WOCC 2023

The 32nd Wireless and Optical Communications Conference (WOCC 2023)
May 5th - May 6th, 2023
Newark, New Jersey, USA

www.wocc.org

Welcome Message

On behalf of the Wireless and Optical Communications Conference (WOCC) Planning Committee, we welcome you to our 32nd annual event, the WOCC 2023.

Under the theme of "Exploring Intelligent Communication Networks and the Smart World", the WOCC 2023 features four keynote speeches, highlighting the latest technology advances and potentials on wireless and optical communications, machine learning and AI in communications: "High Capacity Optical Communications" by Prof. William Shieh of Westlake University / University of Melbourne; "Integrated Sensing and Communication (ISAC): A Radar-Enabled Backscatter Communication (RadBackCom) Approach" by Prof. Xiaodong Wang of Columbia University; "5G Advanced Opportunities, Challenges, and Vision for 6G" by Dr. Ozge Koymen of Qualcomm, USA; and "Exploring Wireline and Wireless Convergence" by Dr. Larry Zhou of AT&T, USA.

The WOCC2023 will present invited and peer reviewed papers on three parallel symposiums: Wireless Networks and Communications, Optical Communications and Networks, and Machine Learning and Artificial Intelligence in Communications. Papers presented will be included in WOCC 2023 Conference Proceedings published in IEEE Xplore Digital Library. WOCC Charles K. Gao Best Paper Awards will be given to selected high quality papers. The WOCC has become a major event for telecommunications professionals both in the U.S. and the Asia-Pacific region throughout the last two decades. This conference provides an excellent forum and opportunity for presenting new research results, discussing emerging technologies, innovative research ideas, and networking among telecommunications professionals.

The WOCC 2023 will be held as a hybrid conference with both in-person and online presentations. However, the quality and integrity of the research content and conference organization will remain. Thank you for your support of our shared mission to advance technology for humanity. We hope your participation in the WOCC2023 is a productive and rewarding experience. Thank you for your involvement and contribution in making our WOCC 2023 Conference a success.

Meilong Jiang, Qualcomm
Conference Co-chair

Zhanyang Zhang, City University of New York
Conference Co-chair

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Wei Zou	Xi'an Jiaotong University

PROGRAM AT A GLANCE

WOCC, Friday, May 5, 2023

10:30–12:30	**Keynote Sessions, Room 240**		
10:30–11:30	**K1** **Keynote Session** (*Chair: Jessica Jiang*) **Room 240** Keynote Zoom Link	Prof. William Shieh, IEEE Fellow and OSA Fellow, Westlake University / University of Melbourne. *"High-Capacity Optical Communications"*	
11:30–12:30	**K2** **Keynote Session** (*Chair: Meilong Jiang*) **Room 240** Keynote Zoom Link	Dr. Ozge Koymen, Senior Director, Qualcomm, USA, *"5G Advanced Opportunities, Challenges, and Vision for 6G"*	
12:30–13:30	**Lunch**		
13:00	**Welcome Remarks, Room 240, Prof. Atam P Dhawan, Interim Provost and Senior Executive Vice President, NJIT**		
13:30–15:10	**W1** **Emerging Wireless Technologies** *Chair: Xiao-Feng Qi, University of Delaware & Phase Sensitive Innovations*, **Room 225**	**O1** **Advances in Optical Networking** *Chair: Kevin Lu, Stevens Institute of Technology* **Room 230**	**M1** **Emerging Applications of Machine Learning and AI** *Chair: Ying Tang, Rowan University* **Room 235**
15:10–15:30	**Break**		
15:30–17:30	**W2** **Coding and Modulation** *Chair: Tao Han, NJIT* **Room 225**	**O2** **Optical Communications and Photonic devices** *Chair: Liang Zhang, George Mason University* **Room 230**	**M2** **Advance in Machine Learning and its Application** *Chair: Jiacun Wang, Monmouth University,* **Room 235**

WOCC, Saturday, May 6, 2023

10:30–10:40	**Best Paper Award Ceremony, Room 240 Kevin Lu, Stevens Institute of Technology,** Keynote Zoom Link		
10:40–11:40	**K3** **Keynote Session** (*Chair:Zhanyang Zhang,* **Room 240**) Keynote Zoom Link	Prof. Xiaodong Wang, IEEE Fellow, Columbia University. *"Integrated Sensing and Communication (ISAC): A Radar-enabled Backscatter Communication (RadBackCom) Approach"*	
11:40–12:40	**K4** **Keynote Session** (*Chair: Mengchu Zhou,* **Room 240**) Keynote Zoom Link	Dr. Larry Zhou, AT&T Fellow, AT&T, USA, *"Wireline and Wireless Convergence"*	
12:40–13:30	Lunch		
13:30–15:10	W3 **Wireless for Autonomous Systems** *Chair: Marcus Wong, OPPO* **Room 225**	O3 **Emerging Applications of Networks** *Chair: Yuanqiu Luo, Futurewei Technologies* **Room 230**	**M3** **Machine Learning for Communication** *Chair: Yao Ma, New Jersey Institute of Technology,* **Room 235**
15:10–15:30	*Break*		
15:30–17:30	W4 **Advanced MIMO and Beamforming Technologies** *Chair: Ang Gao, Northwestern Polytechnical University* **Room 225**		

K – Keynote **(Room 240)**	W – Wireless Networks and Communications **(Room 225)**	O – Optical Communications and Networks Symposium **(Room 230)**	ML and AI in Communications **(Room 235)**

WOCC Technical Sessions – Friday, May 05, 2023, 13:30 – 15:10

W1 Emerging Wireless Technologies, Room 225

Session Zoom Link

Chair Xiao-Feng Qi
University of Delaware
& Phase Sensitive Innovations

C-RAN at Millimeter Wave and Above: Full Beamspace Radio Access Architecture **(Invited)**
Xiao-Feng Qi; Janusz Murakowski, Garrett Schneider and Dennis W. Prather
University of Delaware & Phase Sensitive Innovations, Inc.

Enhancing 5G Core with Multi-Access Edge Computing
Ho-Cheng Lee, Fuchun Joseph Lin, Jyh-Cheng Chen, Chien Chen and Patrick Wang
National Yang Ming Chiao Tung University, Taiwan

DRL-based Joint Optimization for Energy Efficiency Maximization in UAV-NOMA Networks
Shuhua Liu, Ang Gao and Qinyu Wang
Northwestern Polytechnical University, China;
Yansu Hu
Chang'an University, China

Deep Interference Recognition for Spread Spectrum Communications using Time-Frequency Transformer
Yi Wei
Zhejiang University, China;
Xiaoxiao Zhuo
Shanghai Institute of Microsystem and Information Technology, Chinese Academy of Sciences, China

O1 Advances in optical networking, Room 230

Session Zoom Link

Chair: Kevin Lu
Stevens Institute of Technology

A Novel Multi-Objective Routing Scheme based on Cooperative Multi-Agent Reinforcement Learning for Metaverse Services in Fixed 6G
Xueming Zhou, Bomin Mao, and Jiajia Liu
Northwestern Polytechnical University, China

On the Generalization of Machine-Learning-aided QoT Estimation in Optical Networks ***(invited)***
Hanyu Gao **SYSU, China**;
Liang Zhang, **George Mason University, USA;**
Xiaoliang Chen, **Sun Yat-Sen University, USA;**
Zhaohui Li , **Sun Yat-sen University, China**

Slotted Aloha for Optical Wireless Communications in Internet of Underwater Things
Milica Petkovic,**University of Novi Sad, Serbia**;
Sotiris A. Tegos and, Panagiotis D. Diamantoulakis
Aristotle University of Thessaloniki, Greece; Dejan Vukobratović, **University of Novi Sad, Serbia;**
Erdal Panayirci, **Kadir Has University, Turkey;**
Čedomir Stefanović
Aalborg University, Denmark;
George K. Karagiannidis
Aristotle University of Thessaloniki, Greece

Recent progress in optical access and home networking standards ***(invited)***
Frank Effenberger
Futurewei Technologies, USA

M1 Emerging Applications of Machine Learning and AI, Room 235

Session Zoom Link

Chair: Ying Tang,
Rowan University

Hierarchical Deep Reinforcement Learning with Experience Sharing for Metaverse in Education **(Invited)**
Ryan Hare and Ying Tang
Rowan University, USA

Introduction to AI Techniques for Forecasting Epidemic Dynamics
Lijing Wang **(Invited)**
New Jersey Institute of Technology, USA

Hands-on Active Learning Approach to Teach Artificial Intelligence/Machine Learning to Elementary and Middle School Students
Neelu Sinha; Ryan F Evans; Mackenzie Carbo
Fairleigh Dickinson University, USA

Deep Learning for the Detection of Emotion in Human Speech: The Impact of Audio Sample Duration and English versus Italian Languages **(Invited)**
Alexander Wurst; Michael Hopwood; Sifan Wu; Fei Li; Yu-Dong Yao
Stevens Institute of Technology, USA

Parallel Session 2 of 4

WOCC Technical Sessions – Friday, May 05, 2023, 15:30 – 17:30

W2 Coding and Modulation, Room 225

Session Zoom Link

Chair: Tao Han
Stevens Institute of Technology

Combined Signal Representations for Modulation Classification Using Deep Learning: Ambiguity Function, Constellation Diagram, and Eye Diagram **(Invited)**
Abdullah Samarkandi, Alhussain Almarhabi, Hatim, Alhazmi and Yu-Dong Yao
Stevens Institute of Technology, USA

Estimate BLER for Coded Modulation Based on Finite Block Coding **(Invited)**
Eva C. Song∗ and Guosen Yue†
∗Walmart Inc. and †Google LLC

Construction of Shortened Systematic PAC Codes Based on Monte-Carlo Algorithm **(Invited)**
Ziqi Qiu and Yejun He
Shenzhen University, China

Improved Stack Decoding for PAC Codes **(Invited)**
Li Zhang, Haina Liu and Yejun He
Shenzhen University, China

O2 Optical Communications and Photonic Devices, Room 230

Session Zoom Link

Chair: Liang Zhang,
George Mason University

Free Space Optics as Full Duplex Fronthauling for Drone-Assisted Mobile Networks **(Invited)**
Xiang Sun, Liangkun Yu, and
Abee Alazzwi
University of New Mexico, USA

An Efficient Pulse Position Modulation Scheme to Improve the Bit Rate of Photoacoustic Communication
Md Shafiqul Islam, Mohamed Younis and
Muntasir Mahmud
University of Maryland Baltimore County USA
Fow-Sen Choa
UMBC, USA

Novel resonance manipulation method in coupled resonators using "coupling structure technique" for Quantum coherence effect and optical communication applications **(Invited)**
Benjamin B Dingel
Nasfine Photonics Incorporated, USA &
School of Science and Engineering
Ateneo de Manila University, Philippines

M2 Advance in Machine Learning and its Application, Room 235

Session Zoom Link

Chair: : Jiacun Wang,
Monmouth University

Hybrid Disassembly Line Optimization with Reinforcement Learning **(Invited)**
Jay Wang; XiwangGuo; Guipeng
Xi; Shujin Qin
Monmouth University, USA

Performing Effective Generative Learning from a Single Image Only **(Invited)**
Qihui Xu, Jinshu Chen, Jiacheng Tang, Qi
Kang
Tongji University, Shanghai, China
Mengchu Zhou
New Jersey Institute of Technology,

Fruit Fly Optimization Algorithm for Hybrid Disassembly Line Balancing Problem
XiaoYu Niu, XiWang Guo (**Invited**)
Petrochemical University Fushun, China
Jiacun Wang
Monmouth University Wes Long Branch
Shujin Qin
Normal University Shangqiu, China
ChenYang Fan
Petrochemical University Fushun, China

Photovoltaic Power Generation Prediction Based on In-depth Learning for Smart Grid Integration
Zhengshi Wang; Yuyin Li; Anguo
Wang; You Wu; Tao Han; Yao Ge
Zhejiang University, China

Parallel Session 3 of 4

WOCC Technical Sessions – Saturday, May 06, 2023, 13:30 – 15:10

W3 Wireless for Autonomous Systems, Room 225

Session Zoom Link

Chair: Marcus Wong
OPPO

Localization of Autonomous Underwater Vehicles using Airborne Visible Light Communication Links
Jaeed Bin Saif, Mohamed Younis, Fow-Sen Choa
University of Maryland, Maryland, USA
Akram Ahmed
King Fahd University of Petroleum and Minerals Dhahran, Saudi Arabia

Physical Layer Security Communications and Path Planning For UAV Base Stations **(Invited)**
Guanchong Niu and Qi Cao , **Xidian University, China**
Man-On Pun , **The Chinese University of Hong Kong, Shenzhen, China**

Joint Optimization of Flight Path and Power Allocation in A UAV Relay-assisted Communication System
Lipei Liu, Rugui Yao, Ye Fan and Xiaoya Zuo
Northwestern Polytechnical University, China
Juan Xu, **Chang'an University, China**

Adaptive Delivery for High Definition Map Using A Multi-Arm Bandit Approach
Dawei Chen
InfoTech Labs, Toyota North America R&D, USA
Haoxin Wang, **Georgia State University, USA**
Kyungtae Han
InfoTech Labs, Toyota North America R&D, USA

Lightweight and Anonymity-preserving Secure Group Communication Mechanism for Cooperative Driving
Wassila Lalouani
Towson University, USA
Mohamed Younis
University of Maryland Baltimore County, USA
Dayuan Tan, **UMBC, USA**

O3 Emerging applications of networks, Room 230

Session Zoom Link

Chair: Yuanqiu Luo
Futurewei Technologies

Industrial PON System Architecture and Applications **(Invited)**
Xiao Yu, Hui Sun, Dezhi Zhang, and Jialiang Jin
China Telecom Research Institute

On a Novel Content Edge Caching Approach based on Multi-Agent Federated Reinforcement Learning in Internet of Vehicles
Yangbo Liu and Bomin Mao
Northwestern Polytechnical University, China

On the Deployment and Operation of Correlated Data-Intensive vNF-SCs in Inter-DC EONs **(Invited)**
Zuqing Zhu
University of Science and Technology of China,
Liang Zhang and Bijan Jabbari
George Mason University, USA

