Guest Editorial Introduction to the Special Issue on Internet of Things in Intelligent Transportation Infrastructure

THE Internet of Things (IoT), as an important part of the new generation of information technology, connects any object to the Internet according to the agreed protocol through radio frequency identification, global positioning system, and other information sensing equipment for information exchange and communication. With the continuous development of the IoT technology, it has injected new power into its further development and improvement. The Internet of Vehicles (IoV) is the development focus of the IoT, and the improvement of its connection capability enables the application of IoV to be upgraded from vehicle entertainment to unmanned driving, fleet arrangement and management, and traffic intelligent service. With the release of the market potential of IoV, the transportation cost will also drop significantly, and more transformation opportunities will emerge in the traditional intelligent transportation industry. As an important part of intelligent transportation, intelligent city, intelligent village, and intelligent park, the IoT intelligent infrastructure plays an important role in providing high-quality public services, reducing costs, and achieving sustainable development. At present, the IoT intelligent infrastructure has a wide range of demand around the world, and has become an important innovation and industrial development force in this field.

Intelligent infrastructure use IoT technology to connect the IoV in the area. According to different seasons and times, pedestrian flow, vehicle flow and weather conditions, and other statistical data and sensor data, adjust equipment communication bandwidth and vehicle networking scale and other facility parameters, and remotely control intelligent infrastructure service areas to optimize public services and improve efficiency and reduce costs. In recent years, the rise and development of low-power wide area networks (LPWAN) have provided a huge impetus for the widespread application of the IoT intelligent infrastructure. Especially after the LoRaWAN protocol entered the field of the IoV, its long distance, low power consumption, self-organization, security, and controllability have promoted a large number of innovations in related fields around the world, and the system is composed of LoRaWAN devices. And for the module, the application supports the use of LoRaWAN protocol for the intelligent infrastructure control system of the IoT to apply to different regional markets around the world, and even a comprehensive solution innovation chain that can fully meet the global market demand and management requirements.

With the rapid development of emerging industries such as artificial intelligence and the IoT, the construction of intelligent transportation systems has become a strategic development trend. The IoT infrastructure is an essential part of the intelligent transportation infrastructure system. Implementing the fine management of the IoT infrastructure can not only realize the remote monitoring of the IoT infrastructure, but also can change the equipment communication bandwidth and the scale of the IoV when the traffic volume increases according to the external traffic demand, greatly reducing the transportation cost. This Special Issue aims to introduce the latest discoveries and applications of the IoT technology in the emerging field of intelligent transportation infrastructure.

After a rigorous review, 55 articles have been accepted for this Special Issue. The evaluation process took into consideration factors pertaining to originality, technical quality, presentational quality, and overall contribution. Below is a brief introduction to each of them.

In [A1], Ji et al. present a lightweight high-precision image inpainting model RSG-Net to eliminate light adhesions and mend stripe fractures in grayscale wheelset multiline laser stripe images. RSG-Net adopts soft-coding partial convolutional layers to improve the feature representational ability. To reduce the influence of the background features, an asymmetrical similarity measure is designed to calculate not only the angle difference between the target and the source feature vectors but also the activation of the source ones. The multi-scale structural similarity (MS-SSIM) loss term is introduced to precisely guide the structural information restoration. Moreover, the ghost convolution is introduced to compress the model that can retain the core features and remove the redundant.

In [A2], Yao et al. propose a novel IoT positioning technology-based intelligent delivery system to enhance the efficiency and security of traditional parcel delivery. By introducing blockchain system and location information encryption, three fatal problems of the traditional delivery system: different party shares all information, location information interaction is too exposed, and the system is unattractive to recipients are all solved.

In [A3], Manogaran et al. propose a Permissible Service Selection and Allocation (PSSA) method to address issues with spontaneous resource availability in vehicular communication and connection. The method takes into account vehicle

Digital Object Identifier 10.1109/TITS.2023.3324790

displacement and minimum interconnection factors when accessing cloud services, and uses random forest learning to adjust the balancing factors. The service access is probed through the active infrastructure based on the balancing factor, and the ordering process of the learning intervals provides ease of service selection and allocation. Reallocation is not preferred due to the random displacement of the vehicles, so the interval dropouts are reduced in both handoff and non-handoff communication scenarios.

In [A4], Hou et al. propose a novel approach that integrated transfer learning with lightweight models MobileNet and MobileNet-SSD to identify concrete bridge distresses. By comparison of the model performance, the best model for two tasks was respectively recognized. The findings of this article have significant implications for optimizing the model structure and learning procedure for the lightweight identification models based on transfer learning for concrete bridge distresses. And the proposed approach has application potential for practical road inspection work in traffic infrastructure maintenance.

In [A5], Zhang et al. present a DFA method based on the computational errors in an early round of SIMON cipher which is applied in the security vehicle system. The attack proposed can retrieve three rounds of keys by inducing only one round of faults. Especially, based on only one-bit fault in LT-4, the attack presented can retrieve 5.5 (when n = 24, 32, 48 and 64) or 4.5 (when n = 16) bits of KT-1 on average. Compared with previous DFAs against SIMON under the random bit fault model, the attack proposed requires the lowest numbers of fault-induced and fault locations (or rounds) and thus is more effective.

Unmanned Aerial Vehicles (UAVs) have surged in significance within Mobile Edge Computing Networks (MECN), driving advancements in communication, computation, and data collection. Central to this is the Age of Information (AoI), crucial for timely information gathering and processing. However, security threats, notably channel access attacks (CAAs), threaten the optimization of AoI. In [A6], Wang et al. address this gap by examining the AoI-centric channel access challenge under CAA through a game theory lens. After constructing a system model that considers active probability, the study frames the AoI minimization issue from the Ordinary Potential Game (OPG) perspective. The introduction of two algorithms, AACSD and DCASD, facilitates the determination of channel access strategies, targeting a Nash Equilibrium in the OPG.

Controller Area Network (CAN) is one of the main in-vehicle communication protocols in modern cars. However, its lack of a sender verification mechanism makes CAN particularly vulnerable to cyber-attacks. Most state-of-the-art works exploited the supervised learning algorithm to identify the transmitter based on the hardware characteristics. This makes the decision process hard to understand, and it also limits the deployment of proprietary CAN bus without prior knowledge. In [A7], Zhou et al. design a novel clock-skew-based approach capable of pinpointing the sender and detecting intrusion on proprietary CAN bus.

In [A8], Tong et al. present a universal and extensible multi-hop collaboration model in the considered UAV-enabled fog computing system, where several UAVs equipped with communication and computation modules are deployed to serve ground users collaboratively. With this model, a joint user association, UAV association, task offloading, transmission power, computation resource allocation, and UAV location optimization problem are mathematically formulated. To solve the non-convex problem, a multi-hop collaborative algorithm is proposed to maximize the system utility in each time slot under the premise of considering collaborative fairness.

