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EDITORIAL

IEEE ACCESS SPECIAL SECTION EDITORIAL: HUMAN-DRIVEN EDGE COMPUTING

The advent of Fifth Generation (5G) and the Internet of Things (IoT) is expected not only to make it possible to collect and disseminate information for various crowd-sensing services in densely populated environments but also to put forward a higher request on these services with the rapid evolution of artificial intelligence and edge computing, which provides cloud computing and cache capabilities to reduce the computational load of cellular networks, displacing it at the edges of such networks. However, the costs for deployment and maintenance of mobile edge computing (MEC) are still high. Human-driven edge computing (HEC) is a novel model which integrates the elements of human, devices, internet and information, and combines the power of MEC architecture and the large-scale sensing ability of mobile crowd-sensing (MCS). Realizing better data spreading and environmental coverage in smart cities based on HEC has aroused a great deal of research interest from academia and industry. Although the studies of human-driven edge computing for 5G and the IoT are attractive, there are many open research problems, such as fusion analysis, efficient resource usage, low latency communication, large-scale search, and data security and privacy.

It is obvious that HEC and intelligence will enable and promote a large class of applications and has emerged with a great potential to change our life and improve user's experience. This Special Section aims to report high-quality research on recent advances toward the realization of new models, architecture and framework of HEC, data fusion analysis and computing, emerging artificial intelligence (AI) techniques and its combination with HEC, and security and privacy challenges to cope with real-world challenges. This Special Section has provided a platform for researchers and practitioners from both academia and industry in the area of urban computing and intelligence.

The article entitled "Modeling and understanding the localization performance with network signatures," by Sun *et al.*, proposes a middleware WiLocWare to model and understand the performance of localization. The correlations between localization accuracy and network parameters are evaluated and characterized, including signal propagation, coverage of wireless radios, distributions of wireless devices, and density of the anchor nodes.

The article "A location and optimal coverage based filtering scheme in wireless sensor networks," by Liu *et al.*, presents a location and optimal coverage-based filtering scheme (LOCF), which first derives the optimal coverage degree by considering both the network size and covering efficiency and then employs the covering algorithm to deploy sensors accordingly. Simulation results show that LOCF outperforms existing works in terms of covering effectiveness, filtering efficiency, and compromise robustness.

In the article "Public auditing scheme with identity privacy preserving based on certificateless ring signature for wireless body area networks," by Zhao *et al.*, a certificateless ring signature scheme CLRS is proposed. In addition, a public auditing scheme with identity privacy protection is presented, which combines the certificateless ring signature technology for cloud-assisted body area networks. The comparison between theoretical analysis and experimental simulation shows that the scheme has obvious efficiency advantages compared with the existing schemes.

The article "Securing smart city surveillance: A lightweight authentication mechanism for unmanned vehicles," by Ali *et al.*, explores the significance of the Internet of Drones (IoD), which facilitates real-time data access to the users, especially surveillance data in smart cities using the current cellular networks. Using the lightweight symmetric key primitives and temporal credentials, an improved scheme (iTALAS) is then proposed.

In the article "Sensing cloud computing in Internet of Things: A novel data scheduling optimization algorithm," by Sun *et al.*, the authors address the issues of data matching deviation and load imbalance during the data scheduling process of the Internet of Things. Sensing cloud computing in the IoT, and a data scheduling optimization algorithm, is proposed. The effectiveness and stability of the algorithm are verified compared with other algorithms.

The article "Research on intelligent decision of low carbon supply chain based on carbon tax constraints in human-driven edge computing," by Liu *et al.*, establishes a basic decision-making model for the supply chain under the carbon tax constraint and compares and analyzes the optimal decision-making problem of the supply chain between the centralized and decentralized decisions of producers and retailers.

The article “Cooperative autonomous driving oriented MEC-aided 5G-V2X: Prototype system design, field tests and AI-based optimization tools,” by Ma *et al.*, presents a cooperative autonomous driving oriented MEC-aided 5G-Vehicle-to-Everything (V2X) prototype system, which is developed based on a next-generation radio access network (NG-RAN) experimental platform, a cooperative driving vehicle platoon, and a MEC server providing high-definition (HD) 3-D dynamic map service. The effectiveness of the proposed optimization tools is verified by real-world data and benchmark functions.

The article “Edge computing-based localization technique to detecting behavior of dementia,” by Barua *et al.*, exhibits an ultra-wideband (UWB)-based localization system based on the edge computing (EC) paradigm to analyze the wandering behavior of patients who are suffering from dementia on a large-scale basis. The result shows that the proposed system can achieve high accuracy in classification and is satisfactory for applications in the medical area.