Phasor Analysis of the Symmetric Crisscrossed-assisted Coupled-Ring Reflector

Avram Gutierrez
Ateneo de Manila University, Philippine;
Benjamin B Dingel
Nasfine Photonics Incorporated, USA & Ateneo de Manila University, Philippines

M3 Machine Learning for Communication, Room 235

Session Zoom Link

Chair: Yao Ma,
New Jersey Institute of Technology

Modulation Recognition using YOLOv5 on the WBSig53 Dataset
Bradley Comar
U.S. Department of Defense, USA

Using Mutual Information to Perform Modulation Recognition on the Sig53 Dataset
Bradley Comar
U.S. Department of Defense, USA

The effect of parameter uncertainty in the link on QoT estimation using GN-based analytical model
Jing Zhou
The Hong Kong Polytechnic University, Hong Kong

Automatic modulation recognition of communication signal based on wavelet transform combined with singular value and NCA-CNN
Yixin Ding
Beijing Jiaotong University, China

Parallel Session 4 of 4

WOCC Technical Sessions – Saturday, May 06, 2023, 15:30 – 17:10

W4 **Advanced MIMO and Beamforming Technologies**
Room 225
Session Zoom Link
Chair: Ang Gao
Northwestern Polytechnical University, China

Heterogeneous Multi-Agent Reinforcement Learning for Joint Active and Passive Beamforming in IRS Assisted Communications
Ang Gao, Xinshun Sun, Yongshuai Xu, Wei Liang
Northwestern Polytechnical University, Xi'an, China

A Simplified Message Passing Detection Algorithm for Massive MIMO System
Jing Ye and Jianing Zhao
Southeast University, China
Fei Xu
China Mobile Research Institute, China

Transformer-based CSI Feedback with Hybrid Learnable Non-Uniform Quantization for Massive MIMO Systems **(Invited)**
Binggui Zhou
Jinan University, China
Shaodan Ma
University of Macau, China
Guanghua Yang
Jinan University, China

Parametric Precoding Based on Improved Dynamic Gradient Descent in Multibeam Satellite Communications
Jiayu Wang, Rugui Yao, Donghui Xu, Ye Fan and Xiaoya Zuo **Northwestern Polytechnical University, China**

Note: each technical session will last for 100 minutes and will consist of up to 5 paper presentations. For a 5-paper session, each presentation will be allocated 20 minutes, including Q&A. For a 4-paper session, each presentation will be allocated 25 minutes, including Q&A.

K1 – Keynote Session *Friday, May 5th, 2023 10:35-11:35*

Keynote Speaker

William Shieh

Professor in School of Engineering

IEEE Fellow and OSA Fellow

Westlake University

Zhejiang, 310020 China

shiehw@westlake.edu.cn

High-Capacity Optical Communications

ABSTRACT:
The last two decades of 21st century has seen rapid advances in optical communications led by the dramatic revival of coherent detection to meet the exponential growth of the Internet. This talk will first look into the question whether coherent communication will be the winner-take-all technology that could diminish the fertile research interest in the field. We then will touch upon the future prospect of space-division multiplexing as the next-generation high-capacity transmission scheme.

BIOGRAPHY:

William Shieh is with the School of Engineering, Westlake University, China. His current research interests include OFDM techniques in both wireless and optical communications, few-mode fibers for optical communications and sensing, coherent optical communication systems, and optical packet switching. He has published more than 350 journal and conference papers and submitted 16 U.S. patents (10 issued) covering areas of optical multicarrier systems, polarization controller, wavelength stabilization in WDM systems, and Raman amplifier-based systems and subsystems. He has been awarded Australian Future Fellowship, 2011-2014. He is a fellow of both IEEE and Optical Society of America (OSA).

K2 - Keynote Session *Friday, May 5th, 2023, 11:35 – 12:35*

Keynote Speaker

Ozge Koymen

Senior Director, Technology,

Qualcomm Technologies

okoymen@qti.qualcomm.com

5G Advanced Opportunities, Challenges, and Vision for 6G

ABSTRACT:

The work on 5G Advanced has officially begun, and Release 18 is the inaugural standard release that will set off a new wave of wireless innovations. 5G Advanced will bring enhanced end-to-end 5G system capabilities enabling new levels of performance and efficiency, and it will continue to improve 5G experiences and expand to more connected devices through the rest of this decade.

At the same time, the early vision for 6G is starting to emerge. The next-generation mobile platform is targeted to bring a large technology leap for 2030 and beyond. 6G will be more than a new radio, it is envisioned to be an innovation platform of synergistic technologies, including AI, sensing, security, green networks/devices, and more, which will enable sustained expansion of the Connected Intelligent Edge. This keynote will cover the new technologies underpinning the ongoing 5G Advanced evolution and show Qualcomm's vision for the 6G platform, and our longer-term research vectors.

BIOGRAPHY:

Ozge Koymen is a Senior Director of Technology at Qualcomm Technologies, Inc. where he has been since 2006. He has led the 5G millimeter-wave program within Qualcomm R&D since early 2015, from early conceptual evaluation to commercial deployment. His previous areas as a technical contributor includes Wireless Backhaul, Small Cells, LTE-D, LTE and UMB.

Prior to Qualcomm, he was a member of Flarion Technologies developing a pioneering OFDMA cellular system, Flash-OFDM, during 2003-2006. His earlier work experience includes full-time and consulting work for Impinj, Inc. (2000-2003) and TRW (1996-2000).

He received the B.S. in Electrical and Computer Engineering from Carnegie Mellon University in 1996 and the M.S. and Ph.D. in Electrical Engineering from Stanford University in 1997 and 2003, respectively.

K3 – Keynote Session *Saturday, May 6th, 2023 10:40 -11:40*

Keynote Speaker

Xiaodong Wang

Professor of Electrical Engineering

Columbia University

New York, NY 02139

xw2008@columbia.edu

Integrated Sensing and Communication (ISAC) — A Radar-enabled Backscatter Communication (RadBackCom) Approach

ABSTRACT:

We exploit the radar clutter (i.e., the ensemble of echoes generated by the terrain and/or the surrounding objects in response to the signal emitted by a radar transmitter) as a carrier signal to enable an ambient backscatter communication from a source (tag) to a destination (reader). The proposed idea relies on the fact that, since the radar excitation is periodic, the radar clutter is itself periodic over time scales shorter than the coherence time of the environment. Upon deriving a convenient signal model, we propose two encoding/decoding schemes that do not require any coordination with the radar transmitter or knowledge of the radar waveform. Different tradeoffs in terms of transmission rate and error probability can be obtained upon changing the control signal driving the tag switch or the adopted encoding rule; also, multiple tags can be accommodated with either a sourced or an unsourced multiple access strategy. Some illustrative examples are provided.

BIOGRAPHY:

Xiaodong Wang received the Ph.D degree in Electrical Engineering from Princeton University. He is a Professor of Electrical Engineering at Columbia University in New York. Dr. Wang's research interests fall in the general areas of signal processing and communications, and has published extensively in these areas. Among his publications is a book entitled "Wireless Communication Systems: Advanced Techniques for Signal Reception", published by Prentice Hall in 2003. His current research interests include wireless communications, statistical signal processing, and genomic signal processing. Dr. Wang received the 1999 NSF CAREER Award, the 2001 IEEE Communications Society and Information Theory Society Joint Paper Award, and the 2011 IEEE Communication Society Award for Outstanding Paper on New Communication Topics. He has served as an Associate Editor for the IEEE Transactions on Communications, the IEEE Transactions on Wireless Communications, the IEEE Transactions on Signal Processing, and the IEEE Transactions on Information Theory. He is a Fellow of the IEEE and listed as an ISI Highly-cited Author.

K4 – Keynote Session *Saturday, May 6th, 2023, 11:40 – 12:40*

Keynote Speaker

Wireline and Wireless Convergence

Larry Zhou

AT&T Fellow,
AT&T, USA

lz4257@att.com

ABSTRACT:

As the demand for seamless and uninterrupted internet connectivity grows, service providers face the challenge of balancing convergence and divergence in their offerings. This presentation explores key network convergence trends and technologies impacting the industry, focusing on the integration of 5G, Wi-Fi and Broadband networks to provide customers with a unified experience. The presentation highlights the benefits of convergence, such as reduced cost, simplified management, and the enablement of automation and sustainability, while acknowledging the importance of divergence in fostering innovation and competition. Additionally, the presentation examines the role of artificial intelligence and automation in addressing the complexities associated with network convergence. By analyzing these trends and technologies, the presentation aims to provide valuable insights for service providers seeking to enhance connectivity and deliver a seamless user experience across various access network technologies.

BIOGRAPHY:

Larry is responsible for designing AT&T Network Services including the global internet backbone, Core, Edge, business and residential networks. His groundbreaking contributions to network function virtualization have transformed network functions from physical to virtual, and revolutionizing the internet from core to edge, wireline to wireless. In recognition for being a longstanding innovator and industry disruptor with outstanding contributions to the networking industry, he was awarded the honor of becoming the 66th AT&T Fellow in all 147 years of AT&T history. In his forward-looking research, Larry is focusing on: Edge computing, IOT, LLM, Computer Vision, AR, VR, MR, Metaverse, Blockchain, NFT, Web3.0, 5G Fixed Wireless, Private 5G, Fiber Broadband and Next Generation High Speed Internet Backbone.

Technical Session: Program Chairs

Wireless Program

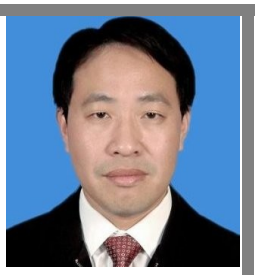
Tao Han

New Jersey Institute of Technology
323 Dr Martin Luther King Jr. Blvd, Newark, NJ 07102

BIOGRAPHY:
Tao Han (M'15-SM'20) is an Associate Professor in the Department of Electrical and Computer Engineering at New Jersey Institute of Technology (NJIT) and an IEEE Senior Member. Before joining NJIT, Dr. Han was an Assistant Professor in the Department of Electrical and Computer Engineering at the University of North Carolina at Charlotte. Dr. Han received his Ph.D. in Electrical Engineering from NJIT in 2015 and is the recipient of NSF CAREER Award 2021, Newark College of Engineering Outstanding Dissertation Award 2016, NJIT Hashimoto Prize 2015, and New Jersey Inventors Hall of Fame Graduate Student Award 2014. His papers win IEEE International Conference on Communications (ICC) Best Paper Award 2019 and IEEE Communications Society's Transmission, Access, and Optical Systems (TAOS) Best Paper Award 2019. His research interest includes mobile edge computing, machine learning, mobile X reality, 5G system, Internet of Things, and smart grid.

Yejun He

Shenzhen University
3688 Nanhai Ave, Nanshan Qu, Shenzhen Shi,
Guangdong Sheng, China, 518060.



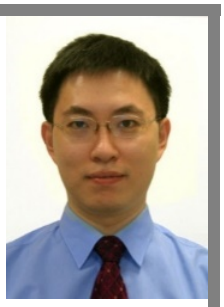
BIOGRAPHY:
He received the Ph.D. degree in Information and Communication Engineering from Huazhong University of Science and Technology (HUST), Wuhan, China, in 2005. He was a Visiting Professor with the Department of Electrical and Computer Engineering, University of Waterloo, Waterloo, ON, Canada in 2012 and an Advanced Visiting Scholar (Visiting Professor) with the School of Electrical and Computer Engineering, Georgia Institute of Technology, Atlanta, GA, USA from 2013 to 2015. He is Pengcheng Scholar Distinguished Professor, and a full professor with the College of Electronics and Information Engineering, Shenzhen University, China, where Dr. He is the Director of Guangdong Engineering Research Center of Base Station Antennas and Propagation, and the Director of Shenzhen Key Laboratory of Antennas and Propagation, Shenzhen, China. He has authored or coauthored over 260 research papers and 7 books. He holds about twenty patents. His research interests include wireless communication, antennas and radio frequency. He is serving as Associate Editor of IEEE Transactions on Antennas and Propagation, IEEE Transactions on Mobile Computing, IEEE Antennas and Wireless Propagation Letters, IEEE Antennas and Propagation Magazine, China Communications, International Journal of Communication Systems, as well as ZTE Communications. He served as an Associate Editor of IEEE Network. He has been a Fellow of The Institution of Engineering and Technology (IET) since 2016, the Chair of IEEE Antennas and Propagation Society-Shenzhen Chapter since 2018, and a Senior Member of The Institute of Electrical and Electronics Engineers (IEEE) since 2009.

Technical Session: Program Chairs

Optical Program

Changyuan Yu

The Hong Kong Polytechnic University
Hung Hom, Kowloon, Hong Kong



BIOGRAPHY:
Prof. Changyuan YU received his Ph.D. in Electrical Engineering from the Univ. of Southern California, USA in 2005. He was a visiting researcher at NEC Labs America in Princeton, USA in 2005. He then joined National Univ. of Singapore (NUS) in 12/2005, where he served as the founding leader of Photonic System Research Group in Dept. of Electrical and Computer Engineering till 12/2015. He was also a joint senior scientist with A*STAR Institute for Infocomm Research (I2R) in this period. And he was a visiting professor with Univ. of Melbourne, Australia in 2007. In 12/2015, he joined The Hong Kong Polytechnic Univ., where he is now a full professor in Dept. of Electronic and Information Engineering, while he also continues as an adjunct faculty member of NUS. His research focuses on photonic devices, optical fiber communication and sensor systems, and biomedical instruments. He has been the PI/co-PI/co-I of 50+ research projects with 10 million+ US dollars fund, and supervised 20+ postdocs and 40+ PhD students. He has authored/co-authored 6 book chapters and 600+ journal/conference papers (100+ keynote/invited, including OFC in USA). He served in organizing or technical program committees for 100+ international conferences, and Telecommunications Standards Advisory Committee for Singapore government. His group won 10 best paper awards in conferences and National Championship in China Innovation and Entrepreneurship Competition in 2014. He is an Optica/OSA fellow.

