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WELCOME MESSAGE

Welcome to the 2024 IEEE 24th International Conference on Communication Technology, taking place in the vibrant city of Chengdu, China, from October 18th to 20th. We are delighted to have you join us as we explore this year's theme, "Communications Empower New Development."

This event brings together academics, researchers, and industry professionals from around the globe, fostering a platform for collaboration and knowledge exchange in the field of communication technology. Our theme this year underscores the transformative power of communication technologies in driving societal and economic development.

Over the next few days, you will have the opportunity to engage in insightful discussions, attend enlightening presentations, and network with some of the brightest minds in our field. We encourage you to take full advantage of these opportunities to broaden your horizons, deepen your understanding, and foster potential collaborations.

We are confident that this conference will provide a fertile ground for the exchange of ideas and the development of innovative solutions to the challenges that lie ahead. As we delve into the role of communication technologies in empowering new development, we hope to inspire and be inspired, to learn, and to advance our field together.

We extend our sincere gratitude to all participants, speakers, sponsors, and the organizing committee for their contributions and dedication. Your collective efforts make this conference possible.

Once again, welcome to the 2024 IEEE 24th International Conference on Communication Technology. We look forward to an exciting and productive event.

IEEE ICCT 2024

Conference Committee

ORGANIZING COMMITTEE

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INVITED SPEAKERS

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Pengcheng Laboratory, China

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Beijing Institute of Technology, China

Zuqing Zhu
University of Science and Technology of China, China

Yuming Xiao
Purple Mountain Laboratory, China

Meng Xiang
Guangdong University of Technology, China

CONFERENCE VENUE

TIVOLI Chengdu At Cultural Heritage Park

(成都非遗博览园缇沃丽酒店)

Address: No. 601-1 Guanghua Avenue, International Intangible Cultural Heritage Expo Park, Qingyang District, Chengdu, Sichuan, China

TRAFFIC INFORMATION

➤ **From Chengdu Shuangliu International Airport**

By Bus: Approx. 33 minutes by car/drive, distance approx. 16.5 km

By Metro: **Line 19**(direction of Jinxing) ➞ **Line 4** (direction of Fengxihe) ➡ Intangible Cultural Heritage Expo Park Station

➤ **From Chengdu Tianfu International Airport**

By BUS: Approx. 68 minutes by car/drive, distance approx. 76.5 km

By Metro: **Line 19**(direction of Jinxing) ➞ **Line 4** (direction of Fengxihe) ➡ Intangible Cultural Heritage Expo Park Station

➤ **From Chengdu East Railway Station**

By BUS: Approx. 52 minutes by car/drive, distance approx. 35.3 km

By Metro: **Line 2** (direction of Xipu) ➞ **Line 4** (direction of Fengxihe Station) ➡ Intangible Cultural Heritage Expo Park Station

➤ **From South Railway Station**

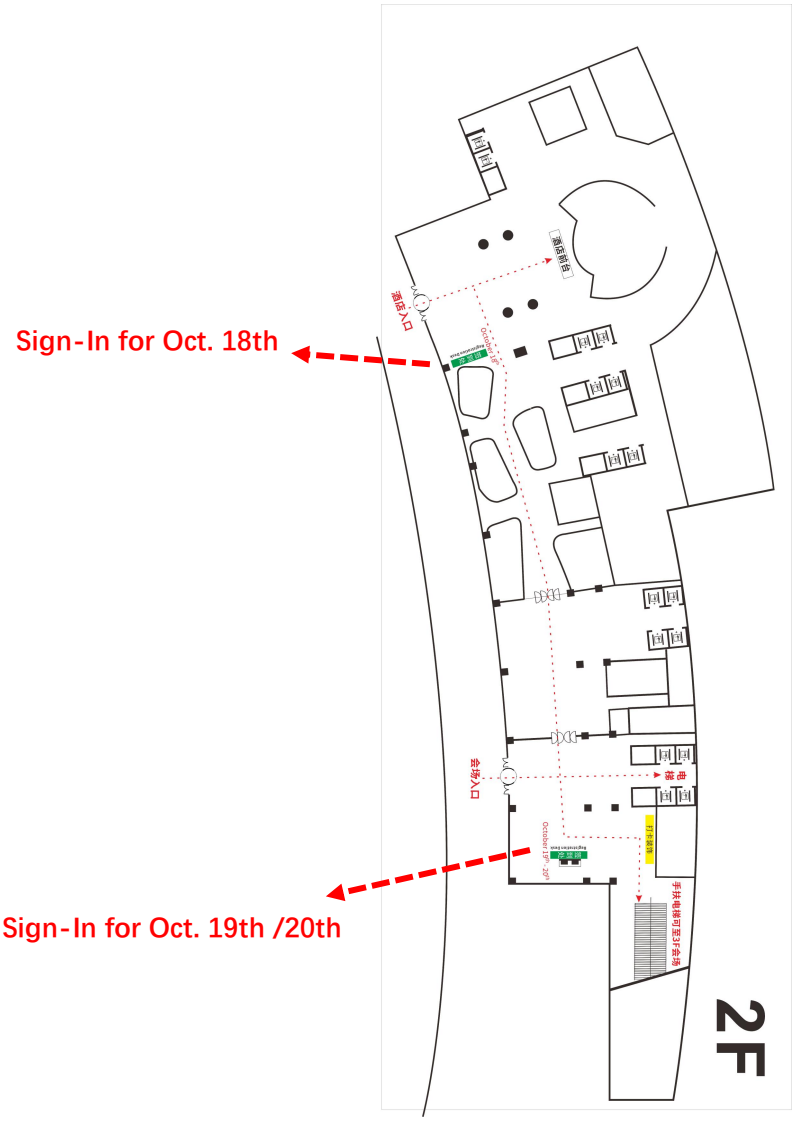
By BUS: Approx. 43 minutes by car/drive, distance approx. 27.3 km

