DL Series Talks -- Connecting People/Things/Vehicles
Vehicular Technology Chapter
IEEE Toronto Section

After two-years' online events, IEEE Vehicular Technology Chapter of IEEE Toronto Section, is pleased to announce our first in-person Distinguished Lecturer (DL) Series Talks on June 23, 2022, for a theme as Connecting People/Things/Vehicles.

This in-person series of talks will be a great opportunity to meet and chat and exchange with our International and National visitors, colleagues, and Chapter members in Toronto area. Details of the events are given below. All are welcome!

Time: 1:30-5:35pm, Thursday, June 23, 2022.

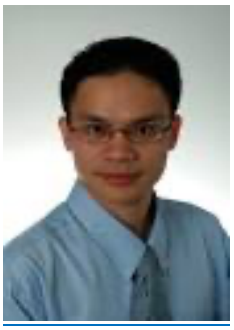
Location: DCC204 (Daphne Cockwell Health Sciences Complex, 288 Church Street, Toronto) at Toronto Metropolitan University (formerly Ryerson University). The program is listed below.

	Program	Chair
1:30-1:33	Opening and welcome	
1:33-2:15	Dr. Duist Niyato, "Metaverse virtual service management: game theoretic approaches"	Dr. Khalid Hafeez
2:15-3:00	Dr. Jelena Mišić, "Blockchain in IoT based on practical Byzantine fault tolerance"	Dr. Khalid Hafeez
3:00-3:15	Break	
3:15-3:45	Dr. Ping Wang, "Towards Fast-Convergent Federated Learning with non-IID data"	Dr. Jie Gao
3:45-4:15	Dr. Hina Tabassum, "Mobility-Aware Performance Optimization for Next Generation Vehicular Networks"	Dr. Jie Gao
4:15-4:30	Break	
4:30-5:00	Dr. Lian Zhao, "Computing offloading and task scheduling at network edge"	Dr. Ajmery Sultana
5:00-5:30	Dr. Jie Gao, "Network Planning: from Slicing to Digital Twin"	Dr. Ajmery Sultana
5:30-5:33	Closing remark	

Organization committee: Lian Zhao, Khalid Hafeez, Ajmery Sultana
Chair/Vice-Chairs for Vehicular Technology Chapter, IEEE Toronto Section
Please have free-registration at: https://events.vtools.ieee.org/m/315853

Aknowledgement: Great thanks for the leadership and financial support from DL Program of IEEE Vehicular Technology Society (VTS), VTS Chapter Support Program, and IEEE Toronto Section

Speaker: Dr. Dusit (Tao) Niyato, Nanyang Technological University
Fellow, IEEE and IET



Title: Metaverse virtual service management: game theoretic approaches

Abstract: Metaverse is the next-generation Internet after the web and the mobile network revolutions, in which humans (acting as digital avatars) can interact with other people and software applications in a three-dimensional (3D) virtual world. In this presentation, we first briefly introduce major concepts of Metaverse and the virtual service management. Then, we discuss applications of game theory in the virtual service management. First, we consider that virtual reality (VR) users in the wireless edge-empowered Metaverse can immerse themselves in the virtual through the access of VR services offered by different providers. The VR service providers (SPs) have to optimize the VR service delivery efficiently and economically given their limited communication and computation resources. An incentive mechanism can be thus applied as an effective tool for managing VR services between providers and users. Therefore, we propose a learning-based incentive mechanism framework for VR services in the Metaverse. Second, we consider virtual services provided through the digital twin, i.e., a digital replication of real-world entities in the Metaverse. The real-world data collected by IoT devices and sensors are key for synchronizing the two worlds. A group of IoT devices are employed by the Metaverse platform to collect such data on behalf of virtual SPs. Device owners dynamically select a VSP to maximize rewards. We adopt hybrid evolutionary dynamics, in which heterogeneous device owner populations can employ different revision protocols to update their strategies. To this end, we discuss some important research directions in Metaverse virtual service management.