In [A9], Feng et al. propose an ensemble sensing scheme for collaborative inference among neighboring intelligent transportation systems. A customized model design approach is proposed to achieve collaborative inference with time constraints for heterogeneous devices. Evaluated on a variety of heterogeneous IoT devices, the experimental results show the effectiveness and practicality of the proposed scheme.

In [A10], Khan et al. propose a framework for optimizing the energy efficiency of backscatter-enhanced Non-Orthogonal Multiple Access (NOMA) cooperative Vehicle-to-Everything (V2X) communications. The system is designed to utilize backscatter communication, which reduces power consumption and enhances energy efficiency by reflecting signals off a nearby object, rather than transmitting them directly to the receiver. The proposed framework utilizes NOMA technology, which enables multiple users to share the same frequency band, thus increasing the system's capacity. The article also addresses the issue of imperfect Channel State Information (CSI), proposing an algorithm to optimize the system's energy efficiency under the constraints of available CSI.

Intelligent Transportation Systems (ITS) play an increasingly significant role in our life, where safe and effective vehicular networks supported by 6G communication technologies are the essence of ITS. Vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communications need to be studied to implement ITS in a secure, robust, and efficient manner, allowing massive connectivity in vehicular communications networks. Besides, with the rapid growth of different types of autonomous vehicles, it becomes challenging to facilitate the heterogeneous requirements of ITS. To meet the above needs, intelligent reflecting surfaces (IRS) are introduced to vehicular communications and ITS, containing the reflecting elements that can intelligently configure incident signals from and to vehicles. In [A11], Song et al. provide a big picture of deep learning-enabled IRS for 6G ITS and appraise most of the important literature in this field. By appraising and summarizing the existing literature, the authors also point out the challenges and worthwhile research directions related to IRS-aided 6G ITS.

In [A12], Yao et al. present a dynamic edge computation offloading schema for data-intensive and latency-sensitive IoV applications that achieve the joint optimization of delay and energy consumption during the computation offloading process. In particular, the dynamic computation offloading problem is structured as a Markov decision process (MDP). The twin delayed deep deterministic policy gradient (TD3)

technique is then employed to achieve the optimal offloading strategy, which can jointly optimize the delay and energy cost.

In [A13], Xu et al. propose a distribution-based temporal knowledge-driven method to leverage the temporal translation property in unmanned aerial vehicle(UAV) tracking. Instead of focusing on the traditional issues in the correlation filter, the authors provide a new method of learning parametric distribution on temporal knowledge by Wasserstein distance which is successfully embedded to solve the problem of temporal degeneration in the learning process of tracking. Furthermore, authors approximate optimal response reasoning with low-rank constraint over response consistency. Furthermore, the proposed method is solved by a simple iterative scheme with alternating direction multiplication ADMM algorithm.

To investigate the diversified technologies in IoVs under intelligent edge computing, in [A14], Yang et al. propose brain-inspired computing techniques, which is a promising biologically inspired method by using brain cognition mechanisms for various applications. A neuromorphic approach in a scalable and fault-tolerant framework is presented, targeting to realize the navigation function for the edge computing in IoV applications. A novel fault-tolerant address event representation approach is proposed for the spike information routing, which makes the presented model both scalable and fault-tolerant.

In [A15], Chen et al. propose an edge intelligence-based improved-YOLOv4 vehicle detection algorithm, introducing an efficient channel attention (ECA) mechanism and a high-resolution network (HRNet) to enhance vehicle detection ability. Second, an edge intelligence-based improved DeepLabv3+ image segmentation algorithm is proposed, replacing the original backbone network with MobileNetv2 and using the softpool method, thus reducing the network size while improving the segmentation accuracy.

In [A16], Bao et al. present a privacy-enhanced and fine-grained data-sharing scheme supporting dynamic users group for the Internet of Vehicles (IoV). To attain efficient and full policy hiding access control, it converts the conventional attribute-matching-based access control into the inner product between an access vector and an attributes vector, then securely outsources most of the cumbersome computations on the vehicle side to an edge device. It also provides available service for dynamic users group by constructing an efficient key revocation module.

In [A17], Miri et al. use TDMA protocol to increase the efficiency of the network and the quality of service it provides. To solve the synchronization problem, the Markov method predicts the size of slots and frames. The scenario field is used in the Markov application section to better predict TDMA gaps on solving the synchronization problem. Accordingly, the higher the quality of service, the lower the latency of the network, and the better the allocation of resources. Optimizing allocation and quality of service is further motivated by reducing collision between packets. In terms of its implementation, this method is divided into two components, the first being the database proposal for constructing the Markov matrix and the second being the simulation on VanetMobisim and the implementation of the network in NS2.

In [A18], Chougule et al. propose a novel intrusion detection system called the Multi-branch Reconstruction Error (MbRE) as a long-term and cost-effective security solution in VANETs. A combination of deep learning and statistics was used to categorize threats in the scope of network availability, sender identity, and data integrity into eight general categories without the need to train on them. Data was first branched into frequency, identity and motion data branches, and Convolutional Neural Networks were trained to reconstruct these branches for normal vehicular behavior. Statistical thresholds were then applied to the reconstruction errors obtained from misbehaviors to obtain their respective categories. The study showed MbRE's ability to detect unknown threats by correctly categorizing nineteen misbehaviors at high accuracy without the need to train on them, thus making it a cost-effective and long-term solution for VANET security.

In [A19], Ahmed et al. propose a smart IoT-enabled deep learning-based end-to-end 3D object detection system that works in real-time, emphasizing autonomous driving situations. The detection model is based on YOLOv3; firstly, the model is utilized for 2D object detection and then modified for 3D object detection purposes. The presented model uses point cloud, and RGB image data as input and outputs detected bounding boxes with confidence scores and class labels.

In [A20], Zhang et al. propose a method of mining driving behavior characteristics based on Convolutional Neural Network (CNN) and vehicle trajectory. Based on the mathematical principle of wavelet packet and Least Square Support Vector Machine (LSSVM), a combined model of trajectory mining is constructed and applied to the short-term prediction of traffic flow. It is of great significance to effectively utilize the knowledge data in Intelligent Transportation System (ITS) and extract valuable information from it, which has a certain reference value for the subsequent refined prediction of vehicle behavior.

In [A21], Kumar et al. propose an approach that leverages the concept of Federated Learning (FL) in the Intelligent Transportation System (ITS). In addition to the fundamental aggregation FL in ITS, the article effectively addresses two critical challenges associated with communication and datasets in the context of federated learning-based ITS. To perform effective and efficient communication the approach employs a Long-Range (LoRa) communication protocol for transmitting weight parameter matrices of trained models on the participants using collected sensory data. Furthermore, the approach reduces the negative impact of label noise in the sensory dataset of the participants using centroid similarities among participants and server. Finally, the authors deduce the expression for estimating centroid similarities and perform extensive experiments to validate the proposed approach.

