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Editorial: Collaborative Computing in AI Empowered Mobile Networks

Xiaoxian Yang[1] · **Li Kuang**[2]

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1 Editorial comment:

The collaborative computing of AI Empowered Mobile Networks includes a bunch of interdisciplinary emerging techniques for networking and communications, such as wireless connection, big data analytics, safety and privacy, and load-balanced routing, as well as the application to the unmanned vehicle and global networking. This special issue accepted six papers for publication from open submissions. A summary of these accepted papers is outlined below.

The first paper titled 'Resource Optimization and Device Scheduling for Flexible Federated Edge Learning with Tradeoff between Energy Consumption and Model Performance' adds a workload constraint and proposes a resource optimization and device scheduling strategy, achieving the tradeoff between energy consumption (EC) and model performance of FEEL(flexible federated edge learning). The strategy is based on the steepest descent method and approximation algorithm. When regulating the training workload threshold, the values of the two metrics are dynamically adjusted. Simulation results show that the proposed strategy achieves the tradeoff compared to two existing FEEL frameworks.

The second paper titled 'AFCC-r: Adaptive Feedback Congestion Control Algorithm to Avoid Queue Overflow in LTE Networks' proposes a virtual queue management algorithm that recalculates the average queue value and the packet dropping probability according to different traffic loads, solving the queue delay and queue overflow problem to provide a balance between throughput, delay, and packet data fraction. Simulation results illustrate that the proposed algorithm reduces the delay of the packets and increases fairness among users compared to the Drop-tail, Random Early Drop, Controlled Delay, Proportional Integral Controller Enhanced, and Packet Limited First-In-First-Out Queue algorithms.

The third paper titled 'Channel Switching Cost-Aware Energy Efficient Routing in Cognitive Radio-Enabled Internet of Things' investigates the routing path selection problem in CR-IoT networks under the assumption that there are customized CR-IoT devices with a single transceiver in the network. A greedy algorithm is proposed that CR-GreedyRPL (Cognitive Radio Enabled Greedy Routing Protocol for Low-power and Lossy Networks). Link capacity maximization and energy consumption minimization are ensured which considers the channel switching latency. The proposed algorithm performs with Objective Functions (OFs) during parent selection and finding the optimal path. The experiment shows that the proposed algorithm has better performance in terms of energy consumption and energy efficiency metrics when compared to the RPL, RPL-Sw, and WPR algorithms.

The fourth paper titled 'An Intelligent Pilot Contamination Attacker Defender Model for Wireless Networks: A Stackelberg Game Based Approach' analyzes the behaviors of the attacker and legitimate user with limited energy in the system, and defines their utilities on energy loss and data eavesdropping. The authors model intelligent pilot contamination attacker-defender confrontation as an anti-PCA Stackelberg game, in which Bob as the leader first determines its pilot transmit power while Eve as the follower chooses its PCA power based on its observed action from Bob. Two equilibriums under different strategy spaces are analyzed. Simulation results show that the proposed scheme can defend against an intelligent active eavesdropper with a higher secrecy rate and utility.

The fifth paper titled 'Deadline-aware Cache Placement Scheme using Fuzzy Reinforcement Learning in Device-to-Device Mobile Edge Networks' studies a realistic scenario with user devices moving at various velocities. The authors

✉ Xiaoxian Yang
xxyang@sspu.edu.cn

Li Kuang
kuangli@csu.edu.cn

[1] School of Computer and Information Engineering, Shanghai Polytechnic University, Shanghai, China

[2] School of Computer Science and Engineering, Central South University, Changsha, China

formulate the cache placement problems as maximization of saved delay with capacity and deadline constraints by considering the contact duration and inter-contact time among the user devices. An on-policy learning integrated fuzzy logic-based caching scheme is designed to handle the high dimensionality of the proposed integer linear programming problem. Simulation results demonstrate that the proposed cooperative caching mechanism significantly improves the performance in terms of reward, acceleration ratio, hit ratio, and offloading ratio compared with existing mechanisms.

The sixth paper titled 'Differential Privacy Enabled Deep Neural Networks for Wireless Resource Management' considers how to determine the effect of differential privacy in neural network-based power allocation schemes. The framework is proposed with two DNN architectures, mainly multi-layer perceptron (MLP) network and convolutional neural network (CNN). It aims to incorporate appropriately calibrated noise to reduce the sensitivity of the gradients. The framework also can solve the high computational time problem of the iterative algorithm. Evaluation illustrates that the proposed framework facilitates the design of privacy-enabled resource management in different-sized wireless networks.

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Xiaoxian Yang received a Ph.D. in Management Science and Engineering from Shanghai University, China, in 2017. She is currently an associate professor at Shanghai Polytechnic University, China. Dr. Yang's research interests include business process management, formal verification, wireless networks, and mobile health. She has published more than 20 papers in academic journals, such as IEEE TITS, IEEE TCSS, ACM TOMM, ACM TOIT, FGCS, MONET, IJSEKE, FGCS, and COMNET. Dr. Yang has participated in organizing international conferences and workshops, such as CollaborateCom 2018–2022, ChinaCom 2019–2020, and Mobicase 2019–2020. She has worked as lead guest editor for MONETWINE, and JIT, and served as a reviewer for IEEE TII, IEEE T-ITS, IEEE T-ASE, IEEE JBHI, FGCS, PPNA, Wireless Networks, COMPUTER NETWORK, etc.

Li Kuang received a Ph.D. in Computer Science from Zhejiang University, China, in 2009. She is currently a professor in the School of Computer Science and Engineering, Central South University. Her research interests include service computing, mobile computing, and privacy preservation.