Yuanqiu Luo

Futurewei Technologies, Basking Ridge, USA

BIOGRAPHY:
Yuanqiu Luo is a Director of Optical Access Standards in Futurewei Technologies, USA. She received the Ph.D. degree in electrical engineering from the New Jersey Institute of Technology. Dr. Luo has been working in the areas of optical access networks for more than 15 years. She has been a key contributor of international standards on optical access systems. She is an Editor of ITU standards G.987.3 (XG-PON), G.988 (OMCI), G.989.2 (NG-PON2), G.9802 (multiwave PON), G.9803 (radio over fiber), G.9804.2 (50G-PON), and G.9807.1(XGS-PON). She is the Chair of the IEEE 802.3dk Task Force (100G and 200G BiDi). She was the Chief Editor of IEEE standard 802.3cp (10G/25G/50G BiDi) and a Clause Editor of IEEE standard 802.1AS (time synchronization).
Dr. Luo is the IEEE Princeton Central Jersey Section Photonics Chapter Chair. She is a member of the IEEE ComSoc Educational Services Board (ESB). She is currently an IEEE ComSoc Distinguished Lecturer. Dr. Luo teaches the ComSoc training course "Empowering Industry 4.0 with Next Generation Optical Access Networks". She has been teaching a course on optical access technilogies at OFC since 2018. She has published over 60 papers and delivered more than 30 talks. She has invented over 50 US patents.
Dr. Luo received the Best Paper Award from IEEE & OSA Journal of Lightwave Technology. She is a two-time recipient of the IEEE Standards Award (both 2011 and 2021). In 2021 she was named a Star in Computer Networking and Communications by the IEEE ComSoc N^2 Women. In 2022 she won the IEEE Region 1 Technological Innovation Award for outstanding innovations on highspeed optical access system design and leadership in driving international standards.

Technical Session: Program Chairs

Machine Learning and AI in Communications Program

Zhi Wei

New Jersey Institute of Technology
Newark, NJ 07102

BIOGRAPHY:
Dr. Wei is a Professor of Computer Science and Statistics (joint appointment) and serves as the Bioinformatics Program Director at the New Jersey Institute of Technology. Additionally, he is an adjunct professor at the Universi of Pennsylvania. Dr. Wei obtained his Ph.D. in Bioinformatics from the University of Pennsylvania and his BS degree in Computer Science from Wuhan University. His research interests include statistical modeling, machine learning, and advanced data analytics, with applications in data-enriched fields. His research has received support from various organizations, including NIH, NSF, DOD, and industry. Dr. Wei has authored over 200 publications in reputable journals and premier conferences, which have garnered 16,000 citations and an H-index of 57. He is also the recipient of the Adobe Data Science Research Award..

Zhanyang Zhang

Computer Science
College of Staten Island, CUNY
Staten Island, NY 10314

BIOGRAPHY:
Zhanyang Zhang acquired his PhD degree in computer science from the City University of New York. He received a MS degree in computer science from the College of Staten Island and a BE degree in computer engineering from Jilin University, Changchun, China.
He is currently a faculty member of Computer Science Department at both College of Staten Island and the Graduate Center, the City University of New York (CUNY). His current research interests include wireless networks, numerical modeling and simulations, IoT/sensor networks in Smartcity applications, high performance and cloud computing.
Before joining CUNY, he was a member of technical staff (MTS) at Bell Labs, Lucent Technology where he worked on several Research and development projects in advance wireless networks. He also works as a communication network consultant with different companies in New York/New Jersey areas.

W1 – Emerging Wireless Technologies (Friday, May 5th, 13:30 -15:10)

Session Chair

Xiao-Feng Qi

[1]Phase Sensitive Innovations, Inc., Newark, Delaware, USA
[2]University of Delaware, Newark, Delaware, USA

BIOGRAPHY:

Dr. Xiao-Feng Qi was Senior Director of Radio Algorithms Research, Futurewei Technologies, Inc., between 2014-2021, where he oversaw the 5G/6G research portfolio of wireless communication and sensing technologies. Between 1992 and 2014, he was with AT&T Microelectronics, Globespan Semiconductors, Level One Communications, Intel, and Broadcom, where he took on lead designer and supervisory roles in wireline and wireless product R&D, among them Senior Director of Advanced Research at Intel, and Technical Manager of Systems Group at Broadcom. He is currently Professor, Electrical and Computer Engineering Department, University of Delaware, and Chief Strategy Officer, Phase Sensitive Innovations, Inc. His current research interests include statistical signal processing techniques applied to wireless communications and sensing. He is the (co)author of more than 20 granted U.S. and international patents and a dozen refereed journals and conference publications.

W1 – Emerging Wireless Technologies (Friday, May 5th, 13:30 -15:10)

W1.1: C-RAN at Millimeter Wave and Above: Full-Beamspace Radio Access Architecture

Xiao-Feng Qi[1,2], Janusz A. Murakowski[1], Garrett J. Schneider[1,2], Dennis W. Prather[1,2]

[1]Phase Sensitive Innovations, Inc., Newark, Delaware, USA
[2]University of Delaware, Newark, Delaware, USA

ABSTRACT:

We report progress toward a RF-photonic centralized radio access network (C-RAN) architecture for distributed multi-point transmission over millimeter wave (mmW) spectra. The architecture comprises three components: (1) access points (APs) employing RF-photonic phased arrays capable of multibeam and multiband operation; (2) an RF-photonic beamspace processor unit (BPU) that carries out centralized beamspace processing across multiple APs, and (3) a single-fiber fronthaul capable of full-dimensional beamspace transportation between the BPU and the APs. It is shown that the photonic portion of the AP and the BPU can be extended with minimal alteration to include arrayed waveguide grating (AWG) functionality. The AWG feature allows a direct conversion between RF beams and optical wavelengths at the AP and the BPU, providing a scalable means of transporting the entire beamspace over a fronthaul network employing single-fiber wavelength division multiplexing (WDM).

BIOGRAPHY:

Dr. Xiao-Feng Qi was Senior Director of Radio Algorithms Research, Futurewei Technologies, Inc., between 2014-2021, where he oversaw the 5G/6G research portfolio of wireless communication and sensing technologies. Between 1992 and 2014, he was with AT&T Microelectronics, Globespan Semiconductors, Level One Communications, Intel, and Broadcom, where he took on lead designer and supervisory roles in wireline and wireless product R&D, among them Senior Director of Advanced Research at Intel, and Technical Manager of Systems Group at Broadcom. He is currently Professor, Electrical and Computer Engineering Department, University of Delaware, and Chief Strategy Officer, Phase Sensitive Innovations, Inc. His current research interests include statistical signal processing techniques applied to wireless communications and sensing. He is the (co)author of more than 20 granted U.S. and international patents and a dozen refereed journals and conference publications.

W1 – Emerging Wireless Technologies (Friday, May 5th, 13:30 -15:10)

W1.2: Enhancing 5G Core with Multi-Access Edge Computing

Ho-Cheng Lee, Fuchun Joseph Lin, Jyh-Cheng Chen, Chien Chen, Patrick Wang

College of Computer Science, National Yang Ming Chiao Tung University, Hsinchu, Taiwan, R.O.C

ABSTRACT:

This research employs NYCU-developed open source 5G core network free5GC and Intel open source edge computing platform OpenNESS to build a 5G private network. An on-line multi-person chorus application is then deployed on the edge platform to (1) achieve High Reliability and Low Latency Communication (URLLC) requirements, and (2) improve the backhaul bandwidth occupancy rate from the edge to the core network. In addition, this research implements the traffic influence function proposed in the 3GPP 5G standards, which can dynamically change traffic rules of the 5G core during execution, directing specific traffic to the edge applications in order to improve the performance of private networks. Finally, to verify the effectiveness of this schema, this research uses the example application deployed to compare the performance of the system equipped with edge computing with that without edge computing. Our analysis is done with both a physical RAN and the UERANSIM simulator.

BIOGRAPHY:

Dr. Fuchun Joseph Lin is currently a consultant to Communication Services/Software Laboratory in the College of Computer Science at National Yang Ming Chiao Tung University (NYCU). He was a full professor in Department of Computer Science at National Chiao Tung University (NCTU) from 1992 to 2021. Also from August 2012 to January 2018, he served as the Associate Chief Director of the Microelectronics and Information Research Center (MIRC) at NCTU. On February 1, 2021, he retired from the professorship, then transferred to be a part-time consultant at NYCU. Before August 2012, Professor Lin served as a Chief Scientist of Network System Research Department in Applied Research of Telcodia (formerly Bellcore). Professor Lin holds a Ph.D. degree from the Ohio State University, a bachelor's degree and a master's degree from NCTU. He has engaged in network research in Bell Labs, Bellcore and Telcordia in the United States since 1988**.**

W1.3: DRL-based Joint Optimization for Energy Efficiency Maximization in UAV-NOMA Networks

Shuhua Liu[1], Ang Gao[1], Qinyu Wang[1], and Yansu Hu[2]

[1]School of Electronics and Information, Northwestern Polytechnical University, Xi'an 710072, China
[2]School of Electronics and Control Engineer, Chang'an University, Xi'an 710064, China.

ABSTRACT:

Unmanned aerial vehicles (UAVs) can be deployed as aerial base stations or relays touring to serve ground users (GUs) chronologically. Combining with non-orthogonal multiple access (NOMA) technology, each UAV is able to serve multiple GUs at the same spectrum without causing server interference which greatly improves the spectrum efficiency. However, in multi-UAV NOMA networks, the UAV-GU service assignment and the transmission power control are integral-involved, which leads to a non-convex mixed integer non-linear programming (MINLP) problem. The paper proposes a joint optimization algorithm based on block coordinate descent (BCD) to iteratively maximize the spectrum energy efficiency (SEE), i.e., solving the service assignment, trajectory optimization and transmission power control by K-means clustering, deterministic deep policy gradient (DDPG) and successive convex approximation (SCA), respectively. The numerical results demonstrate the validity of the proposed algorithm and the superiority to the other benchmarks in terms of the convergence speed and SEE value.

BIOGRAPHY:

Shuhua Liu is currently a master's student under the supervision of Prof. A. Gao with the School of Electronics and Information, Northwestern Polytechnical University, Xi'an, China. Her research interests include mobile edge computing and deep reinforcement learning in wireless communication networks.

W2 – Coding and Modulation (Friday, May 5th, 15:30 -17:10)

Session Chair

Tao Han

New Jersey Institute of Technology

323 Dr Martin Luther King Jr. Blvd, Newark, NJ 07102

BIOGRAPHY:

Tao Han (M'15-SM'20) is an Associate Professor in the Department of Electrical and Computer Engineering at New Jersey Institute of Technology (NJIT) and an IEEE Senior Member. Before joining NJIT, Dr. Han was an Assistant Professor in the Department of Electrical and Computer Engineering at the University of North Carolina at Charlotte. Dr. Han received his Ph.D. in Electrical Engineering from NJIT in 2015 and is the recipient of NSF CAREER Award 2021, Newark College of Engineering Outstanding Dissertation Award 2016, NJIT Hashimoto Prize 2015, and New Jersey Inventors Hall of Fame Graduate Student Award 2014. His papers win IEEE International Conference on Communications (ICC) Best Paper Award 2019 and IEEE Communications Society's Transmission, Access, and Optical Systems (TAOS) Best Paper Award 2019. His research interest includes mobile edge computing, machine learning, mobile X reality, 5G system, Internet of Things, and smart grid.

W2 – Coding and Modulation (Friday, May 5th, 15:30 -17:10)

W2.1: Estimate BLER for Coded Modulation Based on Finite Block Coding

Eva C. Song[1] and Guosen Yue[2]

[1]Walmart Inc., Hoboken, NJ
[2]Google LLC, New York, NY

ABSTRACT:

In this paper, we present a state-of-the-art method to estimate block error rate (BLER) for code modulation with practical channel codes, e.g., turbo or low-density parity-check (LDPC) codes. The method is based on the recent theoretic breakthrough on the finite block coding and a novel rate combining model. With tuning on a very limited number of parameters, the estimates from the proposed method match very well with the simulation results. The proposed method can have wide ranges of applications for wireless communications.

BIOGRAPHY:

Guosen Yue received the B.S. degree in physics and the M.S. degree in electrical engineering from Nanjing University, Nanjing, China, in 1994 and 1997, respectively, and the Ph.D. degree in electrical engineering from Texas A&M University at College Station, College Station, TX, USA, in 2004. He is now a Cellular System Architect with Google LLC. Prior to joining Google, he was a Principal Engineer with Futurewei Technologies, Inc. From 2013 to 2015, he was with Broadcom Corporation, Matawan, NJ, USA, as a System Design Scientist. He also worked as a Senior Research Staff with NEC Laboratories America, Inc., Princeton, NJ, USA. His research interests include wireless communications, signal processing, and machine learning. He has served as an Associate Editor for the IEEE TRANSACTIONS ON WIRELESS COMMUNICATIONS and a Guest Editor for the EURASIP Journal on Wireless Communication and Networking special issue on interference management, and Physical Communication (Elsevier) special issue on signal processing and coding. He has served as the Symposium Co-Chair for the ICNC 2023, the IEEE GLOBECOM 2019 and the IEEE ICC 2010, and as the Track Co-Chair for the IEEE ICCCN 2008.

W2.2: Combined Signal Representations for Modulation Classification Using Deep Learning: Ambiguity Function, Constellation Diagram, and Eye Diagram

Abdullah Samarkandi, Alhussain Almarhabi, Hatim Alhazmi, and Yu-Dong Yao

Department of Electrical and Computer Engineering, Stevens Institute of Technology, Hoboken, NJ 07030, USA

ABSTRACT:

We exploit deep learning convolutional neural networks (CNN) based on joint image representation and propose an automatic modulation classification algorithm to classify the communication signals. The combined representations include a constellation diagram, an ambiguity function (AF), and an eye diagram. Experimentation results show that combining constellation and eye diagrams achieves superior classification performance compared to having these representations separately. Combining AF and an eye diagram results in improvement at low SNR.

BIOGRAPHY:

Abdullah Samarkandi received the BEng degree in computer engineering from Umm Al-Qura University, Makkah, Saudi Arabia in 2012, and the MSc degree in information assurance from the University of Colorado, Colorado Springs in 2017. He is currently a Ph.D. candidate in computer engineering at Stevens Institute of Technology, Hoboken, NJ, USA. His research interests include signal processing, big data, deep learning in wireless communication, and their applications.