By Metro: **Line 7** (direction of North Railway Station) ➞ **Line 4** (direction of Wansheng) ➡ Intangible Cultural Heritage Expo Park Station

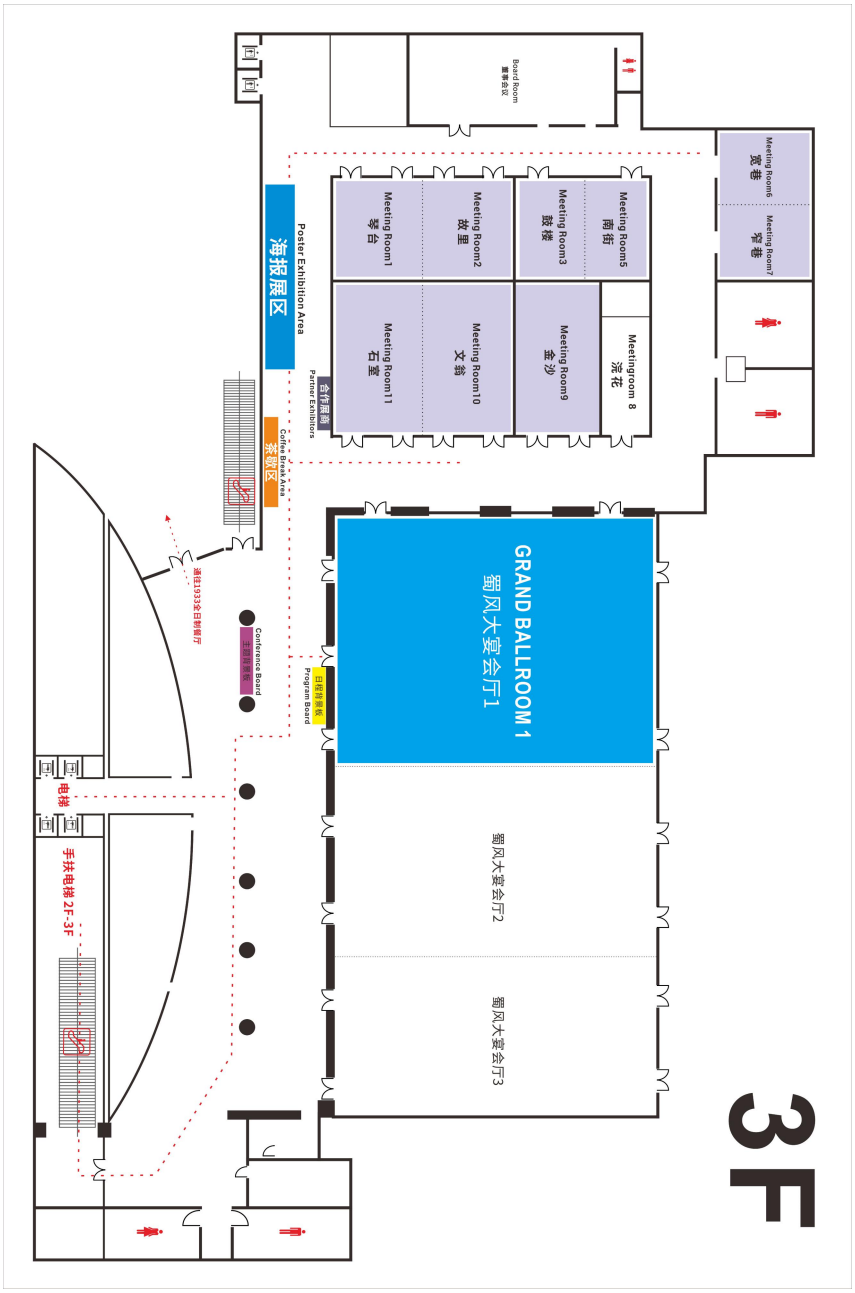
CONFERENCR ROOMS

Level	Meeting Room	Oct. 18	Oct. 19	Oct. 20
3F	GRAND BALLROOM 1		✦	✦
3F	Qin Tai	✦	✦	✦
3F	Gu Li	✦	✦	✦
3F	Gu Lou		✦	✦
3F	Nan Jie		✦	✦
3F	Kuan Xiang	✦	✦	✦
3F	Zhai Xiang		✦	✦
3F	Jin Sha		✦	✦
3F	Wen Weng		✦	✦
3F	Shi Shi		✦	✦

CONFERENCE VENUE



CONFERENCE VENUE



GUIDELINES

Oral Presentation

1. The duration of a presentation slot is 15 minutes. Please target your lecture for a duration of about 10 minutes for the presentation plus about 5 minutes for questions from the audience.
2. Your punctual arrival and active involvement in each session will be highly appreciated.

   - Get your presentation PPT or PDF files prepared and backed up.
3. Laptops, projector & screen, laser sticks will be provided by the conference organizer.

Poster Presentation

It's expected that at least one author stands by the poster for (most of the time of) the duration of the poster session. This is essential both to present your work to anyone interest in it and to make sure that your presence is verified by committee.

