Scanning the Issue

A Review of Fault Detection and Diagnosis for the Traction System in High-Speed Trains

H. Chen and B. Jiang

The primary contribution of this article is to present a comprehensive review on fault detection and diagnosis (FDD) techniques for high-speed trains. The second one is, motivated by the pros and cons of the FDD methods for high-speed trains, to provide researchers and practitioners with informative guidance. Then, the application of FDD for high-speed trains is presented using data-driven methods which have been receiving increasing attention in the transportation fields over the past ten years. Finally, challenges and promising issues are speculated for future investigation.

Bioinspired Computational Intelligence and Transportation Systems: A Long Road Ahead

J. Del Ser, E. Osaba, J. J. Sanchez-Medina, I. Fister, Jr., and I. Fister

This article capitalizes on the increasingly high relevance gained by data-intensive technologies in the development of Intelligent Transportation Systems, which calls for the progressive adoption of adaptive, self-learning methods for solving modeling, simulation, and optimization problems. In this regard, certain mechanisms and processes observed in nature have proved themselves to excel not only in terms of efficiently capturing time-evolving stimuli, but also in undertaking complex tasks by virtue of mechanisms that can be extrapolated to computer methodologies. This article reviews the state-of-the-art in the application of bioinspired methods to the challenges arising in the field of Intelligent Transportation Systems. This systematic survey is complemented by a taxonomic introduction to bioinspired computational intelligence, along with the basics of its constituent techniques. A focus is placed on which research niches are still unexplored. Open issues and research directions are also discussed in detail.

Smart Parking: Using a Crowd of Taxis to Sense On-Street Parking Space Availability

F. Bock, S. Di Martino, and A. Origlia

To monitor the occupancy of on-street parking spaces, past research demonstrated the viability of crowd-sensing by means of probe vehicles, foreseeing the use of high-mileage vehicles, like taxis. In this article, the authors use real-world data to investigate the suitability of taxi fleets of different sizes to crowd-sense on-street parking availability. They consider 579 road segments in San Francisco (USA), covered both by stationary stall sensors and by GPS traces of 536 taxis. By combining taxi transit frequencies with parking occupancy data, they estimate the potential quality of crowd-sensed parking information for different fleet sizes and misdetection amounts. Results show that 300 taxis on normal duty can monitor on-street parking availability with an error up to ± 1 stall in 86% of the cases, with respect to stationary sensors. Also, the quality of the vehicle sensors is as important as the fleet size.

Harnessing Vehicular Broadcast Communications: DSRC-Actuated Traffic Control

O. K. Tonguz and R. Zhang

Traffic congestion in major cities around the globe is a daunting problem that is getting worse as the speed of urbanization keeps increasing. The role of traffic lights at intersections in regulating flows cannot be underestimated. Even though there are a variety of actuated traffic signals based on cameras or loop detectors, the vast majority of existing traffic lights in the world employ a timer-based decision logic which is clearly not very effective. In this article, the authors present a new scheme for controlling traffic at intersections, which is known as DSRC-actuated traffic control. The proposed approach leverages the presence of DSRC radios in vehicles and gives priority (by displaying a green light) to approaches (roads) that include DSRC-equipped vehicles (such as 10% or 20% of vehicles having DSRC radios). Using this priority mechanism, it is shown that the average waiting time at each traffic light can be significantly reduced. This, in turn, can reduce the average commute time of urban workers during rush hour substantially. One of the great advantages of the presented approach is that it can function well with even a low percentage of DSRC-equipped vehicles. Given that many industry forecasts predict a gradual penetration rate for the DSRC technology, this is a very attractive feature. It is also shown that the proposed new approach leads to a cost-effective solution for urban traffic control since the hardware and software platforms needed for its implementation are low-cost.

