5 An assessment of the use of dedicated short-range communications technology to perform travel time monitoring and automated incident detection on a segment of rural freeway is described. The assessment used the CorSim traffic simulation tool to simulate traffic and incidents on a segment of rural freeway. Output data from the simulation was subjected to postprocessing to convert it to probe and beacon data. An incident detection algorithm was developed by using a travel time threshold and a counter. An alarm was generated when a counter reached a preselected level. This algorithm was tested on selected data files, and the results were used to identify the optimum values of the travel time threshold and the counter alarm level. With these optimum values, the algorithm was applied to the probe and beacon data to determine how quickly the system could detect various traffic incidents. The analysis showed that the system could provide rapid and reliable detection of incidents. During the simulation and analysis, several parameters were varied so that their effect on the system performance could be observed. Each parameter proved to have a significant effect on the detection time, and the observed effects were consistent with logical expectations. In general, the time to detect an incident was reduced in response to (a) increased traffic volume, (b) increased incident severity, (c) increased transponder population, (d) reduced reader spacing; and (e) reduced distance from incident to next downstream reader.

6 This paper presents an incident detection algorithm based on the speed and acceleration profiles of probe vehicles as they travel along a freeway. It is based on the assumption that when a probe vehicle approaches a detectable incident, it will decelerate from its normal speed and then accelerate back to the normal speed after passing the incident. The incident detection performance of the algorithm, at various percentages of probe vehicles in the traffic stream, has been tested on a set of incident data generated by a calibrated microscopic traffic simulation model. The results are compared with a multi-layer feed-forward neural network incident detection techniques that uses volume, speed and occupancy measured at fixed locations as inputs. It is found that when there are 30% probe vehicles in the traffic stream, the new probe vehicle algorithm can achieve comparable detection rate and mean time to detection against the neural network model.

7 Short-term traffic forecast is one of the essential issues in intelligent transportation system. Accurate forecast result enables commuters make appropriate travel modes, travel routes, and departure time, which is meaningful in traffic management. To promote the forecast accuracy, a feasible way is to develop a more effective approach for traffic data analysis. The availability of abundant traffic data and computation power emerge in recent years, which motivates us to improve the accuracy of short-term traffic forecast via deep learning approaches. A novel traffic forecast model based on long short-term memory (LSTM) network is proposed. Different from conventional forecast models, the proposed LSTM network considers temporal-spatial correlation in traffic system via a two-dimensional network which is composed of many memory units. A comparison with other representative forecast models validates that the proposed LSTM network can achieve a better performance.

8 The rapid uptake of mobile devices and the rising popularity of mobile applications and services pose unprecedented demands on mobile and wireless networking infrastructure. Upcoming 5G systems are evolving to support exploding mobile traffic volumes, real-time extraction of fine-grained analytics, and agile management of network resources, so as to maximize user experience.

Fulfilling these tasks is challenging, as mobile environments are increasingly complex, heterogeneous, and evolving. One potential solution is to resort to advanced machine learning techniques, in order to help manage the rise in data volumes and algorithm-driven applications. The recent success of deep learning underpins new and powerful tools that tackle problems in this space. In this paper, we bridge the gap between deep learning and mobile and wireless networking research, by presenting a comprehensive survey of the crossovers between the two areas. We first briefly introduce essential background and state-of-the-art in deep learning techniques with potential applications to networking. We then discuss several techniques and platforms that facilitate the efficient deployment of deep learning onto mobile systems. Subsequently, we provide an encyclopedic review of mobile and wireless networking research based on deep learning, which we categorize by different domains. Drawing from our experience, we discuss how to tailor deep learning to mobile environments. We complete this survey by pinpointing current challenges and open future directions for research.

9 Travel time is a fundamental measure in transportation. Accurate travel-time prediction also is crucial to the development of intelligent transportation systems and advanced traveler information systems. We apply support vector regression (SVR) for travel-time prediction and compare its results to other baseline travel-time prediction methods using real highway traffic data. Since support vector machines have greater generalization ability and guarantee global minima for given training data, it is believed that SVR will perform well for time series analysis. Compared to other baseline predictors, our results show that the SVR predictor can significantly reduce both relative mean errors and root-mean-squared errors of predicted travel times. We demonstrate the feasibility of applying SVR in travel-time prediction and prove that SVR is applicable and performs well for traffic data analysis.