Speaker Biography: Dusit Niyato is a professor in the School of Computer Science and Engineering, Nanyang Technological University, Singapore. He received his Ph.D. in ECE from the University of Manitoba in 2008. Dusit's research interests are in the areas of distributed collaborative machine learning, Internet of Things (IoT), edge intelligent metaverse, mobile and distributed computing, and wireless networks. Dusit won the Best Young Researcher Award of IEEE Communications Society (ComSoc) Asia Pacific, 2011 IEEE ComSoc Fred W. Ellersick Prize Paper Award, the IEEE Computer Society Middle Career Researcher Award for Excellence in Scalable Computing in 2021, and Distinguished Technical Achievement Recognition Award of IEEE ComSoc in 2022. Currently, Dusit is serving as Editor-in-Chief of IEEE Communications Surveys and Tutorials, an area editor of IEEE Transactions on Vehicular Technology, editor of IEEE Transactions on Wireless Communications, associate editor of IEEE Internet of Things Journal, IEEE Transactions on Mobile Computing, IEEE Wireless Communications, IEEE Network, and ACM Computing Surveys. He is a Fellow of IEEE and a Fellow of IET.

Speaker: Jelena Mišić, Toronto Metropolitan University
Fellow, IEEE
IEEE VTS Distinguished Lecturer

Title: Adapting Practical Byzantine Fault Tolerance (PBFT) for use with Blockchain-enable IoT systems

Abstract: This work proposes Practical Byzantine Fault Tolerance (PBFT) ordering service needed for block formation in permissioned blockchain environments. Contrary to current PBFT implementations that only provide a single point of entry to the ordering service, we allow each ordering node to act as an entry point that proposes and conducts the consensus process of including new record in the distributed ledger. To ensure atomicity of record insertion in distributed ledger, we have developed a bandwidth reservation protocol that uses a modification of CSMA/CA protocol to regulate access to the broadcast medium formed by the P2P network of TCP connections between orderers. We have modeled record insertion service time in a cluster where ordering nodes have random position within Cartesian coordinate system. We have also modeled total request access time to the ledger which includes waiting time in the ordererís queue and record insertion time. These models are used to evaluate system performance under variable request rate ordering service, variable number of nodes and variable physical cluster dimensions. We also address cluster interconnections which can increase coverage and capacity of PBFT system.

Speaker Biography: Jelena Mišić is a Professor in the Department of Computer Science at Ryerson University, Canada. She received her PhD in Computer Engineering from University of Belgrade, Serbia, in 1993. She is an internationally recognized expert in the area of IoT, blockchain, wireless networking and network security, where she has authored or co-authored four books, 155+ journal papers, 24 book chapters, and 215+ conference papers. She has chaired more than a dozen major international events and guest-edited more than a dozen special issues of various journals. She serves on the editorial boards of IEEE Transactions on Vehicular Technology, IEEE Internet of Things Journal, IEEE Transactions on Emerging Topics in Computing, IEEE Network, ACM Computing Surveys and Ad Hoc Networks journal (published by Elsevier). She is an IEEE Fellow, ACM member and serves as IEEE VTS distinguished lecturer.

Speaker: Dr. Ping Wang, York University
Fellow, IEEE
IEEE VTS Distinguished Lecturer

Title: Towards Fast-Convergent Federated Learning with non-IID data

Abstract: In order to maintain privacy-sensitive data and to facilitate collaborative machine learning (ML) among distributed nodes, Federated Learning (FL) has emerged as an attractive paradigm, where local nodes collaboratively train a task model under the orchestration of a central server without accessing end-user data. However, the non-independent and-identically-distributed (non-IID) data samples across participating nodes slow model training and impose additional communication rounds for FL to converge. In this talk, I will present our recent efforts in addressing this issue, aiming to accelerate model convergence under the presence of nodes with non-IID dataset. Firstly, we propose an adaptive weighting strategy that assigns weight proportional to node contribution instead of according to the size of local datasets. It can reinforce positive (suppress negative) node contribution dynamically, leading to a significant communication round reduction. Secondly, we design a probabilistic node selection scheme that can preferentially select nodes to boost model convergence of FL with non-i.i.d. datasets. The proposed scheme adjusts the probability for each node to be selected in each round based on measuring the relationship between the local gradient and the global gradient from participating nodes. The superiority of the proposed approaches over the commonly adopted Federated Averaging (FedAvg) algorithm has been verified by extensive experimental results.