How Road and Mobile Networks Correlate: Estimating Urban Traffic Using Handovers

T. Derrmann, R. Frank, F. Viti, and T. Engel

The authors propose a novel way of linking mobile network signaling data to the state of the underlying urban road network. They show how a predictive model of traffic flows can be created from mobile network signaling data. In order to achieve this, they estimate the vehicular density inside specific areas using a polynomial function of the inner and exiting mobile phone handovers performed by the base stations covering those areas. They can then use the aggregated handovers as flow proxies alongside the density proxy to directly

Digital Object Identifier 10.1109/TITS.2020.2968015

estimate an average velocity within an area. They evaluate the model in a simulation study of Luxembourg City, and generalize their findings using a real-world data set extracted from the LTE network of a Luxembourg operator. Predicting the real traffic states as measured through floating car data, they achieve a mean absolute percentage error of 11.12%. Furthermore, in their study case, approximations of the network Macroscopic Fundamental Diagrams (MFD) of road network partitions can be generated. The analyzed data exhibits low variance with respect to a quadratic concave flow-density function, which is in line with previous theoretical results on MFDs, and are similar when estimated from simulation and real data. These results indicate that mobile signaling data can potentially be used to approximate MFDs of the underlying road network, and contribute to better estimate road traffic states in urban congested networks.

Fast, Efficient Broadcast Schemes Based on the Prediction of Dynamics in Vehicular Ad Hoc Networks

X. M. Zhang, L. Yan, K. H. Chen, and D. K. Sung

The highly varying link dynamics caused by the mobility of vehicles and complex wireless channel environment greatly affects the performance of multihop broadcast in vehicular ad hoc networks (VANETs). Considering the impact of link qualities and vehicular mobility, the authors investigate how to select broadcast relays to minimize the broadcast delay and maximize the broadcast efficiency. They first propose a novel broadcast scheme based on the prediction of dynamics (BPD), which utilizes the dynamic information to achieve the model-based prediction and combines the sender-based and receiver-based relay selection schemes for multihop broadcast. Then, they propose a novel metric called the expected remaining delay (D), and implement it in BDP (BPD-D) for minimizing the broadcast delay. They also propose a novel metric called the expected rebroadcast efficiency (E), and implement it in BDP (BPD-E) for maximizing the broadcast efficiency.

Convolutional Neural Network With Adaptive Regularization to Classify Driving Styles on Smartphones

M. M. Bejani and M. Ghatee

This article proposes a new driving style evaluation system that applies a convolutional neural network (CNN) on acceleration data of smartphones. This network can extract the hidden features for overall driving evaluation instead of features related to the context-awareness. Because of insufficient data for driving evaluation, the considered deep model becomes over-fitted. Thus, two adaptive regularization schemes are extended to prevent the over-fitting. They are called adaptive dropout and adaptive weight decay techniques. To evaluate these overfitting schemes, first, the authors checked the results on three popular large-scale data sets including SVHN, CIFAR-10 and STL, and the results are promising. Then, these CNNs are applied for transportation mode detection and driving style evaluation. The corresponding accuracies increase to 95.8% and 95%, respectively. Thus, the regularized CNN dominates the previous overall and maneuver-by-maneuver driving evaluation systems.

An Efficient Texture Descriptor for the Detection of License Plates From Vehicle Images in Difficult Conditions

M. S. Al-Shemarry, Y. Li, and S. Abdulla

This study aims to identify license plates under difficult image conditions, such as low/high contrast, foggy, distorted and dusty conditions. This article proposes an efficient descriptor, a multilevel extended local binary pattern, for a license plates (LPs) detection system. A pre-processing Gaussian filter with contrast-limited adaptive histogram equalization enhancement method is applied with the proposed descriptor to capture all the representative features. The corresponding bins histogram features for a license plate image at each different level are calculated. The extracted features are used as the input to an extreme learning machine classifier for multiclass vehicle LPs identification. The data set with English cars LPs is extended using an online photo editor to make changes on the original data set to improve the accuracy of the LPs detection system. The experimental results show that the proposed method has high detection accuracy with an extremely high computational efficiency in both training and detection processes compared to the most popular detection methods. The detection rate is 99.10% with a false positive rate of 5% under difficult images. The average training and detection time per vehicle image is 4.25 and 0.735 s, respectively.