W2.3: Construction of Shortened Systematic PAC Codes Based on Monte-Carlo Algorithm

Ziqi Qiu, and Yejun He

College of Electronics and Information Engineering,
Shenzhen University, 518060, China

ABSTRACT:

Polarization transform limits the code length of polarization-adjusted convolutional (PAC) codes to a power of 2, which hinders the flexible use of PAC codes. Shortening is an important method to change the length of the PAC codes. Systematic code makes it possible to select the shortened bit flexibly. In this paper, we propose a flexible code length scheme for shortened systematic PAC codes, where the proposed scheme generates frozen set and shortened set based on Monte-Carlo algorithm. Simulation results show that the Monte-Carlo algorithm can significantly improve the performance in frame error rate (FER), and the proposed shortening scheme can slightly improve the performance in FER.

BIOGRAPHY:

Ziqi Qiu is currently working toward the M.S. degree in information and communication engineering with the College of Electronics and Information Engineering, Shenzhen University, Shenzhen, China. His research interests include wireless communications, information theory and coding theory.

Yejun He received the Ph.D. degree in information and communication engineering from Huazhong University of Science and Technology, Wuhan, China, in 2005. He has been a Full Professor with the College of Electronics and Information Engineering, Shenzhen University, Shenzhen, China, where he is currently the Director of the Guangdong Engineering Research Center of Base Station Antennas and Propagation, the Director of the Shenzhen Key Laboratory of Antennas and Propagation, Shenzhen, China, and the Chair of IEEE APS-Shenzhen Chapter (He obtained 2022 IEEE APS Outstanding Chapter Award). He was selected as a Pengcheng Scholar Distinguished Professor, Shenzhen, and Minjiang Scholar Chair Professor of Fujian Province. He has authored or coauthored more than 260 referred journal and conference papers and seven books (chapters) and holds about 20 patents. His research interests include wireless communications, antennas and radio frequency. He has obtained the Shenzhen Science and Technology Progress Award in 2017 and Guangdong Provincial Science and Technology Progress Award for two times, in 2018 and 2023, respectively. He was also the recipient of the Shenzhen Overseas High-Caliber Personnel Level B (Peacock Plan Award B) and Shenzhen High-Level Professional Talent (Local Leading Talent). He is a Fellow of IET and a Senior Member of the China Institute of Communications and the China Institute of Electronics. Prof. He is serving as Associate Editor of IEEE Transactions on Antennas and Propagation, IEEE Transactions on Mobile Computing, IEEE Antennas and Wireless Propagation Letters, IEEE Antennas and Propagation Magazine, China Communications, and International Journal of Communication Systems.

W2.4: Improved Stack Decoding for PAC Codes

Li Zhang, Haina Liu, and Yejun He

State Key Laboratory of Radio Frequency Heterogeneous Integration
College of Electronics and Information Engineering, Shenzhen University, China

ABSTRACT:

Several classical decoding algorithms, such as Fano decoding, list decoding and list Viterbi decoding algorithm have been proposed for polarization-adjusted convolutional (PAC) codes by some scholars. Inspired by the decoding algorithms mentioned above, two algorithms called stack Viterbi decoding (SVD) and critical set-aided stack decoding are presented in this paper. Simulation results show that performance of the proposed algorithm with stack depth of 100 slightly outperforms that of the conventional stack decoding algorithm with the same stack depth at the cost of higher complexity, and the sorting complexity of conventional stack decoding (CSD) can be further reduced by means of the proposed critical set-aided stack decoding algorithm.

BIOGRAPHY:

Li Zhang received the B.E. degree in communications and information system from Ha er bin Institute of Technology, China, in 1999, and received Ph.D. degree in communications and information system from South China University of Technology, China, in 2002. She joined the College of Information Engineering, Shenzhen University, Guangdong, China, in July 2002. Her research interests include signal processing, antenna system.

Haina Liu is currently working toward the M.S. degree in information and communication engineering with the College of Electronics and Information Engineering, Shenzhen University, Shenzhen, China. His research interests include wireless communications, information theory and coding theory.

Yejun He received the Ph.D. degree in information and communication engineering from Huazhong University of Science and Technology, Wuhan, China, in 2005. He has been a Full Professor with the College of Electronics and Information Engineering, Shenzhen University, Shenzhen, China, where he is currently the Director of the Guangdong Engineering Research Center of Base Station Antennas and Propagation, the Director of the Shenzhen Key Laboratory of Antennas and Propagation, Shenzhen, China, and the Chair of IEEE APS-Shenzhen Chapter (He obtained 2022 IEEE APS Outstanding Chapter Award). He was selected as a Pengcheng Scholar Distinguished Professor, Shenzhen, and Minjiang Scholar Chair Professor of Fujian Province. He has authored or coauthored more than 260 referred journal and conference papers and seven books (chapters) and holds about 20 patents. His research interests include wireless communications, antennas, and radio frequency. He has obtained the Shenzhen Science and Technology Progress Award in 2017 and Guangdong Provincial Science and Technology Progress Award for two times, in 2018 and 2023, respectively. He was also the recipient of the Shenzhen Overseas High-Caliber Personnel Level B (Peacock Plan Award B) and Shenzhen High-Level Professional Talent (Local Leading Talent). He is a Fellow of IET and a Senior Member of the China Institute of Communications and the China Institute of Electronics. Prof. He is serving as Associate Editor of IEEE Transactions on Antennas and Propagation, IEEE Transactions on Mobile Computing, IEEE Antennas and Wireless Propagation Letters, IEEE Antennas and Propagation Magazine, China Communications, and International Journal of Communication Systems.

W3 – Wireless for Autonomous Systems (Saturday, May 5th, 13:30 -15:10)

Session Chair

Guanchone Niu

Guangzhou Institude of Technology, Xidian University,
Guangzhou, P.R. China

BIOGRAPHY:

Guanchong Niu received the bachelor's degree in physics from Jilin University, China, in 2014, and the Ph.D. degree with the Chinese University of Hong Kong, Shenzhen, China, in 2021. Currently, He is an associate professor in Guangzhou Institute, Xidian Univeristy. From September 2021 to October 2022, He was a senior engineer in Huawei working for network optimization. Between January and March 2020, he was an Intern with the Bell Labs, France, developing indoor localization systems. His current research interests include the millimeter wave and multipleinput multiple-output systems for the next-generation wireless communications and robotics.

W3 – Wireless for Autonomous Systems (Saturday, May 5th, 13:30 -15:10)

W3.1: Localization of Autonomous Underwater Vehicles using Airborne Visible Light Communication Links

Jaeed Bin Saif[1], Mohamed Younis[1], Fow-Sen Choa[1], and Akram Ahmed[2]

[1]Department of Computer Science and Electrical Engineering
University of Maryland Baltimore County
[2]Computer Engineering Department
King Fahd University of Petroleum and Minerals
Dhahran, Saudi Arabia

ABSTRACT:

In an application involving Autonomous Underwater Vehicles (AUV) it is important to track the trajectory and spatially correlate the collected data. Relying on an Inertial Navigation System (INS) while factoring in the initial AUV position would not suffice given the major accumulated errors. Employing surface nodes is a logistically complicated option, especially for missions involving emerging events. This paper proposes a novel localization approach that offers both agility and accuracy. The idea is to exploit a communication mechanism across the air-water interface. In particular, we employ an airborne unit, e.g., a drone, that scans the area of interest and uses visual light communication (VLC) to reach the AUV. In essence, the airborne unit defines virtual anchors with known GPS coordinates. The AUV uses the light intensity of the received VLC transmissions to estimate the range relative to the anchor points and then determine its own global coordinates at various time instances. The proposed approach is validated through extensive simulation experiments. The simulation results demonstrate the viability of our approach and analyze the effect of the VLC parameters.

BIOGRAPHY:

Jaeed was Born in Sirajganj, Bangladesh. He received his B.Sc in Electrical and Electronic Engineering from Islamic University of Technology, Bangladesh and his M.S. degree in Electrical Engineering from the University of Maryland, Baltimore County, where he is currently pursuing the Ph.D. degree. From 2019 to 2022, he has been a Teaching Assistant with the Computer Science and Electrical Engineering Department, University of Maryland, Baltimore County (UMBC). He is also a Research Assistant with the Embedded Systems and Networks Laboratory, UMBC. He is also working as Research assistant in Lasarrus Clinic and Research Center. His research interests include underwater optical communication, visible light communication, wireless sensor networks, optoacoustic communication, health sensor development etc.

W3 – Wireless for Autonomous Systems (Saturday, May 5th, 13:30 -15:10)

W3.2: Physical Layer Security Communications and Path Planning for UAV Base Stations

Guanchong Niu[1], Qi Cao[1], , and Man-On Pun[2]

[1] Guangzhou Institude of Technology, Xidian University, Guangzhou, P.R. China
[2] The Chinese University of Hong Kong, Shenzhen, P.R. Chin

ABSTRACT:

Unmanned aerial vehicles (UAVs) have been recognized as the possible revolution in the fifth-generation (5G) wireless networks. In this work, we consider a scenario where a UAV base station (UAVBS) communicates with legitimate user equipment (UEs) in the presence of eavesdroppers (EDs). Specifically, a UAVBS travels around UEs in turn to send commands and collects information from UEs. To guarantee the data transmission rate, the millimeter-wave (mmWave) communication is integrated into the UAVBS system. Two problems are mainly resolved for the proposed system, namely radar-aided beamforming design and physical layer security (PLS) problem. With the assistance of the radar-equipped on the UAVBS, the location of the UEs can be obtained before the beamforming is designed to solve the beam selection problem. In addition, the power allocation is optimized using the difference-of-two-convex-function (D.C.) programming algorithms. In order to safeguard data transmissions against such EDs, the PLS communication system is proposed by considering the location of the UAVBS. We derive the path planning algorithm for the UAVBS to avoid data transmission with the Eds using the disciplined convex and concave programming (DCCP) algorithm. Extensive computer experiments validate the effectiveness of our proposed location-aware PLS communications in the UAVBS system.

BIOGRAPHY:

Guanchong Niu received the bachelor's degree in physics from Jilin University, China, in 2014, and the Ph.D. degree with the Chinese University of Hong Kong, Shenzhen, China, in 2021. Currently, He is an associate professor in Guangzhou Institute, Xidian Univeristy. From September 2021 to October 2022, He was a senior engineer in Huawei working for network optimization. Between January and March 2020, he was an Intern with the Bell Labs, France, developing indoor localization systems. His current research interests include the millimeter wave and multipleinput multiple-output systems for the next-generation wireless communications and robotics.

W3.3: Joint Optimization of Flight Path and Power Allocation in A UAV Relay-assisted Communication System

Lipei Liu[1], Rugui Yao[1], Ye Fan[1], Xiaoya Zuo[1], and Juan Xu[2]

[1]School of Electronics and Information, Northwestern Polytechnical University, Xi'an, Shaanxi, China.
[2]The School of Electronics and Control Engineering, Xi'an, China

ABSTRACT:

Since the transmit power of the unmanned aerial vehicle (UAV) is limited, it exerts remarkable influence on the throughput of communication system. In view of this situation, this paper studies the two-hop UAV relay system, in which the UAV serves as a relay to decode and forward the information from source to destination. To maximize system throughput in the limited flight time, we jointly implement path optimization and power allocation of source/relay transmitters. For the optimization problem involved here is non-convex, we propose an efficient iterative algorithm, jointly considering the block coordinate descent method, the successive convex approximation technology, and the idea of introducing slack variables. The simulation results verify that this scheme significantly improves the system throughput compared with other two schemes where either power or path gets optimized only.

BIOGRAPHY:

Lipei Liu received the bachelor's degree from the School of Physics and Electronic Information Engineering, Shanxi normal university, Linfen, China., in 2021. I am currently pursuing the master's degree in electronics and information with the School of Network and Space Security, Northwestern Polytechnical University (NPU), Xi'an, China. My research interests include unmanned aerial vehicle communications

W3 – Wireless for Autonomous Systems (Saturday, May 5th, 13:30 -15:10)

W3.4: Adaptive Delivery for High-Definition Map Using A Multi-Arm Bandit Approach

Dawei Chen[1], Haoxin Wang [2], and Kyungtae Han[1]

[1]InfoTech Labs, Toyota North America R&D, Mountain View, CA, USA
[2]Department of Computer Science, Georgia State University, GA, USA

ABSTRACT:

A high definition (HD) map is a key technology that enables autonomous driving, which has the characteristics of frequent updates and low latency requirements. Edge computing provides an efficient way to deliver the HD map to autonomous vehicles, which deploys the edge servers at the edge of the network and shortens the transmission distance. The edge-assisted HD map delivery is generally done by the wireless transmission between edge servers, like roadside units (RSU), and vehicles. However, the transmission channel status, like the transmission rate, is fragile and easily influenced by the speed of vehicles, the weather, and the number of connections of RSU. A proper HD map delivery is needed to meet a time deadline over different channel conditions. This work firstly utilizes the love-of-variety-based method to model the different versions of the HD maps with different data sizes. Then, an adaptive upper confidence bound based multi-arm bandit method is proposed to choose the appropriate version of the HD map under the different wireless communication statuses. The simulation results show the effectiveness of our proposed method, which achieves the best total accumulative rewards and the least regret compared with the baseline methods.

BIOGRAPHY:

Dawei Chen received the Ph.D. degree in electrical and computer engineering from the University of Houston, Houston, TX, in 2021. He joined in Toyota Motor North America, InfoTech Labs, since 2022, where he is a principal researcher. His research interests including edge computing, federated learning/analytics, connected vehicles, and wireless networks.

W3 – Wireless for Autonomous Systems (Saturday, May 5th, 13:30 -15:10)

W3.5 Lightweight and Anonymity-preserving Secu CommunicationMechanism for Cooperative Dr

Wassila Lalouani[1], Mohamed Younis[1], and Dayuan Ta

[1]Department of Computer and Information Science,
Towson University
[2]Department of Computer Science and Electrical Engineering
University of Maryland Baltimore county

ABSTRACT:

Platooning is gaining much attention due to its potential for improving road safety, and increasing vehicular throughput. Given the required fine-grained coordination among the involved vehicles, resilience to cyberattacks is very crucial. Moreover, the information sharing among the vehicles should not be at the expense of the user's privacy. Additionally, the platoon operation is based on broadcast and requires a lightweight method to support secure group communication. This paper presents a novel protocol that utilizes lightweight hardware fingerprinting primitives and the Chinese Remainder Theorem (CRT) to automate the key generation and management process. Our protocol eliminates the need for pre-loaded keys and enables vehicles to infer the group key on-the-fly. CRT is utilized to help the transportation authority generate a group key for each platoon and broadcast an obscured version of such a key. Using our scheme, only the vehicles involved in platoon can recover the key using their respective hardware primitives. The validation results confirm the resilience of our protocol to attempts for unveiling the keys by single and collusive actors, while also providing reduced computational complexity compared to competing schemes.