In [A22], Wei et al. point out the existence of an offloading preference inference (OPI) attack in existing MADRL-based task offloading approaches for VANET. This article formulates a joint optimization of offloading action and transmitting power with the objective of minimizing the system cost, including local and edge costs, under the privacy requirement of protecting offloading preference during offloading policy learning process in VANET. Then, a privacy-aware

MADRL (PA-MADRL) approach is proposed to solve it, which can allow the offload decision of each vehicle to reach the Nash Equilibrium (NE) without leaking offloading preference.

In [A23], Qiao et al. propose a general approach to evaluate the performance of learned model for individual agents. Specifically, the common knowledge (i.e., agents are grouped together if they made the same prediction) and correlation (i.e., sending a query to the agent who shared the model) between different agents are explored. Thus, different sub-patterns are identified and the performance of the learned model is evaluated.

In [A24], Lu et al. propose a method based on contrast learning to solve the shape control problem of deformable objects. The method jointly optimizes the visual representation model and dynamic model of deformable objects, maps the target nonlinear state to linear latent space which avoids model inference for deformable objects in infinite-dimensional configuration spaces.

In [A25], Muhammad et al. propose a framework suitable for efficient fire detection and segmentation. The proposed CNN is lightweight, with an optimal number of convolutional kernels per layer to reduce the model size and ensure real-time processing.

In [A26], Gokasar et al. propose an incident detection algorithm using CAVs as data sources and multiple traffic parameters, namely MSND. SUMO Traffic Simulation Software is used to compare MSND, SND, and the California Algorithm in Variable Speed Limits (VSL) implementation with 3,300 different incident scenarios. The proposed method outperforms SND and California in terms of detection rate, false alarm rate, and mean time to detect.

In [A27], Yin aims to reduce the energy consumption and carbon emissions generated during urban logistics transportation and distribution and make the actual path planning flexible. NSGA-II algorithm based on Multifactorial Evolutionary Algorithm (MFEA) (M-NSGA-II) is proposed. In terms of the solution of the stability of the optimal values of four target functions, including distribution cost, customer satisfaction, fuel conservation, and carbon emission, the lowest distribution costs of M-NSGA-II algorithm in ten experiments were all lower than those of other three standard algorithms. The multi-objective path optimization model designed is of great value for reducing carbon emissions under satisfying customers' cargo demand and time requirements.

In [A28], Liu et al. focus on the real-time information processing and task scheduling problems of the IoV system based on Virtual Reality. They are the Quality/Distance Algorithm (QDA), Task Density Algorithm, Distance Balance Algorithm (DBA), and Bionic-DBA (B-DBA). The Utility Function in B-DBA and the Biological Heuristic Search Algorithm in Pareto Ant Colony Optimization play a critically important role in enhancing the overall task quality. In addition, a Transmission based on Privacy Protection (TPP) algorithm is designed to protect the attribute-based privacy information in the traffic information transmission system. This algorithm ensures that the real-time traffic information processing system resists various attacks from malicious nodes. The research content has a practical reference value for providing users with continuous and high-quality IoV network services.

In order to use deep learning (DL) on an important class of IoT devices, digital signal processor (DSP), for accurate vehicle and pedestrian detection, In [A29], Zhang et al., propose a series of general tactics to optimize the object detection convolutional neural network (CNN) model, including convolution layer optimization, cache optimization, compiler optimization, intrinsic optimization and direct memory access acceleration, and then a parallel scheme to extend the model to run on multicore, and further quantize the implementation of the model.

In [A30], Xue et al. propose an embedding-driven multi-hop spatio-temporal attention network for traffic prediction, which mainly focuses on leveraging the multi-scale periodicity of traffic data. Specifically, the proposed network applies a designed Fourier-series-based embedding, to capture the periodicity, which is more in line with real-world facts. Driven by the designed embedding, both local and global temporal dependencies are modeled properly by combining the attention-based methods and the convolution-based methods. Besides, authorsourmplement a trial that can hardly be seen in the existing traffic prediction works to combine the graph self-attention mechanism with a multi-hop diffusion process to explore the large-scale structural information on a designed set of graphs.

In [A31], Wang et al. utilize the emerging network slicing technology to support different services and employ NOMA to help increase the connectivity. In particular, for the safety service, they take advantage of the finite blocklength capacity to correctly record the delay. Their goal is to maximize the connectivity of users by jointly considering the user association and their beamforming vectors, under the restrictions of limited physical resource. The authors propose a two-stage scheme to tackle the intractable MINLP.

In [A32], Djenouri et al. describe the development of a new system known as a secure and intelligent system for the Internet of Vehicles (SISIV). An attention mechanism and deep learning architecture based on graph convolutional networks are developed. Blockchain technology is also used to secure data transfer between IoV system nodes. Using a branch-and-bound approach, the hyperparameters of the generated deep learning model are intelligently selected. Moreover, compared to state-of-the-art traffic prediction technologies, SISIV provides efficient and reliable traffic flow prediction in an IoV environment.

In [A33], Liao et al. propose a context-aware semi-supervised framework for predicting large-scale yet fine-grained trip purposes. It is based on pervasive data sources and is also effective with limited labeled training data, thus making it more applicable in real-world scenarios. The vehicle's GPS trajectory and public POI check-in data are employed to reveal trip contexts. A dual-attention graph embedding network with autoencoder architecture is devised to extract the higher-level activity semantics for trip purpose prediction. The semi-supervised framework could improve the model's performance by incorporating the complementary knowledge from large-scale unlabeled data.

In [A34], Cui et al. propose a cooperative air-ground network for emergency disposal in intelligent transportation systems, where a smaller latency is given through the coordination from task sensing, data/information relay to offloading between RSUs and UAVs. Considering the uncertainty of the scenario, the relay latency described by peak Age of Information (AoI) and offloading latency are characterized by both the average and risk performance metric, i.e., Conditional Value at Risk (CVaR). Besides, the Distributed Matching Algorithm with Minimum Risk (DMAMR) is provided, via which the cooperation strategy with low computation complexity and minimum risk for both sides is obtained.

In [A35], Yassine and Hossain propose a double-sided auction mechanism that matches EVs by pairing bids and asks such that the traded volume and the utilities are maximized. Through theoretical analysis, authors show that the proposed model can indeed be truthful, individually rationale, and computationally efficient. Finally, the authors evaluate the proposed model based on real data and provide performance analysis.