Graded Warning for Rear-End Collision: An Artificial Intelligence-Aided Algorithm

Y. Fu, C. Li, T. H. Luan, Y. Zhang, and F. R. Yu

In order to realize the ultralow latency and high-accuracy solutions for rear-end collision, this article proposes an artificial intelligence-based warning algorithm for rear-end collision avoidance. Three key issues are addressed by applying the neural network approach, including noises in positioning, inaccurate risk assessment, and enhanced comfort level of passengers. First, to filter the noises in positioning, wireless vehicular communications are leveraged; accurate relative lane positioning can be achieved to justify if two vehicles are in the same lane. Second, an online neural network model is developed to assess the risk of collisions in real time when driving. Third, to maximize the comfort of passengers during the braking process, a graded warning strategy is developed at the prerequisite of guaranteed safety. With the above schemes sewed in to one framework, the author's proposal can achieve rear-end warning with reduced missing alarm rate, accurate risk assessment, and enhanced comfort to passengers.

PedPIV: Pedestrian Velocity Extraction From Particle Image Velocimetry

M. Baqui and R. Löhner

Analysis of velocities from high density pedestrian events may provide more information on pedestrian flow dynamics. A framework based on Particle Image Velocimetry (PIV), a technique commonly used in experimental fluid dynamics, has been developed to evaluate pedestrian velocities from high density pedestrian events. The framework takes a sequence of two or more images from a regular Closed-Circuit Television (CCTV) camera and obtains flow properties

(speed, direction) of the pedestrians. A detailed analysis has been done in both qualitative and quantitative aspects of adapting PIV to pedestrian flow. The proposed PIV-based framework enables on-the-spot analysis of pedestrian flow via velocity extraction in a reliable, automated manner.

Development and Evaluation of an Adaptive Traffic Signal Control Scheme Under a Mixed-Automated Traffic Scenario

M. A. S. Kamal, T. Hayakawa, and J.-i. Imura

An adaptive signal control scheme is developed for controlling mixed manual-automated traffic at intersections under a connected vehicle environment. Estimating arrival times of all vehicles, the signals are optimized in a receding horizon control framework aiming at minimum traffic delay. The scheme ensures comfortable crossing of manually driven vehicles by retaining the basic features of the traditional intersections. The optimal signal changing times are broadcasted one cycle ahead, which enables the automated vehicles to cross the intersection with minimum stop-delay. The scheme is evaluated in a traffic simulator and traffic performances in terms of average speed, density, fuel consumption, and emissions are observed. The scheme outperforms the existing adaptive control scheme for 100% manual vehicles. The performances of traffic improve as the penetration of automated vehicles increases. Remarkably, with 100% penetration of the automated vehicles, the scheme facilitates fully idling-free traffic flows and enhanced intersection capacity.

Online Multiple Maneuvering Vehicle Tracking System Based on Multi-Model Smooth Variable Structure Filter

Z. Luo, M. Attari, S. Habibi, and M. V. Mohrenschildt

Autonomous vehicles (AV) need a real-time traffic tracking system in order to interact with multiple moving vehicles in urban situations. This article presents a new LiDAR-based online multiple maneuvering vehicle tracking (LB-OMMVT) problem, and proposes a novel online multimodel smooth variable structure filter (MMSVSF) to address the problem. Real-time experiments show that the author's method is able to deliver superior performance compared to other conventional methods.

A Deep Learning Approach to Infer Employment Status of Passengers by Using Smart Card Data

Y. Zhang and T. Cheng

A thresholding multichannel convolutional neural network model is proposed for inferring passengers' employment status by using traffic smart card data with a household survey. Individual weekly travel patterns are represented as a three-dimensional image, including the information of temporal travel behavior and travel mode preference. The proposed deep learning model is used to automatically extract temporal features in different travel modes. The class-imbalance problem is considered in the prediction task and solved by leveraging the ensemble of oversampling and thresholding techniques to improve the prediction accuracy. The experimental results show the close correlation between travelers' temporal travel patterns, travel mode choice, and their working status.