Security

Please ensure that you take your belongings with you at all times when leaving a room.

Do not leave bags or laptops unattended.

AGENDA OVERVIEW

October 18, 2024 | Friday		
Time	**Activity**	**Venue**
09:00 -18:00	**Sign-in & Conference Materials Collection**	**Lobby of TIVOLI Chengdu At Cultural Heritage Park 2F**
13:30-16:00	**Tutorial 1** When Non-Territorial Networks Meet Digital Twins: Challenges, Recent Advances, and Future Research Trends	**Meeting Room 6 Kuan Xiang 3F**
13:30-15:45	**Tutorial 2** Channel Measurements and Modeling for 6G and Beyond: From Discrete Local-Space Wireless Propagation Channels to 3D Continuous-Space Radio Channels	**Meeting Room 1 Qin Tai 3F**
16:15-18:00	**Tutorial 3** Artificial Intelligence for 6G: Implementations, Algorithms, and Optimizations	**Meeting Room 1 Qin Tai 3F**
13:30-15:45	**Tutorial 4** Advancing the Intelligent Internet of Bio-Nano Things via Molecular Communication	**Meeting Room 2 Gu Li 3F**
16:15-18:00	**Tutorial 5** Wireless Traffic Predition in the Era of Large Language Models	**Meeting Room 2 Gu Li 3F**
18:00	**Dinner**	**Café 1933**