In [A36], Liu et al. propose an efficient management method of positioning reference signal (PRS) transmission, which utilizes a combination of optimized pseudo-random sequences (CO-PRS) for multiple BSs to coordinate the enabling/muting of PRS resources. The sequence selection and information exchange procedures in positioning functions are analyzed.

In [A37], Tang et al. propose an accurate QoS prediction approach using self-attention representation and deep factorization machines based on the QoS records of past service invocations. The approach first leverages the global and local contextual information of services and users to learn personalized representations. Then, based on the representations, it utilizes a deep factorization machine to make QoS value predictions.

In [A38], Wang et al. aim to investigate Network Car-Hailing (NCH) price or the deficiency in NCH Platform in Edge Computing (EC)-based Intelligent Transportation Systems. Aiming at the uncertain capacity and unbalanced load in the car-hailing platform, this work innovatively introduces the EC to unload, constructs an EC-based online car-hailing resource allocation and pricing optimization model by combining with factors such as the number of users and reputation in the network, and further analyzes the performance of the resource allocation and pricing optimization model in the constructed car-hailing platform through simulation experiments. The model constructed in this work can minimize the average cost and consume less energy while the delay is small. It can provide a reference for intelligent pricing and resource allocation of the online car-hailing platform in the later period of intelligent transportation.

In [A39], Budhiraja et al. present a latency-energy-aware, efficient task offloading scheme for connected autonomous vehicular networks. First, vehicles are assembled into clusters, in which the vehicle can transmit tasks to the other vehicle, while on the other hand, the VEC server is used for processing the data. The authors developed a joint resource allocation and offloading decision optimization problem to minimize network latency and total energy usage. Due to the non-convex character of the optimization issue, they employed the Markov decision process (MDP) to convert it to a reinforcement learning (RL) problem. Then, the authors used a soft-actor critic-based scheme to achieve the optimal policy for resource allocation and task offloading to reduce the total latency and energy consumption for connected autonomous vehicles.

In [A40], Liu et al. focus on filling up the gap between deep reinforcement learning (DRL) theory and practical application by involving attention mechanism and hierarchical mechanism to solve some severe problems encountered in the practical application of DRL. More specifically, in order to improve the robustness of DRL, the authors use the averaged estimation function instead of the normal value estimation function. Then, they design a recurrent network and a temporal attention mechanism to improve the performance of the algorithm. Third, they propose a hierarchical framework to improve its performance on long-term tasks.

In [A41], Li et al. studied the development status of ITS and the application status of the BAS algorithm to optimize the Beetle Antenna Search (BAS) algorithm and apply it to the Intelligent Transportation System (ITS) to process traffic data in time and solve traffic congestion. It optimizes BAS to converge to local optimization prematurely in high-dimensional space, affecting the prediction accuracy. Then, combined with the Least Squares Support Vector Machine Algorithm (LSSVM), the algorithm with quadratic interpolation optimization is proposed. The proposed algorithm is named the Quadratic Interpolation Beetle Antenna Search (QIBAS). On this basis, a traffic flow prediction model based on QIBAS-LSSVM is established.

In [A42], Li et al. aim to improve the transmission and sharing efficiency of intelligent transportation data and promote the further development of intelligent transportation and smart city. In this work, an EEMR (Energy Efficient Multi-Hop Routing) is designed for the intelligent transportation wireless sensor network. In the EEMR algorithm, the base station runs the IAP clustering algorithm for network clustering after receiving the information of all surviving nodes. A method called ACRR (Adaptive Cluster-head Round Robin) is proposed for local dynamic election of cluster heads. In addition, the deep learning-based stochastic gradient descent algorithm and its evolution algorithm are sorted out, and its application in practical scenarios is analyzed. Due to the disadvantages of the adaptive algorithm in the current data processing process, the gradient optimization algorithm based on deep learning is adopted and the concept of adaptive friction coefficient is applied to the Adam algorithm to obtain a new adaptive algorithm (TAdam).

In [A43], Yang and Yao aim to investigate the effect of resource allocation and control (RAC) of unmanned aerial vehicle (UAV) assisted IoT communication devices. An IoT system combined with UAVs has been innovatively constructed to meet the user's communication experience while allocating channel resources. A UAV-assisted IoT resource allocation and control model is constructed, and its performance is analyzed by experimental testing on simulation software.

In [A44], Jin aims to use Deep Learning techniques to predict vehicle steering and trajectory behavior in urban road traffic. First, the background of digital logistics and intelligent vehicle research is analyzed. In addition, a behavioral serialization recommendation strategy for the steering point of the intelligent vehicle is proposed by modeling the dynamic state of the intelligent vehicle during driving.

In [A45], Li et al. propose a new multi-class car component dataset ICD-4 (Industrial car Components Dataset) for 6D object pose estimation. ICD-4 dataset delivers quite a few research challenges involving the range of object pose transformations and has significant research value for small-scale pose estimation tasks. The authors also propose an innovative method PoseMLP, a pose estimation network that uses residual MLP (multilayer perceptron) modules to predict the 6D pose estimation directly from point cloud data.

In [A46], Lashkov et al. propose a novel CLAHE-based nighttime image contrast enhancement method for vehicle detection under nighttime conditions. The proposed method improves the contrast of low-quality nighttime images while preventing over-enhancement by employing image dehazing technique and outperforms certain existing well-performing CLAHE-based methods. To provide accurate vehicle detection under nighttime conditions and different challenges, including vehicle overlapping, low-light conditions, camera vibrations, and image distortion, a deep neural network based on YOLOv5 architecture has been designed and trained using the custom-labeled dataset.

The current trend of maritime new buildings is to make the vessels self-driving, endowing them with more sophisticated navigation decision support tools. Following this trend, in [A47], Cassará et al. aim to integrate different enabling technologies to build a cyber-physical system of systems (CPSOS) supporting different levels of autonomy to take advantage of the real and virtual worlds in a continuous exchange of information that allows for improving navigation safety. For this reason, the authors developed a "Virtual Bridge Viewer," which implements an Extended Reality (XR) to display information appropriately selected and processed to enrich the perceived reality on-board and, throughout a Virtual Reality (VR) environment, ashore as well.

In [A48], Zhu et al. propose an enhanced federated learning (FL) model (SemBroc-RF), which considers the advantages of both end-to-end homomorphic encryption (HE) and secure multi-party computation (SMC). To reduce communication overheads and strengthen data security in road side units (RSUs) and end devices simultaneously, a partially encrypted secure multi-party broadcast computation algorithm (SemBroc) is designed, which achieves the time complexity O(n) by constructing the decoding function and sharing the gradients among the local models. To improve the model accuracy by gradients aggregation, a FL algorithm (GreFLa) with reinforcement learning is proposed based on the adaptive assigned weight of the local gradients.

