been modeled as agents, and their interactions (ship-ship encounter situations) have been detected by a geographic information system (GIS)-based intelligent algorithm designed. A case study of the mid-western waters of the Bohai Sea in north China is conducted to demonstrate its utility. The findings show that the proposed methodology framework has potentials to provide decision support for guiding future marine transportation planning as well as improving maritime traffic safety. This paper offers new insights and valuable demonstration on promoting maritime traffic safety management with the integration of GIS and emerging complex system simulation technology.

Online Map Matching With Route Prediction

S. Taguchi, S. Koide, and T. Yoshimura

Recent major map matching approach is the hidden Markov model (HMM)-based method. However, HMM-based approaches suffer from latency because they rely on the availability of future global positioning system (GPS) points. This latency limits the ability of real-time traffic sensing and location services. This paper presents a novel online map matching algorithm that uses a probabilistic route prediction model instead of future GPS points. The probabilistic route prediction model can be trained by using historical trajectory

data. The authors' experimental results show that the accuracy of the untrained proposed model is competitive with a naïve online HMM-based method without any latency. Moreover, the results show that the trained model obtains even higher accuracy. The experimental results also show that the proposed method is faster than the online HMM.

Adaptive Collision Avoidance Using Road Friction Information

Y. Hwang and S. B. Choi

This paper investigates the use of warning braking to gain an awareness of the level of road friction, which is one of the major environmental uncertainties faced on the road. This approach will improve the efficacy of an autonomous emergency braking system because the success of it can be defined technically as whether the system operates at an appropriate time. Any system which is unaware of its environment is prone to be excessively conservative, which could adversely affect the efficacy of the system. Furthermore, a quantized slip-slope method combined with a curve-matching algorithm is introduced for friction estimation, which is robust and suitable for collision avoidance applications.

An Integrated Multi-Criteria Decision Making Approach to Location Planning of Electric Vehicle Charging Stations

H.-C. Liu, M. Yang, M. Zhou, and G. Tian

This paper proposes an integrated multi-criteria decision-making approach to optimally locate public charging stations for electric vehicles (EVs). Uncertain linguistic variables are used to manage the decision makers' uncertain and diverse linguistic assessments. A grey DEMATEL method is used to determine the weights of the evaluation criteria considering their causal relationships. An extended MULTIMOORA model is established to determine the ranking of candidate sites and identify the best one for locating EV charging facilities. Finally, an empirical example is presented to demonstrate the applicability and effectiveness of the proposed approach. The results show that the proposed integrated approach provides a useful and practical tool to address the site location problems of EV charging stations with inter-dependent criteria.

Ferrite Position Identification System Operating With Wireless Power Transfer for Intelligent Train Position Detection

K. Hwang, J. Cho, J. Park, D. Har, and S. Ahn

Wireless power transfer (WPT) is being developed to supply electric power to electric trains, using a source coil in/on the railway track and a pick-up coil on the train. A number of benefits can be obtained by eliminating the catenary and pantograph currently used for railway electric power supply. However, the WPT employs coils, and the electromagnetic field generated by the WPT can interfere with conventional train detection methods, such as track circuits and RFID, installed on the tracks. Train position information is critical for railway operation, especially for high-speed trains. This paper proposes a novel system which provides train position information using a source coil segment. It consists of onboard sensor coils, ferrite blocks designed using specific position information, and a detector. The proposed system can be implemented using the source coil and load coil of the WPT. Information about the train's relative position is obtained by the detection of ferrite blocks distributed within the source coil segment. The train position information provided by the ferrite components is detected by onboard sensor coils and a detector. The proposed ferrite position identification (FPID) system provides accurate train position information and is not affected by WPT electromagnetic interference. The operating principles of the FPID system are presented in detail. The performance of the proposed FPID system was measured by simulations and experiments.

Big Data Analytics in Intelligent Transportation Systems: A Survey

L. Zhu, F. R. Yu, Y. Wang, B. Ning, and T. Tang

This paper first reviews the history and characteristics of Big Data and intelligent transportation systems (ITS). The framework of conducting Big Data analytics in ITS is discussed next, where the data source and collection methods, data analytics methods and platforms, and Big Data analytics application categories are summarized. Several case studies of Big Data analytics applications in intelligent transportation systems are presented. Finally, this paper discusses some open challenges of using Big Data analytics in ITS.

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