BIOGRAPHY:

Wassila Lalouani is currently an assistant professor in the Department of Computer and Information Sciences at Towson University. Before joining Towson University, She was a research assistant at the Embedded Systems and Networks lab at the University of Maryland Baltimore County. Prior to that, she was a lecturer at the High National School of Computing Science, Algiers, Algeria. She received her Ph.D. degree in Computer Science from the University of Maryland Baltimore County and the University of Science and Technologies Houari Boumediene (USTHB). Her research interests include security, machine learning, and network architectures and protocols.

W4 – Advanced MIMO and Beamforming Technologies (Saturday, May 6th, 15:30 -17:10)

Session Chair

Ang Gao

School of Electronics and Information, Northwestern Polytechnical University, Xi'an 710072, China

BIOGRAPHY:

Ang Gao received the Ph.D. degree in control theory and control engineering from the School of Automation, Northwestern Polytechnical University, Xi'an, China, in 2011. He is currently an Associate Professor with the School of Electronics and Information, Northwestern Polytechnical University. His research interests include QoS control, resource management and deep reinforcement learning in wireless communication networks.

W4 – Advanced MIMO and Beamforming Technologies (Saturday, May 6th, 15:30 -17:10)

W4.1: Heterogeneous Multi-Agent Reinforcement Learning for Joint Active and Passive Beamforming in IRS Assisted Communication

Ang Gao, Xinshun Sun, Yongshuai Xu, Wei Liang

School of Electronics and Information, Northwestern Polytechnical University, Xi'an 710072, China.

ABSTRACT:

Intelligent Reflecting Surface (IRS), with the potential capability to reconstruct the electromagnetic propagation environment, evolves a new multi-IRS assisted communication paradigm to beam the scattered signals for better spectrum efficiency (SE). However, when a large number of IRS elements are involved, accurate channel estimation and sharing is still a challenge which will lead to extra hardware complexity and communication overhead. Furthermore, because of the cross-interference caused by massive reflecting paths when multiple IRSs are introduced, SE optimization is hard to get a close-formed solution due to the non-convexity. This paper improves a heterogeneous based multi-agent deep deterministic policy gradient (MADDPG) approach for joint active and passive beamforming optimization without channel estimation, where base station (BS) and multiple IRSs cooperatively learn to enhance SE and suppress the interference. Due to the centralized-training and distributed-execution feature of MADDPG, the well-trained BS and IRSs can execute both the active and passive beamforming optimization independently without referring to other agents, which can greatly reduce the communication overhead and simplify the IRS deployment. Numeral simulations demonstrate the effectiveness of the proposed approach on enhancing SE and suppressing interference in the multi-IRS assisted communication system.

BIOGRAPHY:

Xinshun Sun, received B.S. degree in Electronic information engineering from North University of China, Taiyuan, China,in 2020. He is currently working toward the M.S. degree in Information and communication Engineering with the Northwestern Polytechnical University, Xi'an,China. His research interests include intelligent reflecting surface and channel estimation.

Ang Gao received the Ph.D. degree in control theory and control engineering from the School of Automation, Northwestern Polytechnical University, Xi'an, China, in 2011. He is currently an Associate Professor with the School of Electronics and Information, Northwestern Polytechnical University. His research interests include QoS control, resource management and deep reinforcement learning in wireless communication networks.

W4.2: A Simplified Message Passing Detection Algorithm for Massive MIMO System

Jing Ye[1], Jianing Zhao[1, 2], and Fei Xu[3]

[1]National Mobile Communications Research Laboratory, Southeast University, Nanjing, China
[2]Purple Mountain Laboratories, Nanjing, China
[3]Future Mobile Technology Laboratory, China Mobile Research Institute, Beijing, China

ABSTRACT:

The original message passing detection (MPD) algorithm based on channel hardening theory has shown excellent performance in large-scale multiple-input multiple-output (MIMO) systems. However, with the increase of the numbers of users and modulation order, the high computation complexity of the original MPD algorithm is very unfriendly to hardware implementation. Therefore, this paper proposes a simplified MPD algorithm based on probability approximation, which is called MS-PA-MPD for short. This algorithm simplifies the calculation of log-likelihood ratio in original MPD algorithm, and eliminates many exponential and division operations. It also sorts and selects the symbol probabilities in each iteration. Only the constellation points with high symbol probabilities can be selected to update the probabilities, which greatly reduces the computation complexity. Moreover, an improved algorithm HMS-PA-MPD is proposed to solve the problem of MS-PA-MPD's performance degradation under higher-order modulation. Simulation results show that, for 16QAM, the performance loss of MS-PA-MPD can be almost ignored compared with the original MPD. Besides, the HMS-PA-MPD also shows good detection performance under higher-order modulation. Both of them greatly reduce the computation complexity and hardware overhead, and are especially suitable for large-scale MIMO systems.

BIOGRAPHY:

Jing Ye, received the B.E. degree from the School of Physics and Technology, Nanjing Normal University, Nanjing, China in 2020. She is currently pursuing the M.S. degree with the National Mobile Communications Research Laboratory, Southeast University, Nanjing, China. Her current research interests include signal detection and decoding in massive MIMO system.

W4 – Advanced MIMO and Beamforming Technologies (Saturday, May 6th, 15:30 -17:10)

W4.3: Transformer-based CSI Feedback with Hybrid Learnable Non-Uniform Quantization for Massive MIMO Systems

Binggui Zhou[1,2] , Shaodan Ma[2], and Guanghua Yang[1]

[1]School of Intelligent Systems Science and Engineering, Jinan University, Zhuhai 519070, China
[2]State Key Laboratory of Internet of Things for Smart City, University of Macau, Macao 999078, China

ABSTRACT:

In frequency division duplexing (FDD) massive multiple-input multiple-output (MIMO) systems, accurate channel state information (CSI) needs to be acquired via CSI feedback to reap the potential benefits of massive MIMO. However, the large-scale antenna array enlarges the dimension of the CSI matrix to be fed back and thus leads to unaffordable CSI feedback overhead. In addition, the quantization and dequantization processes in CSI feedback unavoidably introduce non-neglectable quantization errors, which greatly restrict the performance of CSI feedback. To this end, in this paper, we propose a Transformer-based CSI feedback method with a hybrid learnable non-uniform quantization method to eliminate quantization errors and improve CSI feedback accuracy with reduced feedback overhead. Experimental results on a public dataset demonstrate that the proposed Transformer-based CSI feedback method can achieve higher CSI feedback accuracy with the help of the hybrid learnable non-uniform quantization method.

BIOGRAPHY:

Binggui Zhou received the B.Eng. degree from Jinan University, Zhuhai, China, in 2018, and the M.Sc. degree from the University of Macau, Macao, China, in 2021, respectively. He is currently working toward the Ph.D. degree in Electrical and Computer Engineering with the University of Macau, Macao, China. He also serves as a Research Assistant with the School of Intelligent Systems Science and Engineering, Jinan University, Zhuhai, China. His research interests include Artificial Intelligence and AI assisted Wireless Communications.

W4.4: Parametric Precoding Based on Improved Dynamic Gradient Descent in Multibeam Satellite Communications

Jiayu Wang, Rugui Yao, Donghui Xu, Ye Fan, and Xiaoya Zuo

School of Electronics and Information, Northwestern Polytechnical University, Xi'an, Shanxi, China

ABSTRACT:

Precoding and beamforming have been studied in multibeam satellite. In this paper, we propose a precoding method based on dynamic gradient descent, which is suitable for large array antenna and multiuser multibeam satellite environment. This method doesn't need complex vector or matrix design because of combining zero-forcing and maximum ratio transmission. And gradient descent algorithm is used to solve this combining zero-forcing and maximum ratio transmission model. Meanwhile, the convergence of gradient descent is also proved. The simulation results show that the improved gradient descent based on parametric design can get higher sum rate, whether it is in the case of multiple users with massive antennas or small users with a few number of antennas. Meanwhile, for the gradient descent convergence problem, we propose a dynamic adaptive learning rate updating method, which has faster and better convergence performance than traditional gradient descent algorithm.

BIOGRAPHY:

Jiayu Wang received the B.S. degree in electronic information engineering from Honors College, Northwestern Polytechnical University, in 2021, and he is currently pursuing the M.S. degree in information and communication engineering from School of Electronic Information. His research interests include multibeam satellites and cognitive radio.He was also involved in several projects in which these techniques are being applied in the fields of wireless communications.

O1 – Advamces in Optical Networking (Friday, May 5th , 13:30- 15:10)

Session Chair

Kevin Lu

Teaching Professor and Associate Chair for Undergraduate Studies
Electrical and Computer Engineering
Stevens Institute of Technology, Hoboken, NJ 07030

BIOGRAPHY:

Dr. Kevin W. Lu is a teaching professor and associate chair for undergraduate studies of electrical and computer engineering at Stevens Institute of Technology. He is an IEEE life senior member. He has served as Chair (2012-2013) and Advisor (2014-2017) of the ComSoc Standards Development Board, and a member (2016-2023) of the Standardization Programs Development Board. He has been a member of the IEEE Standards Association (IEEE-SA) Standards Board (SASB 2016-2023), New Standards Committee (NesCom 2013-2016, 2018-2019), Patent Committee (PatCom 2023), Procedures Committee (ProCom 2020-2023), Standards Review Committee (RevCom 2017), and IEEE Standards Education Committee (SEC 2017-2019). He has also served as Standards Coordinating Committee (SCC) Coordinator (2017-2018), Member (2019-2020) and Chair (2021-2023) of Audit Committee (AudCom), and Member (2016-2017) and Chair (2018-2023) of Industry Connections Committee (ICCom).

Kevin was a chief scientist and executive director at Telcordia Applied Research, then a senior principal scientist at Broadcom where he contributed to 3GPP Radio Access Network Working Groups RAN1 and RAN4. He was Chair (2007–2010) of the TIA TR-48 Engineering Committee on Vehicular Telematics, and authored “All-in-one: Making connected vehicles possible” in the February 2012 issue of ISO Focus+. He contributed to the 2011 ATIS Machine-to-Machine Focus Group and the 2011–2014 Strategic Plan for the U.S. Department of Transportation’s Intelligent Transportation System Standards Program. Kevin received B.S. in control engineering from National Chiao Tung University, and M.S. and D.Sc. in systems science and mathematics from Washington University in St. Louis.

O1 – Advamces in Optical Networking (Friday, May 5th , 13:30- 15:10)

O1.1: A Novel Multi-Objective Routing Scheme based on Cooperative Multi-Agent Reinforcement Learning for Metaverse Services in Fixed 6G

Xueming Zhou, Bomin Mao, and Jiajia Liu

School of Cybersecurity, Northwestern Polytechnical University

ABSTRACT:

The 6th Generation Fixed networks (F6G) with holographic communication and omni-directional sensory coverage is expected to arrive in 2030. Due to the characteristics of cross-integration between the physical and digital worlds, metaverse has been widely recognized as an important application in F6G to be utilized in all walks of life in the future. However, the metaverse applications will generate diversified communication services with differentiated Quality of Service (QoS) requirements, which will be a great challenge for F6G to develop End-to-End (E2E) customized transmission strategies. Traditional single metric-based routing algorithms cannot efficiently orchestrate the network resources to meet the diversified QoS requirements. To solve the above problems, we propose a Cooperative Multi-Agent Reinforcement Learning (Co-MARL) routing algorithm, which measures the differentiated QoS demands through a generic utility function to facilitate multiple agents to solve the multi-objective optimization problem. The simulation results show our scheme outperforms the traditional routing algorithm in meeting the diversified QoS requirements.

BIOGRAPHY:

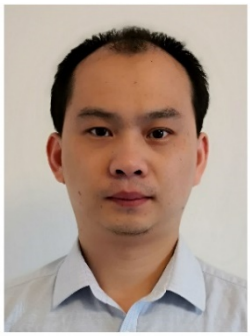
Xueming Zhou received the B.S. degree in Computer Science and Technology from Northwest Normal University in 2022. He is currently pursuing the M.S. degree in School of Cybersecurity, Northwestern Polytechnical University. His research interests cover metaverse, routing algorithm, and deep reinforcement learning. He is a student member of IEEE.

Bomin Mao is currently a full professor with the School of Cybersecurity, Northwestern Polytechnical University, China. His research interests are involving intelligent wireless networks, software defined networking, IoT, particularly with applications of machine intelligence and deep learning. He received several Best Paper Awards from IEEE conferences, such as Globecom and IC-NIDC. He was a recipient of the prestigious IEEE Communications Society Asia Pacific Outstanding Paper Award in 2020 and Niwa Yasujiro Outstanding Paper Award in 2019.

Jiajia Liu is a full professor and vice dean with the School of Cybersecurity, Northwestern Polytechnical University, Xi'an 710072 China. His research interests include intelligent and connected vehicles, Mobile/edge/cloud computing and storage, and Internet of Things security. He has published more than 180 peer-reviewed papers and currently serves as an editor of IEEE Network and IEEE Transactions on Wireless Communications. He is a Senior Member of IEEE.

O1 – Advamces in Optical Networking (Friday, May 5th , 13:30- 15:10)

O1.2: *On the Generalization of Machine-Learning-aided QoT Estimation in Optical Networks*



Hanyu Gao, Liang Zhang†, Xiaoliang Chen, Zhaohui Li,

Information Processing Chips and Systems, Sun Yat-sen University, Guangzhou, China, and Southern Marine
Science and Engineering Guangdong Laboratory, Zhuhai, China
†Department of Electrical and Computer Engineering, George Mason University, Fairfax, VA 22030, USA

ABSTRACT:

This paper presents a composable machine learning method for generalizing the quality-of-transmission (*QoT*) metric estimation in optical networks. The composable machine learning approach characterizes this metric for lightpaths of arbitrary lengths by compositions of launch, propagation and readout modules. Results verify the feasibility of the design and show its successful application in facilitating autonomous lightpath provisioning.