In [A49], Guo et al. propose a video super-resolution algorithm based on inter-frame information utilization. First, a novel U-shaped feature extractor is designed to fully extract the feature expression of video frame sequences. Second, a deformable inter-frame alignment module based on residual learning is constructed to make the inter-frame alignment more accurate and thus promote the mutual utilization of inter-frame information. Finally, an up and down sampling residual block is proposed to extract features that better match the upsampling reconstruction requirements.

In [A50], Bai et al. investigate the task assignment problem for one truck and one drone to deliver packages to a group of customer locations. The truck, carrying a large number of packages, can only travel between a group of prescribed street-stopping/parking locations to replenish the drone with both packages and batteries. The drone can carry multiple packages simultaneously to serve customers sequentially within its limited operation range. The objective is to reduce the amount of time it takes the drone to deliver the necessary package to the last customer while taking into account its operation range and loading capacity. First, the package delivery task assignment problem is shown to be an NP-hard problem, which guides us to design heuristic task assignment algorithms. Secondly, based on graph theory, a lower bound on the minimum time for the drone to serve the last customer is achieved to approximately evaluate the performance of a task assignment algorithm. Third, several decoupled heuristic algorithms are designed to sequentially plan the routes for the drone and the truck. Two coupled heuristic algorithms, namely the improved nearest inserting algorithm and the improved minimum marginal-cost algorithm, are proposed to simultaneously plan the routes for the drone and the truck.

In [A51], Liu et al. propose a decentralized P2P resource sharing system for vehicle-to-vehicle (V2V) assisted vehicular edge computing (VEC). The system ensures system security and user privacy by introducing blockchain, and motivates more participants to share resources by a two-stage Stackelberg game. The experimental results show the effectiveness to motivate more participants and potential to construct a security resource-sharing system.

In [A52], Yang et al. propose a multi-lane collaborative control strategy using cooperative game theory, as past research focused on single mainlines. Defining merging rules for different lanes ensures safe cooperative merging. Cooperative game theory determines optimal merging sequences based on driving efficiency, comfort, and fuel consumption. The Pontryagin principle provides an analytical solution for longitudinal optimal control.

In [A53], Xiao et al. propose a unified cross-layer policy-adaption approach to enhance the secure throughput performance in intelligent transportation systems. Statistical security and perfect physical layer security strategies are alternatively used to fulfill the diverse quality-of-security (QoSec) requirements over highly varying wireless environments. When wireless channel quality is good, the perfect physical layer security strategy is adopted. When wireless channel quality turns to bad, the statistical security strategy is employed to reach a compromise between security guarantees and throughput improvement.

In [A54], Tao et al. propose an artificial flow potential field algorithm that combines the artificial potential field algorithm and the gradient descent algorithm with the assistance of SDN, to plan the path for the multi-submersible system. In particular, to improve the safety and efficiency of path planning, the

authors propose a dual leader-follower algorithm-based escort formation obstacle avoidance mechanism for dealing with all categories of obstacle avoidance situations.

In Lashkov et al. [A55], an effective approach is developed to apply machine learning and computer vision techniques to extract traffic parameters from videos captured by surveillance cameras installed along signalized arterials. Video camera vibrations are particularly addressed by applying image-matching algorithms. The projective transformation is utilized to calculate vehicle speed by computing the real object distance from an image. The developed approach is effective in estimating vehicle speed and traffic volume using video sequences captured from a stationary camera.

In [A56], Zhao et al. propose GMAT-DU, a novel model that aims to predict traffic anomaly from sparse data in fine-grained manner. To solve the first issue, the authors propose a Decay Unrolling (DU) mechanism to make the model applicable to sparse datasets. The performance will be progressively enhanced by the spatiotemporal unrolling of high-impact neighbors. For the second issue, they combine the meta-features of roads with correlations between roads, which are learnt from road semantic information and historical spatiotemporal data, and make the model focusing on the high-impact neighbors by a Graph Meta-features based ATtention (GMAT) mechanism. Extensive experiments on two real-world datasets validate the effectiveness of our method. The experimental results show the significant advantages against the state-of-the-art models.

In closing, the Guest Editors would like to thank all the authors, who significantly contributed to this Special Issue and the reviewers for their efforts in respecting deadlines and their constructive reviews. The Guest Editors would like to thank the authors for their contributions, the reviewers for their valuable work, and the editorial team of the journal for their professional support and collaboration.

HAIBIN LV, *Guest Editor*
North China Sea Offshore Engineering Survey Institute
Ministry of Natural Resources North Sea Bureau
Qingdao 266061, China
e-mail: lvhaibinsoa@gmail.com

JAIME LLORET, *Guest Editor*
Instituto de Investigacion para la Gestion
Integrada de Zonas Costeras
Universitat Politecnica de Valencia
46022 Valencia, Spain
e-mail: jlloret@dcom.upv.es

HOUBING SONG, *Guest Editor*
Department of Information Systems
University of Maryland Baltimore County (UMBC)
Baltimore, MD 21250 USA
e-mail: h.song@ieee.org

APPENDIX: RELATED ARTICLES

[A1] Z. Ji, X. Song, Q. Feng, H. Wang, C.-H. Chen, and C.-C. Chang, "RSG-Net: A recurrent similarity network with ghost convolution for wheelset laser stripe image inpainting," *IEEE Trans. Intell. Transp. Syst.*, vol. 24, no. 11, pp. 12852–12861, Nov. 2023.

[A2] Y. Yao et al., "Internet of Things positioning technology based intelligent delivery system," *IEEE Trans. Intell. Transp. Syst.*, vol. 24, no. 11, pp. 12862–12876, Nov. 2023.

[A3] G. Manogaran, J. Gao, and T. N. Nguyen, "Optimizing resource and service allocations for IoT-assisted intelligent transportation systems," *IEEE Trans. Intell. Transp. Syst.*, vol. 24, no. 11, pp. 12877–12887, Nov. 2023.

[A4] Y. Hou, H. Shi, N. Chen, Z. Liu, H. Wei, and Q. Han, "Vision image monitoring on transportation infrastructures: A lightweight transfer learning approach," *IEEE Trans. Intell. Transp. Syst.*, vol. 24, no. 11, pp. 12888–12899, Nov. 2023.

[A5] J. Zhang, X. Ji, J. Wang, J. Li, and N. Wang, "A differential fault attack on security vehicle system applied Simon block cipher," *IEEE Trans. Intell. Transp. Syst.*, vol. 24, no. 11, pp. 12900–12911, Nov. 2023.

[A6] W. Wang, G. Srivastava, J. C. Lin, Y. Yang, M. Alazab, and T. R. Gadekallu, "Data freshness optimization under CAA in the UAV-aided MECN: A potential game perspective," *IEEE Trans. Intell. Transp. Syst.*, vol. 24, no. 11, pp. 12912–12921, Nov. 2023.