Model Predictive-Based Shared Control for Brain-Controlled Driving

Y. Lu, L. Bi, and H. Li

Using brain signals rather than limbs to drive a vehicle can help persons with disabilities to extend their movement range and thus improve their self-independence. However, the driving performance of brain-controlled vehicles (BCVs) is poor. In this article, to improve the performance of BCVs, the authors propose a new shared control method based on the model predictive control (MPC) strategy. Particularly, to maintain the maximum control authority of brain-control drivers while ensuring the safety of BCVs, the MPC controller is designed by introducing a penalty on the deviation from drivers' output in the cost function and setting safety constraints. Driver-and-hardware-in-the-loop experiments are conducted under two road-keeping scenarios and one obstacle-avoidance scenario with different subjects to validate the proposed method. The results demonstrate the effectiveness of the proposed method in avoiding roadway departures and obstacles while maintaining the control authority of users.

Is Travel Demand Actually Deep? An Application in Event Areas Using Semantic Information

I. Markou, F. Rodrigues, and F. C. Pereira

Time-series data and semantic information combinations are explored using machine learning and deep learning techniques in the context of creating a prediction model that is able to capture in real-time future stressful situations of the studied transportation system. The suggested framework is applied in event areas in New York using publicly available taxi data and events' information retrieved from the Web. It is illustrated that the forecasting models are able to significantly reduce their prediction error by fusing these two complementary cross-modal sources of information.

Profitable Taxi Travel Route Recommendation Based on Big Taxi Trajectory Data

B. Qu, W. Yang, G. Cui, and X. Wang

In this article, a method named ASER is proposed to recommend profitable travel routes for taxi drivers. The method uses a probabilistic grid network to summarize the passenger information, and the shortest expected cruising distance is then introduced to formulate the potential cruising distance of taxis. ASER recommends the traveling route with the shortest expected cruising distance to the drivers; it also considers the capacity of each grid to achieve a balance between taxis and passengers. In addition, ASER is deployed on a MapReduce platform with a new data structure named kdS-tree to efficiently recommend profitable routes. The experiments on two data sets show that ASER can provide more profitable routes to a group of taxis compared to existing methods.

Smartphone Placement Within Vehicles

J. Wahlström, I. Skog, P. Händel, B. Bradley, S. Madden, and H. Balakrishnan

Smartphone-based driver monitoring is quickly gaining ground as a feasible alternative to competing in-vehicle and aftermarket solutions. Today, the main challenges for data

analysts studying smartphone-based driving data stem from the mobility of the smartphone. In this article, the authors use kernel-based k-means clustering to infer the placement of smartphones within vehicles. All in all, trip segments are mapped into 15 different placement clusters. The proposed method is evaluated on more than 10 000 kilometers of driving data collected from approximately 200 drivers. To validate the interpretation of the clusters, they compare the data associated with different clusters and relate the results to real world knowledge of driving behavior. The clusters associated with the label "Held by hand" are shown to display high gyroscope variances, low maximum speeds, low correlations between the measurements from smartphone-embedded and vehicle-fixed accelerometers, and short segment durations.

A Fusion Framework Based on Sparse Gaussian–Wigner Prediction for Vehicle Localization Using GDOP of GPS Satellites

V. Havyarimana, Z. Xiao, A. Sibomana, D. Wu, and J. Bai

Road safety and collision avoidance/self-driving applications require highly accurate vehicle localization methods in intelligent transportation systems (ITS). Global Positioning System (GPS) is the most popular tool for outdoor vehicle localization and navigation. However, obstacles such as high buildings, tunnels, thick tree cover may block the satellite signal reception and make GPS impractical in urban environments. This article aims at developing prediction framework-based low-cost GPS/INS fusion model to provide enhanced vehicle localization even during partial and complete GPS outages. To achieve this, a sparse Gaussian Wigner prediction (SG-WP) method by taking into account geometric dilution of precision iGDOP jof GPS satellites is proposed to provide enhanced vehicle localization even during challenging environments. Real road tests and experimental comparison with the existing prediction methods are conducted to evaluate the proposed strategy performance in both non-Gaussian and Gaussian environments.

Zonotoptic Fault Estimation for Discrete-Time LPV Systems With Bounded Parametric Uncertainty

M. Zhou, Z. Cao, M. Zhou, J. Wang, and Z. Wang

This article presents a novel interval fault estimation approach by using zonotope technique for discrete-time linear parameter-varying systems in the presence of bounded parametric uncertainties, measured perturbation, and system disturbance. With the aid of augmentation technique, interval fault estimation is transformed into zonotoptic augmented states estimation by using zonotopes. A vehicle lateral dynamic nonlinear model is utilized to demonstrate the feasibility and effectiveness of the proposed method.