Speaker Biography: Dr. Ping Wang is an Associate Professor at the Department of Electrical Engineering and Computer Science, York University, and a Tier 2 York Research Chair. Prior to that, she worked with Nanyang Technological University, Singapore, from 2008 to 2018. Her research interests are mainly in the area of wireless communication networks, cloud computing and Internet of Things with the recent focus on integrating Artificial Intelligence (AI) techniques into communications networks. She has published more than 250 papers/conference proceedings papers. Her scholarly works have been widely disseminated through top-ranked IEEE journals/conferences and received the Best Paper Awards from IEEE Wireless Communications and Networking Conference (WCNC) in 2022, 2020 and 2012, from IEEE Communication Society: Green Communications & Computing Technical Committee in 2018, and from IEEE International Conference on Communications (ICC) in 2007. Her work received 21,000+ citations with H-index 70 (Google Scholar). She is an IEEE Fellow and a Distinguished Lecturer of the IEEE Vehicular Technology Society.

Speaker: Dr. Hina Tabassum, York University

Title: Mobility-Aware Performance Optimization for Next Generation Vehicular Networks

Abstract: Vehicle-to-Infrastructure (V2I) communication is becoming critical for the enhanced reliability of autonomous vehicles (AVs). However, the uncertainties in the road-traffic and AVs' wireless connections can severely impair timely decision-making. It is thus critical to simultaneously optimize the AVs' network selection and driving policies in order to minimize road collisions while maximizing the communication data rates. This talk will demonstrate a reinforcement learning (RL) framework to characterize efficient network selection and autonomous driving policies in a multi-band vehicular network (VNet) operating on conventional sub-6GHz spectrum and Terahertz (THz) frequencies. The proposed framework is designed to maximize the traffic flow and minimize collisions by controlling the vehicle's motion dynamics (i.e., speed and acceleration) from autonomous driving perspective, and maximize the data rates and minimize handoffs by jointly controlling the vehicle's motion dynamics and network selection from telecommunication perspective. Numerical results demonstrate interesting insights related to the inter-dependency of vehicle's motion dynamics, handoffs, and the communication data rate. The proposed policies enable AVs to adopt safe driving behaviors with improved connectivity.

Speaker Biography: Hina Tabassum is an Assistant Professor at the Lassonde School of Engineering, York University, Canada. Prior to that, she was a PDF at the Department of ECE, University of Manitoba, Canada. She received her PhD degree from King Abdullah University of Science and Technology (KAUST) in 2013. She is a Senior member of IEEE and a P.ENG in the province of Ontario. She has published over 70 technical articles in well-reputed IEEE journals and conferences. She is the founding chair of a special interest group on THz communications in IEEE ComSoc: Radio Communications Committee (RCC). She has been recognized as an Exemplary Editor by IEEE Communications Letters, 2020, and an Exemplary Reviewer (Top 2% of all reviewers) by IEEE Transactions on Communications in 2015-2017, 2019, and 2020. Currently, she is serving as an Associate Editor in IEEE Communications Letters, IEEE Transactions on Green Communications, IEEE Communications Surveys and Tutorials, and IEEE Open Journal of Communications Society. Her research interests include stochastic modeling, analysis, and optimization of energy efficient multi-band 5G/6G wireless networks jointly operating on sub-6GHz, millimeter, and Terahertz frequencies with applications to vehicular, aerial, and satellite networks.