BIOGRAPHY:

Liang Zhang (Member, IEEE) received the Ph.D. degree in electrical engineering from New Jersey Institute of Technology, Newark, NJ, USA, in 2020. He is currently a Postdoctoral Research Fellow with the Department of Electrical and Computer Engineering, George Mason University, Fairfax, VA, USA. His research interests include machine learning, mobile-edge computing, UAV communications, wireless communications, and Internet of Things..

O1 – Advamces in Optical Networking (Friday, May 5th , 13:30- 15:10)

O1.3: Slotted Aloha for Optical Wireless Communications in Internet of Underwater Things

Milica Petković[1], Sotiris A. Tegos[2], Panagiotis D. Diamantoulakis[2], Dejan Vukobratović[1], Erdal Panayirci[3], Čedomir Stefanović[4], George K. Karagiannidis[2,5]

[1]Faculty of Technical Sciences, University of Novi Sad, Novi Sad, Serbia
[2]Aristotle University of Thessaloniki, Thessaloniki, Greece
[3]Kadir Has University, Cibali-Fatih, Istanbul, Turkey
[4]Aalborg University, Aalborg, Denmark
[5]Cyber Security Systems and Applied AI Research Center, Lebanese American University (LAU)

ABSTRACT:

In this work, we design and analyse a Slotted ALOHA (SA) solution for Optical Wireless Communication (OWC)-based Internet of Underwater Things (IoUT). In the proposed system, user devices exchange data with an access point (AP) which exploits the capture effect. The space spanned by the IoUT nodes is three-dimensional, i.e., users are located in half-sphere centered at the AP placed at the bottom of a floating object at the water surface level. The analytical expressions for the system throughput and reliability expressed in terms of the outage probability are derived. Based on the simulated signal-to-noise-and-interference-ratio statistics and derived analytical expressions, we present numerical results that investigate the trade-off between the system performance and the IoUT system parameters, such as the number of users, activation probability and type of water medium. The presented conclusions provide valuable insights into the design of an SA-based solution for IoUT communications.

BIOGRAPHY:

Milica Petković (Memeber, IEEE) received her M.Sc. and Ph.D. degrees in electrical engineering from the Faculty of Electronic Engineering, University of Nis, Serbia, in 2010, and 2016, respectively. Currently, she is an Assistant Professor at Faculty of Technical Science, University of Novi Sad, Serbia. Her research interests are in the broad area of Digital Communications Systems and Signal processing, with emphasis on Optical Wireless Communications.

O1 – Advamces in Optical Networking (Friday, May 5th , 13:30- 15:10)

O1.4: Recent progress in optical access and home networking standards

Frank J. Effenberger

Futurewei technologies

ABSTRACT:

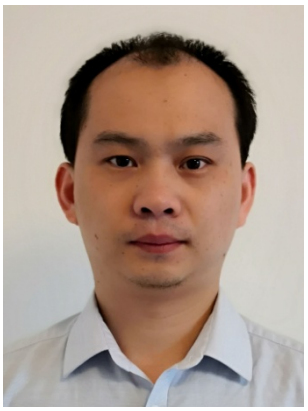
In the past few years there have been several significant advancements in optical networking standards for both access and home networks. These include 50 Gb/s PON, common infrastructure components, high speed bidirectional PHYs, WDM-PON, and fiber home networks. This paper will review each of these major efforts to give their status and suggest their future direction.

BIOGRAPHY:

Dr. Effenberger has worked in the optical access field at Bellcore, Quantum Bridge Communications (Motorola), and Futurewei Technologies, where he is now the Fellow for fixed access network technology. His team works on forward-looking fiber access technologies, with several “world’s first” prototypes and trials. Frank is the rapporteur for ITU-T Q2/15, vice chair of ETSI F5G ISG, is a Fellow of the OSA and the IEEE, and holds 130 US patents.

O2 –Photonic Device (Friday, May 5th , 15:30- 17:10)

Session Chair



Liang Zhang

Postdoctoral Research Fellow, Department of ECE, George Mason University (GMU), Fairfax, VA 22030

BIOGRAPHY:

Liang Zhang [S'15, M'20] (lzhang36 AT gmu.edu) received Ph.D. degree in Electrical Engineering from New Jersey Institute of Technology, Newark, NJ, USA, in 2020, M.S. degree in Electronic Engineering and Information Science from University of Science and Technology of China, Hefei, China, in 2014, and B.S. degree in Electronic and Science and Technology from Huazhong University of Science and Technology, Wuhan, China. He is currently a Postdoctoral Research Fellow with the Department of Electrical and Computer Engineering, George Mason University, Fairfax, VA, USA. Liang Zhang was a recipient of the Outstanding Dissertation Award in NJIT in 2023, the Hashimoto Prize in NJIT for the best doctoral dissertation in 2020, the Travel Grant Award of IEEE GLOBECOM in 2016, the Best Paper Award of IEEE ICNC in 2014, and the prize of the National Scholarship of Graduate Students in China in 2013. He has more than 30 publications and reviewed more than 200 journal articles. His research interests include machine learning, mobile edge computing, UAV communications, wireless communications, Internet of Things (IoT), and optical networks.

O2 –Photonic Device (Friday, May 5th , 15:30- 17:10)

O2.1: Manuscript/Talk Title *Free Space Optics as Full Duplex Fronthauling for Drone-Assisted Mobile Networks*

Xiang Sun, Liangkun Yu, and Abee Alazzwi
Author Affiliation

Department of Electrical and Computer Engineering, University of New Mexico, Albuquerque, NM 87131, USA

ABSTRACT:

Drone-assisted mobile networks have been proposed to quickly and flexibly deploy drones over any places of interest (PoI) to relay traffic between a remote terrestrial base station (TBS) and the users in the PoI. Here, a drone is considered to be a small-cell base station that is capable to be deployed very close to users in order to provide a high access network capacity. However, owing to the long distance and high traffic load, the fronthaul link between the TBS and the drone would be the bottleneck of the network. Free space optical (FSO) communications have been proposed as a potential solution to increase the fronthaul link capacity. As compared to RF-based fronthaul link solutions, FSO can achieve higher link capacity over a long distance, lower licensing cost and interference, and more reliable communications to resist interception and eavesdropping, and thus could be more suitable to be applied as the fronthaul link solution. However, there are many existing and unveiled challenges to apply FSO as a full duplex fronthaul link for a drone-assisted mobile network. In this paper, we will explore these challenges and investigate related solutions.

BIOGRAPHY:

Liangkun Yu obtained his B.E. and M.E. degrees in Communications Engineering from Fuzhou University in 2014 and 2017, respectively. Following this, he joined China Telecom as a wireless network engineer from 2017 to 2019. He commenced his doctoral studies at the SENet lab in the University of New Mexico in 2019. Specializing in machine learning and wireless networks, his research explores various topics, including reinforcement learning for UAV swarm traffic management in aerial corridors, wireless IoT federated learning, queueing theory application in wireless networks, and drone-assisted mobile access networks.

O2 –Photonic Device (Friday, May 5th , 15:30- 17:10)

O2.2: An Efficient Pulse Position Modulation Scheme to Improve the Bit Rate of Photoacoustic Communication

Md Shafiqul Islam, Mohamed Younis and Muntasir Mahmud

School of Cybersecurity, Northwestern Polytechnical University

ABSTRACT:

Wireless communication from air-to-underwater is quite challenging because of the lack of proper physical signal that propagates well in both air and water medium. Photoacoustic energy transfer mechanism is the most promising method for such cross-medium communication, where a high energy pulsed light is focused on the water surface, causing the generation of an acoustic signal inside the water. Since acoustic signals can travel a long distance inside the water, this method enables an airborne unit to reach nodes at increased underwater depth. Yet the achievable bit rate for this process is very low. When a pulsed laser light with a higher repetition rate is focused inside the water, a vapor cloud is generated around the focus point, which blocks subsequent generation of acoustic signal and consequently limits the achievable bit rate. This paper opts to overcome such a limitation by proposing a novel pulse position modulation technique which can avoid such generation of vapor cloud and increases the bit rate significantly

BIOGRAPHY:

Not available.

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O2 –Photonic Device (Friday, May 5th , 15:30- 17:10)

O2.3: Novel resonance manipulation method in coupled resonators using "coupling structure technique" for Quantum coherence effect and optical communication applications

Benjamin B. Dingel

Dept. of Physics, School of Science and Engineering (SOSE), Ateneo de Manila University, Philippines
Nasfine Photonics Inc., Painted Post, NY, 14870, USA

ABSTRACT:

Recently, we reported a general technique that uses a “cross-coupling structure” as a new vehicle to manipulate the resonance features of the coupled resonators. The technique is important for the (i) search for new optical analogues of Quantum Coherence Effects (QCEs) and (ii) generation of fresh and richer optical behaviors of the coupled resonators that could open future applications in optical fiber communication. Here, we review two new configurations based on this technique. The first configuration uses a modified standard double resonator (SDR) which we refer to as Cross-coupled SDR (CCSDR). It is a new analogue circuit of QCE that generates a new QC phenomenon we call Cross-coupled Resonator Induced Shifted Absorption (CRISA). It is the first-time a cross-coupled structure has been suggested in studying QCE. Its core mechanism is due to its “cross-coupling structure”. Second, we present a modified coupled ring reflector (CRR) configuration where its original directional couplers (DCs) are replaced with cross-coupler(s) to connect the two ring resonators. We refer to it as crisscrossed-assisted CRR (or X-CCR). We review the unique characteristics of these two configurations and discuss their applications as optical devices.

BIOGRAPHY:

Benjamin B. Dingel received his B.S. degree in Physics from the Ateneo De Manila University, Philippines in 1980, master and doctor degrees in Applied Physics from Osaka University, Japan in 1990 and 1993, respectively. He joined NEC Central Research Laboratory as research engineer in 1993 working in optical lithography, and high power solid state laser. In 1996, he moved to the Communication Research Laboratory (CRL), Japanese Ministry of Post and Telecommunication working on intelligent optical devices for optical networks, and microwave photonics. In 1999, he joined Corning Inc. as a senior research scientist to continue his work on various areas of optical networks from optical equipment and subsystem, and components. In 2003, he co-founded Nasfine Photonics, Inc., and is presently its Scientific Lead of R&D.

Since 2020, he is a Research Fellow at the Ateneo de Manila University, Philippines, and head of the Ateneo Research on Optical Science, Engineering and Systems (ROSES) Laboratory working on Photonics Integrated Circuits (PICs), Microwave Photonics, AI, Analogue Science, Mathematical Physics, others. He is senior editor of SPIE’s Optical Engineering since 2007, program chair of SPIE Photonics West’s Optical Communications track since 2008-2021, and Broadband Access Communication Technologies (2006-2021). He has 15 Patents (approved and pending), more than 10 invited talks and more than 120 journal and conference-published papers.

O3 –Emerging Application of Networks, May 6th , 13:30- 15:10)

Session Chair

Yuanqiu Luo

Futurewei Technologies, Basking Ridge, New Jersey, USA 07920

BIOGRAPHY:

Yuanqiu Luo is a Director of Optical Access Standards in Futurewei Technologies, USA. She received the Ph.D. degree in electrical engineering from the New Jersey Institute of Technology. Dr. Luo has been working in the areas of optical access networks for more than 15 years. She has been a key contributor of international standards on optical access systems. She is an Editor of ITU standards G.987.3 (XG-PON), G.988 (OMCI), G.989.2 (NG-PON2), G.9802 (multiwave PON), G.9803 (radio over fiber), G.9804.2 (50G-PON), and G.9807.1(XGS-PON). She is the Chair of the IEEE 802.3dk Task Force (100G and 200G BiDi). She was the Chief Editor of IEEE standard 802.3cp (10G/25G/50G BiDi) and a Clause Editor of IEEE standard 802.1AS (time synchronization).

Dr. Luo is the IEEE Princeton Central Jersey Section Photonics Chapter Chair. She is a member of the IEEE ComSoc Educational Services Board (ESB). She is currently an IEEE ComSoc Distinguished Lecturer. Dr. Luo teaches the ComSoc training course “Empowering Industry 4.0 with Next Generation Optical Access Networks”. She has been teaching a course on optical access technilogies at OFC since 2018. She has published over 60 papers and delivered more than 30 talks. She has invented over 50 US patents.

Dr. Luo received the Best Paper Award from IEEE & OSA Journal of Lightwave Technology. She is a two-time recipient of the IEEE Standards Award (both 2011 and 2021). In 2021 she was named a Star in Computer Networking and Communications by the IEEE ComSoc N^2 Women. In 2022 she won the IEEE Region 1 Technological Innovation Award for outstanding innovations on highspeed optical access system design and leadership in driving international standards.

O3 –Emerging Application of Networks, May 6th , 13:30- 15:10)

O3.1 Industrial PON system architecture and applications

Xiao Yu; Hui Sun; Dezhi Zhang; Jialiang Jin

China Telecom Research Institute Shanghai, China

ABSTRACT:

The industrial PON is a network technology to meet key communication requirements in industrial intranets, including connectivity, intelligent management, and deterministic capability. This paper introduces the system architecture of Industrial PON with essential features including PON-based large bandwidth access, slicing-based multiple service bearing, and protection schemes. Meanwhile, it presents application cases in two different industrial scenarios.

BIOGRAPHY:

Xiao Yu, graduated from the University of Manchester, with a master's degree in Communication and Signal Processing. Now, I am engaged in the research and development of industrial PON in China Telecom Research Institute.

O3 –Emerging Application of Networks, May 6th , 13:30- 15:10)

O3.2: On a Novel Content Edge Caching Approach based on Multi-Agent Federated Reinforcement Learning in Internet of Vehicles

Yangbo Liu and Bomin Mao

School of Cybersecurity, Northwestern Polytechnical University

ABSTRACT:

Driven by the emerging requirements of Internet of Vehicles (IoV), future vehicles are expected to have the ability to provide not only the autonomous driving services, but also the multimedia services for working and entertainment. The edge caching service enabled by the Road Side Units (RSUs) can complement the limited environment perceiving and computing ability of future vehicles to gather, pre-process, and cache the contents of driving assistance, work, and entertainments. In this paper, we use federated learning to learn the popularity variation tendency considering user preference in different districts and their concerns for privacy-preserving. We further split the possible contents into blocks and use completely cooperative multi-agent reinforcement learning based on Deep Q network to make a more flexible and accurate caching decision considering the various emergency levels and delay requirements of different contents. Numerical results demonstrate that the proposed method outperforms traditional caching strategies.