[A7] J. Zhou et al., "A model-based method for enabling source mapping and intrusion detection on proprietary can bus," *IEEE Trans. Intell. Transp. Syst.*, vol. 24, no. 11, pp. 12922–12932, Nov. 2023.

[A8] S. Tong, Y. Liu, J. Mišic, X. Chang, Z. Zhang, and C. Wang, "Joint task offloading and resource allocation for fog-based intelligent transportation systems: A UAV-enabled multi-hop collaboration paradigm," *IEEE Trans. Intell. Transp. Syst.*, vol. 24, no. 11, pp. 12933–12948, Nov. 2023.

[A9] X. Feng et al., "Time-constrained ensemble sensing with heterogeneous IoT devices in intelligent transportation systems," *IEEE Trans. Intell. Transp. Syst.*, vol. 24, no. 11, pp. 12949–12960, Nov. 2023.

[A10] W. U. Khan, M. A. Jamshed, E. Lagunas, S. Chatzinotas, X. Li, and B. Ottersten, "Energy efficiency optimization for backscatter enhanced NOMA cooperative V2X communications under imperfect CSI," *IEEE Trans. Intell. Transp. Syst.*, vol. 24, no. 11, pp. 12961–12972, Nov. 2023.

[A11] W. Song, S. Rajak, S. Dang, R. Liu, J. Li, and S. Chinnadurai, "Deep learning enabled IRS for 6G intelligent transportation systems: A comprehensive study," *IEEE Trans. Intell. Transp. Syst.*, vol. 24, no. 11, pp. 12973–12990, Nov. 2023.

[A12] L. Yao, X. Xu, M. Bilal, and H. Wang, "Dynamic edge computation offloading for Internet of Vehicles with deep reinforcement learning," *IEEE Trans. Intell. Transp. Syst.*, vol. 24, no. 11, pp. 12991–12999, Nov. 2023.

[A13] G. Xu, H. Wang, M. Zhao, M. Pedersen, and H. Zhu, "Learning the distribution-based temporal knowledge with low rank response reasoning for UAV visual tracking," *IEEE Trans. Intell. Transp. Syst.*, vol. 24, no. 11, pp. 13000–13010, Nov. 2023.

[A14] S. Yang, J. Tan, T. Lei, and B. Linares-Barranco, "Smart traffic navigation system for fault-tolerant edge computing of Internet of Vehicle in intelligent transportation gateway," *IEEE Trans. Intell. Transp. Syst.*, vol. 24, no. 11, pp. 13011–13022, Nov. 2023.

[A15] C. Chen, C. Wang, B. Liu, C. He, L. Cong, and S. Wan, "Edge intelligence empowered object detection and image segmentation for autonomous vehicles," *IEEE Trans. Intell. Transp. Syst.*, vol. 24, no. 11, pp. 13023–13034, Nov. 2023.

[A16] Y. Bao, W. Qiu, X. Cheng, and J. Sun, "Fine-grained data sharing with enhanced privacy protection and dynamic users group service for the IoV," *IEEE Trans. Intell. Transp. Syst.*, vol. 24, no. 11, pp. 13035–13049, Nov. 2023.

[A17] F. Miri, A. Javadpour, F. Ja'fari, A. K. Sangaiah, and R. Pazzi, "Improving resources in Internet of Vehicles transportation systems using Markov transition and TDMA protocol," *IEEE Trans. Intell. Transp. Syst.*, vol. 24, no. 11, pp. 13050–13067, Nov. 2023.

[A18] A. Chougule, V. Kohli, V. Chamola, and F. R. Yu, "Multibranch reconstruction error (MbRE) intrusion detection architecture for intelligent edge-based policing in vehicular ad-hoc networks," *IEEE Trans. Intell. Transp. Syst.*, vol. 24, no. 11, pp. 13068–13077, Nov. 2023.

[A19] I. Ahmed, G. Jeon, and A. Chehri, "A smart IoT enabled end-to-end 3D object detection system for autonomous vehicles," *IEEE Trans. Intell. Transp. Syst.*, vol. 24, no. 11, pp. 13078–13087, Nov. 2023.

[A20] P. Zhang, J. Zheng, H. Lin, C. Liu, Z. Zhao, and C. Li, "Vehicle trajectory data mining for artificial intelligence and real-time traffic information extraction," *IEEE Trans. Intell. Transp. Syst.*, vol. 24, no. 11, pp. 13088–13098, Nov. 2023.

[A21] R. Kumar, R. Mishra, and H. P. Gupta, "A federated learning approach with imperfect labels in LoRa-based transportation systems," *IEEE Trans. Intell. Transp. Syst.*, vol. 24, no. 11, pp. 13099–13107, Nov. 2023.

[A22] D. Wei, J. Zhang, M. Shojafar, S. Kumari, N. Xi, and J. Ma, "Privacy-aware multiagent deep reinforcement learning for task offloading in VANET," *IEEE Trans. Intell. Transp. Syst.*, vol. 24, no. 11, pp. 13108–13122, Nov. 2023.

[A23] C. Qiao, J. Qiu, Z. Tan, G. Min, A. Y. Zomaya, and Z. Tian, "Evaluation mechanism for decentralised collaborative pattern learning in heterogeneous vehicular networks," *IEEE Trans. Intell. Transp. Syst.*, vol. 24, no. 11, pp. 13123–13132, Nov. 2023.

[A24] H. Lu, Y. Teng, and Y. Li, "Learning latent dynamics for autonomous shape control of deformable object," *IEEE Trans. Intell. Transp. Syst.*, vol. 24, no. 11, pp. 13133–13140, Nov. 2023.

[A25] K. Muhammad, H. Ullah, S. Khan, M. Hijji, and J. Lloret, "Efficient fire segmentation for Internet-of-Things-assisted intelligent transportation systems," *IEEE Trans. Intell. Transp. Syst.*, vol. 24, no. 11, pp. 13141–13150, Nov. 2023.

[A26] I. Gokasar, A. Timurogullari, S. S. Özkan, M. Deveci, and Z. Lv, "MSND: Modified standard normal deviate incident detection algorithm for connected autonomous and human-driven vehicles in mixed traffic," *IEEE Trans. Intell. Transp. Syst.*, vol. 24, no. 11, pp. 13151–13160, Nov. 2023.

[A27] N. Yin, "Multiobjective optimization for vehicle routing optimization problem in low-carbon intelligent transportation," *IEEE Trans. Intell. Transp. Syst.*, vol. 24, no. 11, pp. 13161–13170, Nov. 2023.

[A28] Y. Liu, A. Yang, Q. Zeng, Y. Sun, J. Gao, and Z. Lv, "Task scheduling of real-time traffic information processing based on digital twins," *IEEE Trans. Intell. Transp. Syst.*, vol. 24, no. 11, pp. 13171–13179, Nov. 2023.