Speaker: Lian Zhao, Toronto Metropolitan University
IEEE VTS Distinguished Lecturer (starting from July 2022)
IEEE ComSoc Distinguished Lecturer (2020-2021)

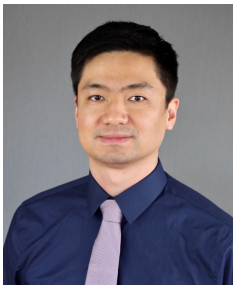
Title: Computing offloading and task scheduling at network edge

Abstract: Mobile edge computing (MEC) is an emergent architecture, which brings computation and storage resources to the edge of mobile network and provides rich services and applications in the proximity of the mobile users. In this talk, motivation for task offloading and edge computing is introduced. Followed by two case studies for task scheduling and resource management for IoV and IoT networks respectively. For the IoV network, a proactive indexed-based scheduling scheme, considering the predicted future vehicle mobility dynamics using deep reinforcement learning (DRL) approach, is proposed to schedule the offloaded tasks. For the IoT network, user collaboration is considered. A joint offloading decision and resource management scheme, inspired from bio-optimization and DRL, is proposed to minimize the total system operation energy consumption.

Speaker Biography: **Lian Zhao** received her Ph.D. degree from the Department of Electrical and Computer Engineering (ELCE), University of Waterloo, Canada, in 2002. She joined the Department of Electrical, Computer, & Biomedical Engineering at Toronto Metropolitan University (formerly Ryerson University), Toronto, Canada, in 2003 and as a professor in 2014. She has been a distinguished lecture for IEEE Communication Society (ComSoc) (2020-2021) and IEEE Vehicular Technology Society (VTS) (starting July 2022). She has been serving as an Editor for IEEE Trans. on wireless communication, Trans. on vehicular technologies, and IEEE Internet of Things Journal. She has served various Chair positions in organizating IEEE conferences.

She received the Best Land Transportation Paper Award from IEEE Vehicular Technology Society in 2016; Best Paper Award from the 2013 International Conference on Wireless Communications and Signal Processing (WCSP) and Best Student Paper Award (with her student) from Chinacom in 2011; the Canada Foundation for Innovation (CFI) New Opportunity Research Award in 2005. She is a licensed Professional Engineer in the Province of Ontario, a senior member of the IEEE ComSoc and VTS.

Speaker: Jie Gao, Carleton University (starting from July 2022)



Title: Network Planning: from Slicing to Digital Twin

Abstract: Service-specific network planning is essential for 5G and beyond since the same network has to simultaneously support a variety of services. Unlike real-time network operations, network planning faces unique challenges such as the large scale and the lack of accurate information. This presentation introduces ideas on fine-grained and flexible network planning for future networks. Specifically, for network planning with network slicing, designs to improve planning granularity along space, time, and slice dimensions are presented. The role of data-driven methods and the potential of digital twins in network planning for meeting diverse service requirements and improving resource utilization are also highlighted.

Speaker Biography: Jie Gao received his Ph.D. degree in electrical and computer engineering from the University of Alberta, Edmonton, AB, in 2014. He was an NSERC postdoctoral fellow with Toronto Metropolitan University (formerly Ryerson University), Toronto, ON, from 2017 to 2019, a research associate with the University of Waterloo, Waterloo, ON, from 2019 to 2020, and an assistant professor with Marquette University, Milwaukee, WI, USA, from 2020 to 2022. He will join the School of Information Technology, Carleton University, Ottawa, ON, in July 2022. Dr. Gao's research interests include machine learning for communications and networking, cloud and multi-access edge computing, Internet of Things (IoT) and industrial IoT solutions, and next-generation (6G) wireless networks in general. He is a senior member of IEEE, a member of IEEE ComSoC and IEEE VTS, and the Lead Associate Editor for the Vehicular Technology Society Section in IEEE Access.