A Novel Dynamic Programming Approach to the Train Marshalling Problem

H. Falsafain and M. Tamannaei

Train marshalling is the process of reordering the railcars of a train in such a way that the railcars with the same destination appear consecutively in the final reassembled train. The process takes place in the shunting yard by means of a number of classification tracks. In the Train Marshalling Problem (TMP), which has been shown to be NP-hard, the objective is to perform this rearrangement of the railcars with the use of as few classification tracks as possible. The authors propose a novel exact dynamic programming (DP) algorithm for the TMP. The worst-case time complexity of this algorithm is lower than that of the best presently available algorithm for the problem, which is an inclusion-exclusion-based DP algorithm. In practice, the proposed algorithm provides a substantially improved performance compared to its counterpart.

On Reliable Neural Network Sensorimotor Control in Autonomous Vehicles

A. Plebe, M. Da Lio, and D. Bortoluzzi

The authors propose an application of neural networks for vehicle longitudinal control that, they believe, indicates a possible approach to tackle the black-box and verifiability issues that affect end-to-end trained networks. They show how to build a deep neural network for car following as a particular example of a more general obstacle avoidance module for automated driving. They adopt a divide et impera approach, in the form of a subsumption architecture, which builds complex behaviors by reusing simpler motor modules which can be extensively tested and inspected to a large extent. This way, the application retains the ability to learn and parallelize computations, while producing complex behaviors based on the "obstacle avoidance" principle.

Structural Analysis of Attributes for Vehicle Re-Identification and Retrieval

Y. Zhao, C. Shen, H. Wang, and S. Chen

A vehicle data set named "VAC21" is collected and 21 classes of structural attributes are hierarchically labeled with bounding boxes. Based on the data set, the one-stage detection method Single-shot Detection (SSD) is used as a baseline model for detecting attributes. A few modifications are made for this application to improve accuracy: 1) adding more proposals from low-level layers to improve the accuracy of detecting small objects and 2) employing the focal loss to improve the mean average precision (mAP). Regions of interests (ROIs)-based vehicle re-identification and retrieval method is proposed which the ROIs' deep features are used as discriminative identifiers, encoding structure information of a vehicle. Wherein, the deep features are input to a boosting model to improve the accuracy. The experimental results demonstrate the effectiveness of the proposed method.

Distributed Multiagent Coordinated Learning for Autonomous Driving in Highways Based on Dynamic Coordination Graphs

C. Yu, X. Wang, X. Xu, M. Zhang, H. Ge, J. Ren, L. Sun, B. Chen, and G. Tan

A multiagent reinforcement learning method has been proposed for high-level strategic decision making of following or overtaking for a group of autonomous vehicles in highway situations. Dynamic coordination graph is used to

model the continuously changing topology during vehicles' interactions, and two basic learning approaches is proposed to coordinate the driving maneuvers for a group of vehicles. Experimental evaluation has verified the benefits of the proposed coordinated learning method, compared with other approaches that learn without coordination or rely on some traditional mobility models based on some expert driving rules.

Robust Design of Connected Cruise Control Among Human-Driven Vehicles

D. Hajdu, J. I. Ge, T. Insperger, and G. Orosz

The structured singular value analysis was applied to investigate the influence of uncertain human car-following parameters on the string stability of connected cruise controllers. Within the framework, uncertainties both in the feedback gains and in the reaction time delays of the human-driven vehicles can be considered. The structure is capable to represent various connectivity topologies and scales well for large-size connected vehicle systems. Based on experiments, it is shown that the robustly tuned control parameters were performing better under human-driver uncertainties than less robust control parameters.

Fog-Based Multi-Class Dispatching and Charging for Autonomous Electric Mobility On-Demand

S. Belakaria, M. Ammous, S. Sorour, and A. Abdel-Rahim

Despite the significant advances in vehicle automation and electrification, the next-decade aspirations for massive deployments of autonomous electric mobility on demand (AEMoD) services in big cities are still threatened by two major bottlenecks, namely the communication/computation and charging delays. In order to target the communication/computation delays, the article suggests the exploitation of fog-based architectures for localized AEMoD system operations. These emerging architectures are soon-to-become widely used, allowing for all localized operational decisions to be made with very low latency by fog controllers located close to the end applications (e.g., each city zone for AEMoD systems). As for the charging delays, an optimized multiclass charging and dispatching queuing model, with partial charging option for AEMoD vehicles, is developed for each of these zones.