In the article “Hybrid entangled states with multi-degree of freedom and high purity for Internet of Vehicles,” by Guo *et al.*, a single-mode fiber (SMF) is proposed to filter the topological charge non-zero photons and purify the polarization entangled photon pairs. Then, the purification setup with M-Z interferometer and beam rotator (BR) is presented, which can purify the polarization-OAM hybrid entangled states. Analysis indicates that the precise purity polarization-OAM hybrid entangled state can increase the fidelity of information and improve the anti-interference ability in this program without mutually unbiased bases (MUBs).

The article “Analysis of choice behaviors of railway shippers for freight services based on a fuzzy integrated choice and latent variable model,” by Jing *et al.*, focuses on the freight service products of China Railway Express (CRE) and private logistics enterprises (PLEs), and constructs a fuzzy integrated choice and latent variable (ICLV) model by combining a fuzzy comprehensive evaluation to analyze choice behaviors in freight services of railway shippers. The results of this study can fill the gaps in choice behaviors in freight services research on Chinese railway shippers.

The article “Wearable computing for defence automation: Opportunities and challenges in 5G network,” by Sharma *et al.*, conducts a study to identify the role of wearable computing for the defense automation system. The taxonomy of wearable computing in defense automation system is presented to explain the relationship of each attribute.

The article “Research on fault detection algorithm of pantograph based on edge computing image processing,” by Li focuses on the shortcomings of traditional pantographs in sliding plate wear and sliding plate crack detection, and presents an improved mean filtering algorithm to optimize the image of pantograph, and the adaptive Canny edge detection technology is used to accurately calculate the skateboard wear.

In the article “Influence of human visual perception and eye tracking motion on the quality of moving image in LCD,”

by Cui *et al.*, an improved method is proposed to calculate the response time of liquid crystal under the new backlight driving and modulation, which is more accurate than the traditional moving window integration method. This article also discusses the eye-tracking movement of the human visual system, including studying the influence of image content, size, motion speed, and motion direction, based on the human vision property study and the analysis of the simulation model of image motion artifacts perceived by human eyes.

In the article “Attention-based adaptive memory network for recommendation with review and rating,” by Liu *et al.*, an attention-based adaptive memory network (AAMN) model is presented to leverage historical reviews and ratings systemically. Specifically, an attention mechanism guided by the static features is proposed to learn the importance of different historical records for modeling the adaptive features of users and items.

The article “Distributed error correction of EKF algorithm in multi-sensor fusion localization model,” by Hu and Wu, focuses on solving the problem that the standard extended Kalman filter (EKF) algorithm has large errors in unmanned aerial vehicle (UAV) multi-sensor fusion localization. A multi-sensor fusion localization method is proposed based on adaptive error correction EKF algorithm. The adaptive degree is obtained according to the absolute value of the difference between the estimated value and the real value of EKF.

In the article “An improved AlexNet for power edge transmission line anomaly detection,” by Guo *et al.*, proposes an improved AlexNet model for anomaly detection, which extracts the characteristics of transmission line equipment through a deep convolutional neural network (DCNN). By referring to the advantages of the traditional machine learning method and incorporating the advantages of the support vector machine (SVM), an SVM classification method incorporating deep learning is proposed. The improved AlexNet model and the SVM classification method are used to classify images of various types of power equipment.

In the article “Dynamic optimization long short-term memory model based on data preprocessing for short-term traffic flow prediction,” by Zhang and Xin, a dynamic optimization long short-term memory (LSTM) model is proposed based on data preprocessing for short-term traffic flow prediction. A new classification algorithm named Asym-Gentle AdaBoost with cost-sensitive support vector machine (AGACS) is used for preprocessing traffic flow data, which tries to employ cost-sensitive SVM (CS-SVM) as weak component classifier in asymmetric gentle AdaBoost, and divides the data collection into outlier data and normal data.

The article “Two-stage spatial mapping for multimodal data fusion in mobile crowd sensing,” by Zhou *et al.*, proposes a fusion and classification method for multimodal data. First, a multimodal data space is constructed, and data of different modalities are mapped into the multimodal data space to obtain a unified representation of different modalities data. Then, through bilinear pooling, the representations of

different modality are fused, and the fused vectors are used in the classification task.

In the article “Securing demand response management: A certificate-based access control in smart grid edge computing infrastructure,” by Chaudhry *et al.*, an authentication scheme for demand response management (DRMAS) is proposed to counter threats and to provide efficiency, which provides necessary security requirements and resists known attacks. The proposed DRMAS is proven secure under formal analysis supplemented by a brief discussion on attack resilience.

In the article “Roof pressure prediction in coal mine based on grey neural network,” by Wang *et al.*, the compaction data of the roof of a mine return air working face in Xuzhou is taken as the experimental data, and an improved grey neural network model is proposed, which combines the grey theory with the neural network algorithm organically. The simulation results verify the effectiveness of the proposed scheme.