10 Decision tree methodology is a commonly used data mining method for establishing classification systems based on multiple covariates or for developing prediction algorithms for a target variable. This method classifies a population into branch-like segments that construct an inverted tree with a root node, internal nodes, and leaf nodes. The algorithm is non-parametric and can efficiently deal with large, complicated datasets without imposing a complicated parametric structure. When the sample size is large enough, study data can be divided into training and validation datasets. Using the training dataset to build a decision tree model and a validation dataset to decide on the appropriate tree size needed to achieve the optimal final model. This paper introduces frequently used algorithms used to develop decision trees (including CART, C4.5, CHAID, and QUEST) and describes the SPSS and SAS programs that can be used to visualize tree structure.

11 As the U.S. federal government is seeking useful applications of Vehicle-Infrastructure Integration (VII) and encouraging a greener and more efficient automobile industry, this paper demonstrated a path to meet the national transportation goal via VII. An impact study was conducted in a midsize U.S. metropolitan area on the potential of utilizing VII communication in Hybrid Electric Vehicle (HEV) operations by simulating a VII-enabled vehicle framework for both conventional HEV and Plug-in Hybrid Electric Vehicles (PHEV). The data collection and communication capability of the VII system allowed the prediction of speed profiles at the vehicle level with an average error rate of 13.2%. With the prediction, at the individual vehicle level, VII technology allowed PHEV and HEV to

achieve additional benefits with an approximately 3% decrease in total energy consumption and emission. At the network level, the benefit–cost analysis indicated that the benefit–cost ratios for PHEV and HEV of the VII vehicle network exceed one at the fleet penetration rate of 20% and 30%, respectively. Our findings encourage to support public and private investments in VII infrastructure and its integration with HEV and PHEV in order to reap the increased energy savings from these vehicles.

1 Parallel control and management have been proposed as a new mechanism for conducting operations of complex systems, especially those that involved complexity issues of both engineering and social dimensions, such as transportation systems. This paper presents an overview of the background, concepts, basic methods, major issues, and current applications of Parallel transportation Management Systems (PtMS). In essence, parallel control and management is a data-driven approach for modeling, analysis, and decision-making that considers both the engineering and social complexity in its processes. The developments and applications described here clearly indicate that PtMS is effective for use in networked complex traffic systems and is closely related to emerging technologies in cloud computing, social computing, and cyberphysical-social systems. A description of PtMS system architectures, processes, and components, including OTSt, Dyna CAS, aDAPTS, iTOP, and TransWorld is presented and discussed. Finally, the experiments and examples of real-world applications are illustrated and analyzed.

2 This study presents a framework for highway incident detection using vehicle kinetics, such as speed profile and lane changing behaviour, as envisioned in the vehicle-infrastructure integration (VII, also known as IntelliDrive) in which vehicles and infrastructure communicate to improve mobility and safety. This framework uses an in-vehicle intelligent module, based on a support vector machine (SVM), to determine the vehicle's travel experiences with autonomously generated kinetics data. Roadside infrastructure agents (also known as RSUs: roadside units) detect the incident by compiling travel experiences from several vehicles and comparing the aggregated results with the pre-selected threshold values. The authors developed this VII-SVM incident detection system on a previously calibrated and validated simulation network in rural Spartanburg, South Carolina and deployed it on an urban freeway network in Baltimore, Maryland to evaluate its transportability. The study found no significant differences in the detection performance between the original network and a new network that the VII-SVM system has not seen before. This demonstrated the feasibility of developing a generic VII-SVM system, applicable across transportation networks.

3 Advanced vehicle guidance systems use real-time traffic information to route traffic and to avoid congestion. Unfortunately, these systems can only react upon the presence of traffic jams and not to prevent the creation of unnecessary congestion. Anticipatory vehicle routing is promising in that respect, because this approach allows directing vehicle routing by accounting for traffic forecast information. This paper presents a decentralized approach for anticipatory vehicle routing that is particularly useful in large-scale dynamic environments. The approach is based on delegate multiagent systems, i.e., an environment-centric coordination mechanism that is, in part, inspired by ant behavior. Antlike agents explore the environment on behalf of vehicles and detect a congestion forecast, allowing vehicles to reroute. The approach is explained in depth and is evaluated by comparison with three alternative routing strategies. The experiments are done in simulation of a

real-world traffic environment. The experiments indicate a considerable performance gain compared with the most advanced strategy under test, i.e., a traffic-message-channel-based routing strategy.