BIOGRAPHY:

Yangbo Liu received the B.S. degree in information management and information system from Shandong University of Science and Technology, Qingdao, China, in 2022. He is currently pursuing the M.S. degree in School of Cybersecurity, Northwestern Polytechnical University. His research interests include Internet of Vehicles, machine learning and cybersecurity.

Bomin Mao is currently a full professor with the School of Cybersecurity, Northwestern Polytechnical University, China. His research interests are involving intelligent wireless networks, software defined networking, IoT, particularly with applications of machine intelligence and deep learning. He received several Best Paper Awards from IEEE conferences, such as Globecom and IC-NIDC. He was a recipient of the prestigious IEEE Communications Society Asia Pacific Outstanding Paper Award in 2020 and Niwa Yasujiro Outstanding Paper Award in 2019..

O3 –Emerging Application of Networks, May 6th , 13:30- 15:10)

O3.3: On the Deployment and Operation of Correlated Data-Intensive vNF-SCs in Inter-DC EONs

Zuqing Zhu†, Liang Zhang‡, Bijan Jabbari‡

†School of Information Science and Technology, University of Science and Technology of China, China, zqzhu@ieee.org
‡Department of Electrical and Computer Engineering, George Mason University, USA, {lzhang36, bjabbari}@gmu.edu

ABSTRACT:

In this work, we study the problem of deploying and operating correlated data-intensive vNF-SCs in inter-datacenter elastic optical networks. Requiring for a set of correlated data-intensive vNF-SCs, the service completion time (SCT) of a network service is related to the maximum branch completion time of those vNF-SC branches, making the correlation awareness of importance for the problem optimization. Being aware of it, we propose a dynamic programming based optimization scheme for the deployment and operation of single vNF-SC branch and two correlation-aware service provisioning algorithms to minimize the average SCT of network services. Simulation results verified that the proposed algorithms can effectively reduce the average SCT of network services compared with a benchmark algorithm that ignores the importance of correlation awareness.

BIOGRAPHY:

Liang Zhang (Member, IEEE) received the Ph.D. degree in electrical engineering from New Jersey Institute of Technology, Newark, NJ, USA, in 2020. He is currently a Postdoctoral Research Fellow with the Department of Electrical and Computer Engineering, George Mason University, Fairfax, VA, USA. His research interests include machine learning, mobile-edge computing, UAV communications, wireless communications, Internet of Things, and optical networks..

O3.4: Phasor Analysis of the Symmetric Crisscrossed-assisted Coupled-Ring Reflector

Avram Gutierrez[1], Benjamin B. Dingel[1,2,*]
Joel T. Maquiling[1], Jan Llenzl Dagohoy[1], and
David Jonas P. Bambalan[1]

[1]Dept. of Physics, School of Science and Engineering (SOSE), Ateneo de Manila University, Philippines
[2]Nasfine Photonics Inc., Painted Post, NY, 14870, USA

ABSTRACT:

We investigate the general phasor characteristics of the recently reported crisscrossed coupled-ring reflector (X-CRR) and compare it with the typical coupled-ring reflector (CRR) configuration. We observe that they distinctly have different phasor features under arbitrary parameter conditions. We also (i) discuss the importance of normalized frequency range in generating the complete phasor picture of these configurations and (ii) show that in most cases the X-CRR appears to be a spread-out, rotated version of the phasor diagram of the CRR. These phasor features imply that X-CRR possesses more interesting functionalities for various potential telecom applications.

BIOGRAPHY:

Benjamin B. Dingel received his B.S. in Physics from the Ateneo De Manila University, Philippines in 1980, master and doctor degrees in Applied Physics from Osaka University, Japan in 1990 and 1993, respectively. He joined NEC Central Research Laboratory as a research engineer in 1993 working in optical lithography, and high-power solid-state laser. In 1996, he moved to the Communication Research Laboratory (CRL), Japanese Ministry of Post and Telecommunication working on intelligent optical devices for optical networks, and microwave photonics. In 1999, he joined Corning Inc. as a senior research scientist to continue his work on various areas of optical networks from optical equipment and subsystem, and components. In 2003, he co-founded Nasfine Photonics, Inc., and is presently its Scientific Lead of R&D.

Since 2020, he has been a Research Fellow at the Ateneo de Manila University, Philippines, and head of the Ateneo Research on Optical Science, Engineering and Systems (ROSES) Laboratory working on Photonics Integrated Circuits (PICs), Microwave Photonics, AI, Analogue Science, Mathematical Physics, others. He is senior editor of SPIE's Optical Engineering since 2007, program chair of SPIE Photonics West's Optical Communications track since 2008-2021, and Broadband Access Communication Technologies (2006-2021). He has 15 Patents (approved and pending), more than 10 invited talks and more than 120 journal and conference-published papers.

M1 – Emerging Applications of Machine Learning and AI *(Friday, May 5th ,* 13:30 – 15:10*)*

Session Chair

Ying Tang

Rowan University

BIOGRAPHY:

Ying Tang (Senior Member, IEEE) received the B.S. and M.S. degrees from Northeastern University, Shenyang, China, in 1996 and 1998, respectively, and the Ph.D. degree from the New Jersey Institute of Technology, Newark, NJ, USA, in 2001. She is a Full Professor of Electrical and Computer Engineering with Rowan University, Glassboro, NJ, USA. S. Her work has resulted in three USA patents, and over 200 peer-reviewed publications, including 71 journal articles, two edited books, and six book/encyclopedia chapters. Her current research interests lie in the area of discrete event systems and visualization, including virtual reality/augmented reality, modeling and adaptive control for computer-integrated systems, intelligent serious games, green manufacturing and automation, blockchain, and Petri Nets.

M1 – Emerging Applications of Machine Learning and AI *(Friday, May 5th*, 13:30 – 15:10*)*

M1.1: Hierarchical Deep Reinforcement Learning with Experience Sharing for Metaverse in Education

Ryan Hare and Ying Tang

Rowan University

ABSTRACT:

Metaverse has gained increasing interest in education, with much of literature focusing on its great potential to enhance both individual and social aspects of learning. However, little work has been done to address the systems and technologies behind providing meaningful Metaverse learning. This article proposes a technical framework to address this research gap, where a hierarchical multiagent reinforcement learning approach with experience sharing is developed to augment the intelligence of nonplayer characters in Metaverse learning for personalization. The utility and benefits of the proposed framework and methodologies are demonstrated in Gridlock, a Metaverse learning game, as well as through extensive simulations.

BIOGRAPHY:

Ying Tang (Senior Member, IEEE) received the B.S. and M.S. degrees from Northeastern University, Shenyang, China, in 1996 and 1998, respectively, and the Ph.D. degree from the New Jersey Institute of Technology, Newark, NJ, USA, in 2001. She is a Full Professor of Electrical and Computer Engineering with Rowan University, Glassboro, NJ, USA. S. Her work has resulted in three USA patents, and over 200 peer-reviewed publications, including 71 journal articles, two edited books, and six book/encyclopedia chapters. Her current research interests lie in the area of discrete event systems and visualization, including virtual reality/augmented reality, modeling and adaptive control for computer-integrated systems, intelligent serious games, green manufacturing and automation, blockchain, and Petri Nets.

M1 – Emerging Applications of Machine Learning and AI *(Friday, May 5th ,* 13:30 – 15:10*)*

M1.2: Introduction to AI Techniques for Forecasting Epidemic Dynamics

Lijing Wang

New Jersey Institute of Technology, USA

ABSTRACT:

Forecasting the spatial and temporal evolution of epidemic dynamics has been an area of active research over the past couple of decades. The importance of the topic is evident: policy makers, citizens, and scientists would all like to get accurate and timely forecasts.

In contrast to physical systems, the co-evolution of epidemics, individual and collective behavior, viral dynamics, and public policies make epidemic forecasting a problematic task. Data-driven methods are popular since they do not need explicit knowledge of the physical behavior of the system, and have been deployed successfully in multiple domains. For instance, deep learning-based predictive models have gained increasing prominence in epidemic forecasting. However, they are challenging to train due to sparse and noisy training data and the limited ability to explicitly incorporate mechanisms of disease spread. In recent times, theory-based mechanistic methods have become a mainstay of epidemic forecasting due to their ability to capture the underlying causal processes through mathematical and computational representations. This workshop covers the state-of-the-art for epidemic forecasting. It starts with a formal definition of an epidemic process and details the different aspects of disease spread dynamics. The problem of spatiotemporal epidemic forecasting is then formulated and the central challenges are outlined. Subsequently, it covers major methodologies for epidemic forecasting including theory-based mechanistic methods and data-driven methods. Then a range of methods that have been developed will be described and the experience of our team will be discussed.

BIOGRAPHY:

Lijing Wang, assistant professor of data science, works on computing methods to solve problems in domains ranging from epidemics, to health informatics, to public health, including work on COVID-19 forecasting for the CDC. She developed deep-learning techniques to forecast disease trajectories, including short-term predictions of case count, peak time, and peak intensity.

M1.3: Hands-on Active Learning Approach to Teach Artificial Intelligence/Machine Learning to Elementary and Middle School Students

Neelu Sinha; Ryan F Evans; Mackenzie Carbo

Fairleigh Dickinson University, USA
1.

ABSTRACT:

The last decade has seen a surge in expanding access to Computer Science (CS) education, especially for K-12, with many states even stipulating student learning standards in CS and Computational Thinking (CT). Our 21st century K-12 students are no longer just computer users, but are now required to be computationally literate creators with proficient skills both in the concepts and practices of CS and CT. At the same time, technology continues to pervade our lives and expand at a relentless pace and all aspects of our lives are now embedded in technology surrounded by Artificial Intelligence (AI). AI in the form of Machine Learning (ML) is a key technology in a diversity of applications, where we use sensors to meaningfully perceive the world around us, analyze and organize the perceived data, and autonomously use that data to make predictions and decisions. In higher education, AI/ML courses proliferate, with many institutions now conferring degrees and certifications in these. To an extent, some high schools (grades 9-12) have started introducing these concepts in a technology class, or a robotics club, or as an after-school activity. As for middle (grades 6-8) and elementary school (grades K-5), there are very few examples of such instruction. In this paper, we present a complete framework for elementary and middle school teachers to help them prepare and incorporate AI/ML lessons in their classrooms using hands-on active learning strategies. We want to empower these teachers to impart improved learning to their students, which in turn will prepare their students to become effective thinkers, problem solvers, communicators, and gain necessary skills for high-skilled and high-demand jobs. We describe a detailed AI/ML lesson plan based on standards and framework, AI4K12 big ideas, art and science of curriculum design, active learning, and culturally responsive and inclusive pedagogy. Then we discuss our experiences in teaching the same to 4th grade students in an elementary school.

BIOGRAPHY:

M1 – Emerging Applications of Machine Learning and AI *(Friday, May 5th ,* 13:30 – 15:10*)*

M1.4: Deep Learning for the Detection of Emotion in Human Speech: The Impact of Audio Sample Duration and English versus Italian Languages

Alexander Wurst; Michael Hopwood; Sifan Wu; Fei Li; Yu-Dong Yao

Stevens Institute of Technology, USA

ABSTRACT:

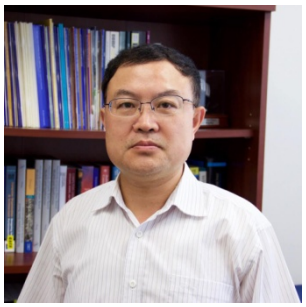
Identification of emotion types is important in the diagnosis and treatment of certain mental illnesses. This study uses audio data and deep learning methods such as convolutional neural networks (CNN) and long short-term memory (LSTM) to classify the emotion of human speech. We use the IEMOCAP and DEMoS datasets, consisting of English and Italian audio speech data in our experiments to classify speech into one of up to four emotions: angry, happy, neutral, and sad. The classification performance results demonstrate the effectiveness of the deep learning methods, and our experiments yield between 62 and 92 percent classification accuracies. We specifically investigate the impact of the audio sample duration on the classification accuracy. In addition, we examine and compare the classification accuracy for English versus Italian languages.

BIOGRAPHY:

Alexander Wurst received his B.E. and M.E. degrees in computer engineering from Stevens Institute of Technology, Hoboken, New Jersey, in 2021 and 2022, respectively. He is currently working as an embedded software engineer at CACI International Inc. in the photonics division. His research interests include deep learning and embedded communication systems.

M2 – Advance in Machine Learning and its Application (Friday May 5th , 15:30- 17:30)

Session Chair



Jiacun Wang

Monmouth University

BIOGRAPHY:

Jiacun Wang received a Ph.D. in computer engineering from Nanjing University of Science and Technology (NJUST), China in 1991. He is currently a Professor in the Computer Science and Software Engineering Department at Monmouth University, West Long Branch, New Jersey. From 2001 to 2004, he was a member of scientific staff with Nortel Networks in Richardson, Texas. Prior to joining Nortel, he was a research associate of the School of Computer Science, Florida International University (FIU) at Miami. Prior to joining FIU, he was an associate professor at NJUST.

Dr. Wang has published four books and about 150 papers. He is the AVP Finance of the IEEE SMC Society. He was the Secretary of the Organizing and Planning Committee of the IEEE SMC Society. He is an Associate Editor of several international journals and has served as general chair, program chair, program co-chair, or special sessions chair for many international conferences. Dr. Wang has been a senior member of IEEE since 2000.