In the article “Soft decision cooperative spectrum sensing with entropy weight method for cognitive radio sensor networks,” by Lin *et al.*, a soft decision cooperative spectrum sensing with entropy weight method for cognitive radio sensor networks is presented. Initially, the sensor nodes are organized into logical groups to obtain energy efficiency and improved sensing performance. After receiving the soft sensing information from all member nodes, the cluster heads employ the equal gain soft combination for inter-cluster fusion and then forward the local decision to the fusion center. During the final decision, the entropy weight method is applied to Assign an optimal weight value to corresponding cluster local decisions.

In the article “A two-layer deep learning method for Android malware detection using network traffic,” by Feng *et al.*, a two-layer method is proposed to detect malware in Android APPs. The first layer is a permission, intent, and component information-based static malware detection model. It combines the static features with a fully connected neural network to detect malware. In the second layer, CACNN, which cascades CNN and Auto Encoder, is used to detect malware through network traffic features of APPs. The experimental results show that the two-layer method can not only achieve semi-supervised learning but also effectively improve the detection rate of malicious Android APPs.

In the article “Efficient, customizable and edge-based WebGIS system,” by He and Zhu, an edge computing-based WebGIS architecture is proposed to meet customization needs by applying the idea of SaaS. In this distributed architecture, the resource load is reasonably balanced between the server and the browser, which improves the overall performance of the system. Also, it utilizes edge computing to reduce the pressure on the server by sharing map tiles among WebGIS clients. The proposed WebGIS system can not only be customized and personalized as it is edge computing based but it is also usable for a large number of visits due to its distributed features.

In the article “Entity thematic similarity measurement for personal explainable searching services in the edge environment,” by Bai *et al.*, a semantic augmentation method is proposed with a double attention mechanism, which refers to a dynamic representation learning process that maps an entity to a real number vector in semantic space. A thematic similarity measure approach is employed to analyze the connotation and denotation similarities among entities. The model can make a separation among the entities from different domains effectively.

In the article “Secure cooperative spectrum sensing strategy based on reputation mechanism for cognitive wireless sensor networks,” by Luo, a secure cooperative spectrum sensing strategy is presented based on reputation mechanism for cognitive wireless sensor networks to counter the above kind of attack. The beta reputation model is applied to assign reputation value to cognitive sensor nodes according to their historical sensing behavior, and a dynamic trust evaluation scheme of cooperative spectrum sensing is established.

The article “Survival study on blockchain based 6G-enabled mobile edge computation for IoT automation,” by Sekaran *et al.*, focuses on recent work on blockchain-based 6G-enabled MEC, and estimates main challenges in the integration of Blockchain and IoT technologies to attain high-level solutions by addressing the shortcomings and limitations of IoT and Blockchain technologies.

In the article “Two-dimensional new communication technology for networked ammunition,” by Zhou *et al.*, a communication technology with two dimensions is proposed to improve the transmission data rate and the three-resistance characteristics of the network ammunition communication link. Orthogonal frequency division multiplexing (OFDM) is used for 1-D data transmission, and the G-function-driven subcarrier frequency change rule in differential frequency hopping (DFH) is used for 2-D data transmission. The theoretical analysis and simulation results show the effectiveness of the proposed scheme.

In the article “Energy-aware data gathering mechanism for mobile sink in wireless sensor networks using particle swarm optimization,” by Zhang and Li, an energy-aware data gathering mechanism is proposed for mobile sink in wireless sensor networks using particle swarm optimization. Experimental results show that the proposed method can meet the delay requirements and reduce the total energy consumption of the network.

The article “Human-driven dynamic community influence maximization in social media data streams,” by Ge *et al.*, proposes a multi-topic learning-based independent cascade model (MTL-IC), and a similarity priority mechanism-based event evolution model (SPM-EE). MTL-IC incorporates multi-topic factors and considers the authority and hub in interests of users, which makes the results more efficient and more accurate. SPM-EE can update the seed users according to their changeable interests in time.

In the article “Artificial intelligent multi-access edge computing servers management,” by Fragkos *et al.*, an

artificial intelligence-based MEC servers' activation mechanism is proposed, by adopting the principles of reinforcement learning (RL) and Bayesian reasoning. A human-driven peer-review-based evaluation of the edge computing system's provided services is also introduced based on the concept of Bayesian truth serum (BTS), which supports the development of a reputation mechanism regarding the MEC servers' provided services.

In the article "Security challenges and cyber forensic ecosystem in IoT driven BYOD environment," by Ali *et al.*, a strategic practical approach is presented to detect malicious activities so that organizations can adapt to protect critical infrastructure and smart city critical infrastructure. In order to achieve the goal of detecting malicious activities in BYOD environments, a simulation was performed in three phases.