Re-Plannable Automated Parking System With a Standalone Around View Monitor for Narrow Parking Lots

C. Jang, C. Kim, S. Lee, S. Kim, S. Lee, and M. Sunwoo

The authors propose a re-plannable automated parking system with a standalone around view monitor. The proposed system can constantly reflect several errors and risks of perception, positioning, and control in real-life situations, and then regenerate the parking path to improve the parking precision and avoid any collisions. In their experiments, they evaluated the system in narrow parking lots with a perpendicular parking space defined as 2.1×5.0 m. The proposed system successfully performed reverse automated parking with a lateral error of 0.049 m, a longitudinal error of 0.249 m, and a heading error of 0.468 degrees.

Ground-Plane-Based Absolute Scale Estimation for Monocular Visual Odometry

D. Zhou, Y. Dai, and H. Li

Recovering absolute metric scale from a monocular camera is a challenging but highly desirable problem for monocular camera-based systems. By using different kinds of cues, various approaches have been proposed for scale estimation, such as camera height, object size etc. In this article, first, the authors summarize different kinds of scale estimation approaches. Then, they propose a robust divide and conquer absolute scale estimation method based on the ground plane and camera height by analyzing the advantages and disadvantages of different approaches. By using the estimated scale, an effective scale correction strategy has been proposed to reduce the scale drift during the Monocular Visual Odometry (VO) estimation process. Finally, the effectiveness and robustness of the proposed method have been verified on both public and self-collected image sequences.

A Bayesian Reference Model for Visual Time-Sharing Behaviour in Manual and Automated Naturalistic Driving

A. Morando, T. Victor, and M. Dozza

Visual time-sharing (VTS) behavior characterizes an inattentive driver. Because inattention has been identified as the major contributing factor in traffic crashes, understanding the relation between VTS and crash risk could help reduce crash risk through the development of inattention countermeasures. The aims of this work are: 1) to develop a reference model of VTS behavior and 2) reveal if vehicle automation influences VTS behavior. The reference model was based on naturalistic eye-tracking data. VTS sequences were extracted from routine driving data (including manual and automated driving). The authors used Bayesian Generalized Linear Mixed Models for a range of on- and off-path glance-based metrics. Each parameter was estimated with a probability distribution and summarized with credible intervals containing the model parameters with 95% probability. The reference model corroborates previous driving simulator experiments and on-road studies, but also captures the characteristics of on-path and off-path glance behavior in greater detail. The model demonstrated that: 1) there was minimal change in VTS behavior due to automation and 2) the percentage of time that glances fell on-path (PRC) was greater for all routine driving ($\sim$80%) than for VTS sequences ($\sim$50%). The PRC was the only metric that was sensitive to VTS, but it did not differentiate between manual and automated driving. Their model, by describing a measure of inattention (VTS behavior), can be used in the future driver models to improve the computer simulations used to design ADASs and evaluate their safety benefits. Additionally, the model could serve as a detailed reference for inattention guidelines.

Experimental Evaluation of the Stimuli-Induced Equilibrium Point Concept for Automatic Ramp Merging Systems

K. Amezquita-Semprun, Y. C. Pradeep, P. C. Y. Chen, W. Chen, and Z. Zhao

The concept of stimuli-induced equilibrium point (SIEP) has been introduced to characterize the psychological interaction

of a ramp driver with its putative leader and follower on the expressway during a merging maneuver. SIEP enables the computation of the reference target gap speed and position for the on-ramp merging vehicle based on current traffic conditions and ramp vehicle response. Thus far, the performance and advantages of the SIEP-based approach have been assessed only through numerical simulations. In this article, the authors further validate their methodology by conducting a comprehensive experimental evaluation of performance and safety of the SIEP-based approach to ramp merging control using a lab-based test-bed.