M2 – Advance in Machine Learning and its Application (Friday May 5th , 15:30- 17:30)

M2.1: Hybrid Disassembly Line Optimization with Reinforcement Learning

Guipeng Xi[1], Jiacun Wang[2], Xiwang Guo[1], Shixin Liu[3], Shujin Qin[4], Liang Qi[5]

Liaoning Petrochemical University, China[1]
Monmouth University, USA[2]
Northwest University, China[3]
Shangqiu Normal University, China[4]
Shandong University, China[5]

ABSTRACT:

This paper explores the benefits of combining a U-shaped disassembly line with a single-row linear disassembly line for specific scenarios. To address the balancing problem that arises with such a hybrid disassembly line, the authors establish a mathematical model aimed at maximizing recovery profit. The Soft Actor-Critic (SAC) algorithm is proposed to find the solution, taking into account the characteristics of the problem. The performance of the SAC algorithm is compared to the Advantage Actor-Critic (A2C) algorithm, Deep Deterministic Policy Gradient (DDPG). The results demonstrate that the SAC algorithm is capable of achieving an approximately optimal result for small-scale cases and outperforms DDPG, A2C in solving large-scale disassembly cases.

BIOGRAPHY:

Jiacun Wang received the PhD in computer engineering from Nanjing University of Science and Technology, China, in 1991. He joined Monmouth University in 2004 and is currently a professor of software engineering. He served as the computer science and software engineering department chair from 2009 to 2015. He has been the graduate program director of the department since 2016. His research interests include machine learning, formal methods, discrete event systems, software engineering, workflow, and real-time distributed systems. He published four books and more than 170 papers. He served as an Associated Editor of IEEE Transactions on Systems, Man, and Cybernetics: Part C, from 2004 to 2012, and is currently an Associate Editor of IEEE Transactions on Systems, Man, and Cybernetics: Systems and IEEE/CAA Journal of Automatica Sinica. He has served as general chair and program chair in several international conferences.

Xiwang Guo received his B.S. degree in Computer Science and Technology from Shenyang Institute of Engineering, Shenyang, China, in 2006, M.S. degree in Aeronautics and Astronautics Manufacturing Engineering. from Shenyang Aerospace University, Shenyang, China, in 2009, Ph. D. degree in System Engineering from Northeastern University, Shenyang, China, in 2015. He is currently an associate professor of the College of Computer and Communication Engineering at Liaoning Petrochemical University. From 2016 to 2018, he was a visiting scholar of Department of Electrical and Computer Engineering, New Jersey Institute of Technology, Newark, NJ, USA. He has authored 140+ technical papers in journals and conference proceedings, including IEEE Transactions on Cybernetics, IEEE Transactions on System, Man and Cybernetics: Systems, IEEE Transactions on Intelligent Transportation Systems, and IEEE/CAA Journal of Automatica Sinica. His current research interests include Petri nets, remanufacturing, recycling and reuse of automotive, intelligent optimization algorithm.

M2 – Advance in Machine Learning and its Application (Friday May 5th , 15:30- 17:30)

M2.2: Performing Effective Generative Learning from a Single Image Only

Qihui Xu, Jinshu Chen, Jiacheng Tang, Qi Kang

Tongji University, Shanghai, China

Mengchu Zhou

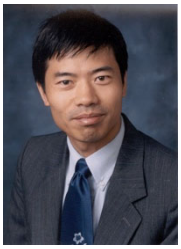
New Jersey Institute of Technology,

ABSTRACT:

Generative adversarial networks (GANs) can be well used for image generation. Yet their training typically requires large amounts of data, which may not be available. This paper proposes a new algorithm for effective generative learning given a single image only. The proposed method involves building GAN models with a hierarchical pyramid structure and a parallel-branch design that enables independent learning of the foreground and background areas. This work conducts a set of well-designed experiments. The results well demonstrate that the proposed method produces the images of higher quality and better diversity than existing methods do. Thus, this work advances the field of generative learning for image generation.

BIOGRAPHY:

Qihui Xu received the B.S. degree in Automation from Tongji University, Shanghai, China, in 2020. She is currently pursuing the M.S. degree in control science and engineering with the Tongji University, Shanghai, China. Her research interests include data generation, few-shot learning and fault diagnosis.



MengChu Zhou received his B.S. degree from Nanjing University of Science and Technology, Nanjing, China in 1983, M.S. from Beijing Institute of Technology, Beijing, China in 1986, and Ph. D. from Rensselaer Polytechnic Institute, Troy, NY in 1990. He joined the Department of Electrical and Computer Engineering, New Jersey Institute of Technology in 1990, and is now a Distinguished Professor. His interests are in intelligent automation, robotics, Petri nets, Internet of Things, edge/cloud computing, and big data analytics. He has over 1100 publications including 14 books, over 750 journal papers including over 600 IEEE Transactions papers, 31 patents and 32 book-chapters. He is a recipient of Excellence in Research Prize and Medal from NJIT, Humboldt Research Award for US Senior Scientists from Alexander von Humboldt Foundation, and Franklin V. Taylor Memorial Award and the Norbert Wiener Award from IEEE Systems, Man, and Cybernetics Society, and Edison Patent Award from the Research & Development Council of New Jersey. He is a life member of Chinese Association for Science and Technology-USA and served as its President in 1999. He is Fellow of IEEE, International Federation of Automatic Control (IFAC), American Association for the Advancement of Science (AAAS), Chinese Association of Automation (CAA) and National Academy of Inventors (NAI).

M2.3: Fruit Fly Optimization Algorithm for Hybrid Disassembly Line Balancing Problem

XiaoYu Niu, XiWang Guo
Petrochemical University Fushun, China

Jiacun Wang
Monmouth University Wes Long Branch

Shujin Qin
Normal University Shangqiu, China

ChenYang Fan
Petrochemical University Fushun, China

ABSTRACT:

Forecasting the spatial and temporal evolution of epidemic dynamics has been an area of active research over the past couple of decades. The importance of the topic is evident: policy makers, citizens, and scientists would all like to get accurate and timely forecasts.

In contrast to physical systems, the co-evolution of epidemics, individual and collective behavior, viral dynamics, and public policies make epidemic forecasting a problematic task. Data-driven methods are popular since they do not need explicit knowledge of the physical behavior of the system, and have been deployed successfully in multiple domains. For instance, deep learning-based predictive models have gained increasing prominence in epidemic forecasting. However, they are challenging to train due to sparse and noisy training data and the limited ability to explicitly incorporate mechanisms of disease spread. In recent times, theory-based mechanistic methods have become a mainstay of epidemic forecasting due to their ability to capture the underlying causal processes through mathematical and computational representations. This workshop covers the state-of-the-art for epidemic forecasting. It starts with a formal definition of an epidemic process and details the different aspects of disease spread dynamics. The problem of spatiotemporal epidemic forecasting is then formulated and the central challenges are outlined. Subsequently, it covers major methodologies for epidemic forecasting including theory-based mechanistic methods and data-driven methods. Then a range of methods that have been developed will be described and the experience of our team will be discussed.

BIOGRAPHY:

Xiwang Guo received his B.S. degree in Computer Science and Technology from Shenyang Institute of Engineering, Shenyang, China, in 2006, M.S. degree in Aeronautics and Astronautics Manufacturing Engineering. from Shenyang Aerospace University, Shenyang, China, in 2009, Ph. D. degree in System Engineering from Northeastern University, Shenyang, China, in 2015. He is currently an associate professor of the College of Computer and Communication Engineering at Liaoning Petrochemical University. From 2016 to 2018, he was a visiting scholar of Department of Electrical and Computer Engineering, New Jersey Institute of Technology, Newark, NJ, USA. He has authored 140+ technical papers in journals and conference proceedings, including IEEE Transactions on Cybernetics, IEEE Transactions on System, Man and Cybernetics: Systems, IEEE Transactions on Intelligent Transportation Systems, and IEEE/CAA Journal of Automatica Sinica. His current research interests include Petri nets, remanufacturing, recycling and reuse of automotive, intelligent optimization algorithm.

M2 – Advance in Machine Learning and its Application (Friday May 5th , 15:30- 17:30)

M2.4: Photovoltaic Power Generation Prediction Based on In-depth Learning for Smart Grid Integration

Zhengshi Wang; Yuyin Li; Anguo Wang; You Wu; Tao Han; Yao Ge

Zhejiang University, China

ABSTRACT:

With the continuous development of photovoltaic power generation technology, the problems of intermittence and randomness of photovoltaic power generation become prominent. Therefore, the connection of the photovoltaic system to the grid will have a certain impact on the stability of the power system and power dispatching. If the power of photovoltaic power generation can be accurately predicted, it will be of great significance for the reasonable coordination of power generation of the photovoltaic system and the stability of the power grid after the system grid connection. In an actual photovoltaic system, there are many factors affecting photovoltaic power and there are different algorithms for power prediction. In this report, long short-term memory (LSTM) is used to predict the power generation of the photovoltaic power system. LSTM can learn the correlation features of the time series data without the problems of data gradient disappearance of the traditional recurrent neural network algorithm. The prediction results are then directly applied to the existing integrated optical storage system. Through the experiments, it is verified that the prediction results accuracy can reach more than 98%..

BIOGRAPHY:

M3 – Machine Learning for Communication (Saturday, May 6th , 13:30- 15:10)

Session Chair

Yao Ma

New Jersey Institute of Technology

BIOGRAPHY:

Yao Ma is an Assistant Professor in the Department of Computer Science at the New Jersey Institute of Technology (NJIT). He received his Ph.D. in Computer Science from Michigan State University (MSU) in 2021, with a focus on machine learning with graph-structured data. His research contributions to this area have led to numerous innovative works presented at top-tier conferences such as KDD, WWW, WSDM, ICLR, NeurIPS, and ICML. He has also organized and presented several well-received tutorials at AAAI and KDD, attracting over 1000 attendees. He is the author of the book "Deep Learning on Graphs", which has been downloaded tens of thousands of times from over 100 countries. He was awarded the Outstanding Graduate Student Award (2019-2020) from the College of Engineering at MSU.

M3 – Machine Learning for Communication (Saturday, May 6th , 13:30- 15:10)

M3.1: : Modulation Recognition using YOLOv5 on the WBSig53 Dataset

Bradley Comar

U.S. Department of Defense, USA

ABSTRACT:

This paper discusses applying a set of YOLOv5 neural networks to the WBSig53 dataset in order to perform modulation recognition. Identifying modulation schemes is a main step in the development of smart receivers. In this effort, attention is payed to the amount of time needed for training as well as inference speed. Signal detection, modulation family classification, and individual modulation scheme recognition are explored on clean and impaired WBSig53 data.

BIOGRAPHY:

Bradley Comar obtained a Bachelors of Science in Electrical Engineering at MIT in 1995 and a Masters of Engineering in Electrical Engineering at MIT in 2000. He currently works at Laboratory of Telecommunication Sciences on the University of Maryland campus where he conducts research in physical layer communications and neural **networks.**

M3 – Machine Learning for Communication (Saturday, May 6th , 13:30- 15:10)

M3.2: Using Mutual Information to Perform Modulation Recognition on the Sig53 Dataset

Bradley Comar

U.S. Department of Defense, USA

ABSTRACT:

This paper discusses an approach to classification (modulation recognition) of RF signals based on mutual information calculations. A small amount of labeled (representative) signals from each source are used by the classification system when determining the class of an unknown (test) signal. This method may be useful in scenarios where labeled data is unavailable in significant quantities.

BIOGRAPHY:

Bradley Comar obtained a Bachelors of Science in Electrical Engineering at MIT in 1995 and a Masters of Engineering in Electrical Engineering at MIT in 2000. He currently works at Laboratory of Telecommunication Sciences on the University of Maryland campus where he conducts research in physical layer communications and neural **networks.**

M3 – Machine Learning for Communication (Saturday, May 6th , 13:30- 15:10)

M3.3: The effect of parameter uncertainty in the link on QoT estimation using GN-based analytical model

Jing Zhou[1], Jianing Lu[1], Zhongxu Liu[1], Changyuan Yu[1,2]

[1]Department of Electronic and Information Engineering
The Hong Kong Polytechnic University
[2]Shenzhen Research Institute, The Hong Kong Polytechnic University,
Shenzhen 518000, China

ABSTRACT:

This paper discusses an approach to classification (modulation recognition) of RF signals based on mutual information calculations. A small amount of labeled (representative) signals from each source are used by the classification system when determining the class of an unknown (test) signal. This method may be useful in scenarios where labeled data is unavailable in significant quantities.

BIOGRAPHY:

Jing Zhou was born in Beijing, China. He received the B. Eng. Degree in optical and electrical information engineering in 2016 from the Huazhong University of Science and Technology, Wuhan, China. He received the M.Sc. degree in Photonics Research Centre, Department of Electronic and Information Engineering, The Hong Kong Polytechnic University, Hong Kong. He is pursuing a Ph.D. in Electronic and Information Engineering at Hong Kong Polytechnic University, Hong Kong. His research interest includes the digital coherent optical communication and optical performance monitoring, high capacity and long-haul fiber-optic transmission systems.

M3.4: Automatic modulation recognition of communication signal based on wavelet transform combined with singular value and NCA-CNN

Yixin Ding

Beijing Jiaotong University, China

ABSTRACT:

In communication signal recognition, there are problems such as a tedious feature extraction process and low applicability of extracted features. This paper simulates wireless communication channels and suggests an algorithm that uses nearest neighbor component analysis (NCA) along with convolutional neural networks (CNN) for classification. The algorithm chooses wavelet entropy (WE), wavelet approximate energy ratio (WAER), and the first 2-4 singular values as the core features. Eight different forms of modulations, including GFSK, CPFSK, B-FM, DSB-AM, SSB-AM, BPSK, QPSK and PAM4 would be automatically classified using the technique. According to the experiment results, the average recognition accuracy for the eight signals is 93.6% when the signal-to-noise ratio is 30dB. In addition, this paper also discusses the results and accuracy of the model to identify 6 and 10 types of signal modulation and studies the accuracy of the recognition under different signal-to-noise ratios, verifying the robustness of the model.

BIOGRAPHY:

Yixin Ding, was born in 2002 , from Jiangsu China, undergraduate student jointly cultivated by Beijing Jiaotong University and Lancaster University, pursuing a dual degree in Communication Engineering. Research direction: signal processing, image processing and artificial intelligence. She once got several modeling price such as: Honorable Mention award in MCM/ICM and prize of Chinese Mathematical Modeling Contest. She was also honored with 2021-2022 first-class scholarship, excellent standing volunteer of Student Union, merit student, 2022-2023 excellent student cadre from Beijing jiaotong University.