The article "Privacy and utility preserving trajectory data publishing for intelligent transportation systems," by Liu and Zhu, presents (α, K) L-privacy model and an anonymization scheme aimed at identifying and eliminating violating privacy sub-trajectories (IEVS), to prevent privacy disclosure while preserving the accuracy and high quality of published trajectories. In particular, IEVS employs three anonymization techniques, i.e., trajectory splitting, location suppression, and sensitive value generalization to eliminate all sub-trajectories violating (α, K) L-privacy principle.

In the article "An enhanced cooperative spectrum sensing scheme against SSDF attack based on Dempster-Shafer evidence theory for cognitive wireless sensor networks," by Yao *et al.*, an enhanced cooperative spectrum sensing scheme against SSDF attacks based on the Dempster-Shafer evidence theory for cognitive wireless sensor networks is introduced. Simulation results demonstrate that the proposed method can resist SSDF attacks significantly and outperforms the traditional secure schemes in the aspect of sensing accuracy.

The article "Deep learning enabled data offloading with cyber attack detection model in mobile edge computing systems," by Gopalakrishnan *et al.*, presents a new deep learning (DL)-based traffic prediction model that includes a data offloading mechanism with a cyber-attack detection (DLTPDO-CD) technique. The proposed model involves three major processes: traffic prediction, data offloading, and attack detection. The experimental outcome stated the superiority of the presented model over the compared methods under different dimensions.

In the article "A research on the indoor rotating arc triangle positioning algorithm based on RSSI," by Wang *et al.*, an indoor positioning algorithm with a rotating arc triangle layout is proposed to improve the indoor positioning accuracy of wireless sensor networks, which uses a circular arc triangle to deploy the beacon nodes and changes the position of the beacon nodes by rotating.

In the article "MEMO box: Health assistant for depression with medicine carrier and exercise adjustment driven by edge computing," by Luan *et al.*, a health management assistant MEMO box system is proposed that focuses on emotion and takes smart medicine box as carrier. Specifically, the MEMO

box system is composed of an electronic medicine box and a smart application for phones. The electronic medicine box can collect the multi-mode data of patients, which provides a data basis for the health assistant.

The article "Research on resource optimization of music multi-terminal based on edge computing," by Wang, proposes a resource optimization scheme based on edge computing. A music multi-terminal architecture is presented through a wireless sensor network to perform wireless transmission of related data and information. A music multi-terminal resource optimization model based on edge computing is proposed, which can perform fast computing and storage tasks at the edge of the music wireless network.

In the article "Trust research on behavior evaluation based on fuzzy similarity," by Li *et al.*, a trust model based on fuzzy similarity is proposed in accordance with the features of node behaviors. The evaluation message is presented to various nodes, and the theory of fuzzy similarity is applied to process the evaluation message. Through integrating these evaluation messages, the rules of node behaviors are obtained. For malicious and selfish nodes, the trust update algorithm is proposed.

The article "Optimization of task offloading strategy for mobile edge computing based on multi-agent deep reinforcement learning," by Lu *et al.*, designs the MEC model of mobile devices with random mobility and hybrid access point (HAP) with data transmission and energy transmission. The selection of the target server and the amount of data offloading are taken as the learning objectives, and the task offloading strategy based on multi-agent deep reinforcement learning is constructed. The experimental results show that the improved algorithm has good stability and convergence.

In the article "Energy-efficient cooperative spectrum sensing strategy for cognitive wireless sensor networks based on particle swarm optimization," by Cao and Pan, a cooperative spectrum sensing strategy for cognitive wireless sensor networks (CWSNs) based on particle swarm optimization is proposed. To avoid local optimization in the process of problem solving, a Cauchy mutation method is introduced to optimize the parameter selection of fitness function.

The article "Research on aided reading system of digital library based on text image features and edge computing," by Shi and Zhu, presents a digital library assisted reading system to improve the service quality and experiences of users, which combines text image features and edge computing and improves the service quality and information transmission level of the digital library. The auxiliary reading model of the digital library is presented based on text image features and RBF neural network.

The last article titled "Research on adaptive energy-efficient reference broadcasting synchronization," by Sun *et al.*, proposes an adaptive energy-efficient reference broadcasting synchronization method (AERBS) for WSNs, aiming to reduce energy consumption while improving synchronization precision. Moreover, the proposed method can

reduce the number of synchronization information exchanges and self-adaptively determine the re-synchronization cycle.

In conclusion, we are thankful to all the research scholars who submitted their original articles to this Special Section. Along with this, we are also extremely appreciative of the contributions and time spent by the respective reviewers for their constructive comments, recommendations, and suggestions. Furthermore, we also would like to acknowledge the cooperation of the IEEE ACCESS editorial staff members, as well as the guidance from the Editor-in-Chief. Moreover, we hope that this Special Section “Human-Driven Edge Computing” will contribute to the knowledge base and will benefit the research community at large.

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