Advances in Position Based Routing Towards ITS Enabled FoG-Oriented VANET–A Survey

A. Ullah, X. Yao, S. Shaheen, and H. Ning

This article presents a collection of Position Based Routing (PBR) schemes for exploring the advancements of conventional VANET to FoG oriented VANET in city environment. A taxonomy of PBR schemes is included to arrange the literature under various categories including greedy based schemes, linear regression, genetic algorithms and linear programming based schemes. Moreover, connectivity aware routing based schemes are considered more appropriate for PBR in city environment. The authors have also presented a novel FoG based architecture for PBR in VANET with the inclusion of parked vehicles as guard nodes near road junctions to achieve better PDR, delay and communication costs. As a final task, a number of opportunities and challenges of proposed architecture are explored.

Forecasting Markers of Habitual Driving Behaviors Associated With Crash Risk

G. Panagopoulos and I. Pavlidis

This article describes a machine learning method that forecasts in near real-time the crash risk associated with certain habitual driving behaviors. Specifically, the algorithm can track distracted and aggressive driving–two behaviors linked to increasingly grim crash statistics. Physiological data of drivers collected from imaging and wearable sensors, as well as driving data collected from the vehicle, serve as input to the machine learning operation. The classifier arrives at a verdict every minute with respect to distracted driving and every half minute with respect to aggressive driving. The algorithm attained classification performance in excess of 87% in SIM 1–a public data set from a well-known experiment involving 59 drivers. This method can be used in current vehicles to issue sobering alerts to drivers, while in the future semiautomated vehicles can weigh in the computer's decision to wrest vehicular control.

Cloud Computing-Based Analyses to Predict Vehicle Driving Shockwave for Active Safe Driving in Intelligent Transportation System

B.-J. Chang and J.-M. Chiou

This article proposes a Predictive backward Shockwave Analysis approach (PSA) to achieve RT-ASD based on the analyses of Macroscopic Traffic Shockwave (PSA_MA) and Microscopic Car-following (PSA_mi). PSA contributes to several aspects of active safe driving: 1) predicting and analyzing high threat of backward shockwaves from the gathered big data of the driving state information vehicles; 2) informing the analyzed threat messages to the vehicles in high-threat areas via the 3-Tier hierarchical cloud computing mechanism; 3) reducing the driving threat certainly; and 4) PSA_MA and PSA_mi can be applied for achieving active safe driving in autonomous self-driving vehicles and the human-driving vehicles.

Adaptive Group-Based Zero Knowledge Proof-Authentication Protocol in Vehicular Ad Hoc Networks

A. A. Rasheed, R. N. Mahapatra, and F. G. Hamza-Lup

Vehicular Ad Hoc Networks (VANETs) are a particular subclass of mobile ad hoc networks that raise a number of security challenges, notably from the way users authenticate the network. Authentication technologies based on existing security policies and access control rules in such networks assume full trust on Roadside Unit (RSU) and authentication servers. The disclosure of authentication parameters enables user's traceability over the network. VANETs' trusted entities (e.g., RSU) can utilize such information to track a user traveling behaviour, violating user privacy and anonymity. In this article, the authors proposed a novel, lightweight, Adaptive Group-based Zero Knowledge Proof-Authentication Protocol (AGZKP-AP) for VANETs. The proposed authentication protocol is capable of offering various levels of users' privacy settings based on the type of services available on such networks. Their scheme is based on the Zero-Knowledge-Proof (ZKP) crypto approach with the support of tradeoff options. Users have the option to make critical decisions on the level of privacy and the amount of resources usage they prefer such as short system response time versus the number of private information disclosures. Furthermore, AGZKP-AP is incorporated with a distributed privilege control and revoking mechanism that render user's private information to law enforcement in case of a traffic violation.

A Robust Parking Detection Algorithm Against Electric Railway Magnetic Field Interference

Z. Zhang, X. He, and H. Yuan

The problem of magnetic field interference caused by electric railway is discussed. The authors propose an algorithm for parking space detection which can effectively eliminate the geomagnetic background interference. Based on mathematical morphology, two filters are designed for extracting target structures from interfered signals. Experiment results verify that the proposed algorithm is more accurate than existing algorithms.

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