[A29] J. Zhang, R. Wang, R. Liu, D. Guo, B. Li, and S. Chen, "DSP-based traffic target detection for intelligent transportation," *IEEE Trans. Intell. Transp. Syst.*, vol. 24, no. 11, pp. 13180–13191, Nov. 2023.

[A30] R. Xue, S. Zhao, and F. Han, "An embedding-driven multi-hop spatio-temporal attention network for traffic prediction," *IEEE Trans. Intell. Transp. Syst.*, vol. 24, no. 11, pp. 13192–13207, Nov. 2023.

[A31] J. Wang, D. Li, H. Jiang, and M. Qiu, "Maximizing the connectivity of network slicing enabled Internet of Vehicle with differentiated services," *IEEE Trans. Intell. Transp. Syst.*, vol. 24, no. 11, pp. 13208–13217, Nov. 2023.

[A32] Y. Djenouri, A. Belhadi, D. Djenouri, G. Srivastava, and J. C. Lin, "A secure intelligent system for Internet of Vehicles: Case study on traffic forecasting," *IEEE Trans. Intell. Transp. Syst.*, vol. 24, no. 11, pp. 13218–13227, Nov. 2023.

[A33] C. Liao et al., "Enriching large-scale trips with fine-grained travel purposes: A semi-supervised deep graph embedding framework," *IEEE Trans. Intell. Transp. Syst.*, vol. 24, no. 11, pp. 13228–13239, Nov. 2023.

[A34] Z. Cui, T. Yang, X. Wu, and B. Hu, "An air-ground coordinated sensing, relay and offloading for emergency disposal in ITS system," *IEEE Trans. Intell. Transp. Syst.*, vol. 24, no. 11, pp. 13240–13249, Nov. 2023.

[A35] A. Yassine and M. S. Hossain, "Match maximization of vehicle-to-vehicle energy charging with double-sided auction," *IEEE Trans. Intell. Transp. Syst.*, vol. 24, no. 11, pp. 13250–13259, Nov. 2023.

[A36] Q. Liu et al., "Management of positioning functions in cellular networks for time-sensitive transportation applications," *IEEE Trans. Intell. Transp. Syst.*, vol. 24, no. 11, pp. 13260–13275, Nov. 2023.

[A37] M. Tang, W. Tang, and F. Xie, "Accurately predicting quality of services in IoT via using self-attention representation and deep factorization machines," *IEEE Trans. Intell. Transp. Syst.*, vol. 24, no. 11, pp. 13276–13285, Nov. 2023.

[A38] Z. Wang, Y. Wang, and K. Muhammad, "Network car hailing pricing model optimization in edge computing-based intelligent transportation system," *IEEE Trans. Intell. Transp. Syst.*, vol. 24, no. 11, pp. 13286–13295, Nov. 2023.

[A39] I. Budhiraja, N. Kumar, H. Sharma, M. Elhoseny, Y. Lakys, and J. J. Rodrigues, "Latency-energy tradeoff in connected autonomus vehicles: A deep reinforcement learning scheme," *IEEE Trans. Intell. Transp. Syst.*, vol. 24, no. 11, pp. 13296–13308, Nov. 2023.

[A40] Z. Liu, Y. Cao, J. Chen, and J. Li, "A hierarchical reinforcement learning algorithm based on attention mechanism for UAV autonomous navigation," *IEEE Trans. Intell. Transp. Syst.*, vol. 24, no. 11, pp. 13309–13320, Nov. 2023.

[A41] X. Li, Z. Hu, Y. Shen, L. Hao, and W. Shang, "Distributed intelligent traffic data processing and analysis based on improved longhorn whisker algorithm," *IEEE Trans. Intell. Transp. Syst.*, vol. 24, no. 11, pp. 13321–13329, Nov. 2023.

[A42] X. Li, H. Zhang, Y. Shen, L. Hao, and W. Shang, "Intelligent traffic data transmission and sharing based on optimal gradient adaptive optimization algorithm," *IEEE Trans. Intell. Transp. Syst.*, vol. 24, no. 11, pp. 13330–13340, Nov. 2023.

[A43] G. Yang and Y. Yao, "Resource allocation control of UAV-assisted IoT communication device," *IEEE Trans. Intell. Transp. Syst.*, vol. 24, no. 11, pp. 13341–13349, Nov. 2023.

[A44] L. Jin, "Serialized recommendation prediction for steering point behavior of intelligent transportation vehicles based on deep learning," *IEEE Trans. Intell. Transp. Syst.*, vol. 24, no. 11, pp. 13350–13358, Nov. 2023.

[A45] Y. Li et al., "Pose estimation of point sets using residual MLP in intelligent transportation infrastructure," *IEEE Trans. Intell. Transp. Syst.*, vol. 24, no. 11, pp. 13359–13369, Nov. 2023.

[A46] I. Lashkov, R. Yuan, and G. Zhang, "Edge-computing-facilitated nighttime vehicle detection investigations with CLAHE-enhanced images," *IEEE Trans. Intell. Transp. Syst.*, vol. 24, no. 11, pp. 13370–13383, Nov. 2023.

[A47] P. Cassará, M. Di Summa, A. Gotta, and M. Martelli, "E-navigation: A distributed decision support system with extended reality for bridge and ashore seafarers," *IEEE Trans. Intell. Transp. Syst.*, vol. 24, no. 11, pp. 13384–13395, Nov. 2023.

[A48] R. Zhu, M. Li, J. Yin, L. Sun, and H. Liu, "Enhanced federated learning for edge data security in intelligent transportation systems," *IEEE Trans. Intell. Transp. Syst.*, vol. 24, no. 11, pp. 13396–13408, Nov. 2023.

[A49] K. Guo et al., "Video super-resolution based on inter-frame information utilization for intelligent transportation," *IEEE Trans. Intell. Transp. Syst.*, vol. 24, no. 11, pp. 13409–13421, Nov. 2023.

[A50] X. Bai, Y. Ye, B. Zhang, and S. S. Ge, "Efficient package delivery task assignment for truck and high capacity drone," *IEEE Trans. Intell. Transp. Syst.*, vol. 24, no. 11, pp. 13422–13435, Nov. 2023.

[A51] P. Liu, W. Jing, X. Fu, Y. Xiao, and L. Jia, "Consortium blockchain-based security and efficient resource trading in V2V-assisted intelligent transport systems," *IEEE Trans. Intell. Transp. Syst.*, vol. 24, no. 11, pp. 13436–13447, Nov. 2023.

[A52] L. Yang et al., "Multi-lane coordinated control strategy of connected and automated vehicles for on-ramp merging area based on cooperative game," *IEEE Trans. Intell. Transp. Syst.*, vol. 24, no. 11, pp. 13448–13461, Nov. 2023.

[A53] Y. Xiao, Q. Du, Y. Zhang, and C. Lu, "Secure vehicular communications with varying QoS and environments: A unified cross-layer policy-adaptation approach," *IEEE Trans. Intell. Transp. Syst.*, vol. 24, no. 11, pp. 13462–13471, Nov. 2023.

[A54] Q. Tao, G. Han, C. Lin, L. Wang, S. Huang, and C. Lu, "A scheme for cooperative-escort multi-submersible intelligent transportation system based on SDN-enabled underwater IoV," *IEEE Trans. Intell. Transp. Syst.*, vol. 24, no. 11, pp. 13472–13485, Nov. 2023.

[A55] I. Lashkov, R. Yuan, and G. Zhang, "Edge-computing-empowered vehicle tracking and speed estimation against strong image vibrations using surveillance monocular camera," *IEEE Trans. Intell. Transp. Syst.*, vol. 24, no. 11, pp. 13486–13502, Nov. 2023.

[A56] S. Zhao, D. Zhao, R. Liu, Z. Xia, B. Cheng, and J. Chen, "GMAT-DU: Traffic anomaly prediction with fine spatiotemporal granularity in sparse data," *IEEE Trans. Intell. Transp. Syst.*, vol. 24, no. 11, pp. 13503–13517, Nov. 2023.

Haibin Lv (Senior Member, IEEE) received the Ph.D. degree from the First Institute of Oceanography, State Oceanic Administration, in 1990. He is currently a Full Professor with the North China Sea Offshore Engineering Survey Institute, Ministry of Natural Resources North Sea Bureau, Qingdao, China. He has 30 years of research and practical experience in geoinformatics, image processing, the Internet of Things, marine surveying and mapping, evaluation, and assessment of the marine environment. He has completed more than 30 consulting and research projects in related fields. He has published more than 80 high-quality articles in journals, such as IEEE TRANSACTIONS ON INDUSTRIAL INFORMATICS, IEEE ACCESS, *Neurocomputing*, including five IEEE TII papers. He has won the Chinese National Oceanic Science and Technology Progress Award two times. He is an Editorial Board Member of *PLOS One*, *IET Image Processing*, and *PeerJ Computer Science*, and a Leading Guest Editor of IEEE TRANSACTIONS ON INTELLIGENT TRANSPORTATION SYSTEM, *Computers and Electrical Engineering*, and *The Journal of Supercomputing*. He is a reviewer of IEEE TRANSACTIONS ON INDUSTRIAL INFORMATICS, *IEEE Internet of Things*, IEEE ACCESS, *Multimedia Tools and Applications*, *PLOS One*, and *Scientific Reports*.

Jaime Lloret (Senior Member, IEEE) received the M.Sc. degree in physics from the University of Valencia, Valencia, Spain, in 1997, the postgraduate master's degree in corporative networks and systems integration from the Department of Communications in 1999, the M.Sc. degree in electronic engineering from the University of Valencia in 2003, and the Ph.D. (Dr.Ing.) degree in telecommunication engineering from the Polytechnic University of Valencia in 2006. He is currently a Cisco Certified Network Professional Instructor at the regional academy "Universidad Politécnica de Valencia (UPV)" in the Cisco Networking Academy Program (CNAP) and a Legal Main Contact of UPV-ADIF (local academy of the CNAP). He also teaches local area networks and systems integration at the "Escuela Politécnica Superior de Gandia" from the Polytechnic University of Valencia. He has been working as a network designer and an administrator in several companies. His academic interests and research interests include P2P networks, wireless local area networks, sensor networks, and routing protocols. He also researches educational approaches and strategies. He was awarded the prize of the Best Doctoral Student in the telecommunications area in 2006 according to the Social Council of the Polytechnic University of Valencia. Before concluding the Ph.D. thesis, he obtained the first place given by the Spanish Agency for Quality Assessment and Accreditation for the Campus of Excellence in the New Technologies and Applied Sciences Area.

Houbing Song (Fellow, IEEE) received the Ph.D. degree in electrical engineering from the University of Virginia, Charlottesville, VA, USA, in August 2012.

He is currently a tenured Associate Professor, the Director of the NSF Center for Aviation Big Data Analytics (Planning), the Associate Director for Leadership of the DOT Transportation Cybersecurity Center for Advanced Research and Education (Tier 1 Center), and the Director of the Security and Optimization for Networked Globe Laboratory (SONG Lab, www.SONGLab.us), University of Maryland, Baltimore County (UMBC), Baltimore, MD, USA. Prior to joining UMBC, he was a tenured Associate Professor of electrical engineering and computer science with Embry—Riddle Aeronautical University, Daytona Beach, FL, USA. He is an editor of eight books, the author of more than 100 articles, and an inventor of two patents. His research interests include cyber-physical systems/the Internet of Things, cybersecurity and privacy, and AI/machine learning/big data analytics. His research has been sponsored by federal agencies (including the National Science Foundation, U.S. Department of Transportation, and Federal Aviation Administration) and industry. His research has been featured by popular news media outlets, including IEEE GlobalSpec's *Engineering360*, Association for Uncrewed Vehicle Systems International (AUVSI), *Security Magazine, CXOTech Magazine*, Fox News, U.S. News and World Report, *The Washington Times, and New Atlas*.

Dr. Song is an ACM Distinguished Member (for outstanding scientific contributions to computing). He has been an ACM Distinguished Speaker since 2020, an IEEE Vehicular Technology Society (VTS) Distinguished Lecturer since 2023, and an IEEE Systems Council Distinguished Lecturer since 2023. He has been a Highly Cited Researcher identified by Clarivate in 2021 and 2022 and a Top 1000 Computer Scientist identified by Research.com. He received the Research.com Rising Star of Science Award in 2022 (World Ranking: 82; U.S. Ranking: 16) and the 2021 Harry Rowe Mimno Award. He was a recipient of more than ten best paper awards from major international conferences, including IEEE CPSCom-2019, IEEE ICII 2019, IEEE/AIAA ICNS 2019, IEEE CBDCom 2020, WASA 2020, AIAA IEEE DASC 2021, IEEE GLOBECOM 2021, and IEEE INFOCOM 2022. He has been serving as an Associate Editor for IEEE JOURNAL ON MINIATURIZATION FOR AIR AND SPACE SYSTEMS since 2020, IEEE INTERNET OF THINGS JOURNAL since 2020, IEEE TRANSACTIONS ON INTELLIGENT TRANSPORTATION SYSTEMS since 2021, and IEEE TRANSACTIONS ON ARTIFICIAL INTELLIGENCE since 2023. He was an Associate Technical Editor of *IEEE Communications Magazine* (2017–2020).