October 19, 2024 | Saturday		
Time	**Activity**	**Venue**
09:00-17:00	**Sign-in & Conference Materials Collection**	**Lobby of Conference Venue Entrance 2F**
Opening Ceremony Host: **Yingchang Liang**, University of Electronic Science and Technology of China, China		
08:30-08:35	**Opening Ceremony**	**GRAND BALLROOM 1 3F**
08:35-08:40	**Opening Remarks** **Hongke Zhang**, Academician of the Chinese Academy of Engineering, Beijing Jiaotong University, China	**GRAND BALLROOM 1 3F**
08:40-08:45	**Welcome Address** **Lingjiang Kong**, University of Electronic Science and Technology of China, China	**GRAND BALLROOM 1 3F**
08:45-08:50	**TPC Chair Address** **Yang Yang**, The Hong Kong University of Science and Technology (Guangzhou), China	**GRAND BALLROOM 1 3F**
08:50-09:20	**Group Photo**	
Keynote Speech Host: **Yingchang Liang**, University of Electronic Science and Technology of China, China		
09:20-10:05	**Keynote Speech 1** **Xuemin (Sherman) Shen**, University of Waterloo, Canada **Title:** Holistic Network Virtualization: AI-Native 6G	**GRAND BALLROOM 1 3F**
10:05-10:25	**Coffee Break**	
10:25-11:10	**Keynote Speech 2** **Geoffrey Ye Li**, Imperial College London, UK **Title:** Fast Adaptation for Deep Learning based Wireless Communications	**GRAND BALLROOM 1 3F**
11:10-11:55	**Keynote Speech 3** **Jianhua Zhang**, Beijing University of Posts and Telecommunications, China **Title:** 6G Channel Research Recent Progress: Modeling, Prediction and Digital Twin	**GRAND BALLROOM 1 3F**
12:00-13:30	**Lunch**	**Café 1933**

13:30-15:20	**Technical Session 1 - Communication Theory and Technology** **Invited Speaker – Ning Jiang** **Invited Speaker – Congduan Li** KT2252, KT2204, KT2244, KT3130, KT3281	**Meeting Room 1** **Qin Tai** **3F**
	Technical Session 2 - Communication Protocol and Technical Standard **Invited Speaker - Peng Yu** **Invited Speaker – Xiaoying Tang** KT2130, KT3357, KT3368, KT3383, KT1062	**Meeting Room 2** **Gu Li** **3F**
	Technical Session 3 - Optical Communication and Optical Network **Invited Speaker - Xin Wang** KT1066, KT2100, KT3301, KT2251, KT3373, KT2234	**Meeting Room 3** **Gu Lou** **3F**
	Technical Session 4 - Channel Characterization and Estimation **Invited Speaker - Chenyuan Feng** KT3312, KT2165, KT2188, KT2214, KT3413, KT3421	**Meeting Room 5** **Nan Jie** **3F**
	Technical Session 5 - Channel Capacity and Prediction **Invited Speaker - Wei Jiang** KT2250, KT3378, KT3328, KT1096, KT3362, KT3276	**Meeting Room 6** **Kuan Xiang** **3F**
	Technical Session 6 - Channel Model and Analysis **Invited Speaker - Yongcheng Li** KT2133, KT2213, KT2247, KT2248, KT1042, KT3438	**Meeting Room 7** **Zhai Xiang** **3F**
	Technical Session 7 –Network Coding and Modulation Technology **Invited Speaker - Ding Wang** KT2246, KT2178, KT2182, KT3389, KT3447, KT1051	**Meeting Room 9** **Jin Sha** **3F**
	Technical Session 8 - Integrated Sensing and Communication System in Massive MIMO **Invited Speaker - Tianming Ma** KT2160, KT2184, KT2238, KT3325, KT3404, KT3463	**Meeting Room 10** **Wen Weng** **3F**
	Poster Session 1 - System Modeling Resource Allocation and Network Performance Optimization in Digital Communications KT1045, KT1060, KT1073, KT1074, KT1085, KT1093, KT2107, KT2119, KT2124, KT2131, KT2151, KT2157, KT2159, KT2177, KT2190, KT2194, KT2197, KT2211, KT2224, KT2228, KT2241, KT2253, KT3268, KT3275, KT3277, KT3298, KT3315, KT3326, KT3329, KT3334, KT3342, KT3371, KT3407, KT3417, KT3424, KT3430, KT3459, KT5164, KT1046, KT1063	**Poster Exhibition Area** **3F**
15:20-15:50	**Coffee Break**	
15:50-17:40	**Technical Session 9 - Computer Network Model and Data Transmission** **Invited Speaker - Wei Wang** KT1029, KT1038, KT2164, KT2168, KT3303, KT3462	**Meeting Room 1** **Qin Tai** **3F**

	Technical Session 10 - UAV Communication and System Performance Optimization **Invited Speaker - Zhaopeng Xu** KT3331, KT2216, KT3280, KT3361, KT3390, KT3434	**Meeting Room 2** **Gu Li** **3F**
	Technical Session 11 – Radar Signal Detection Technology and Application **Invited Speaker - Xiaojun Yuan** KT2163, KT3306, KT2652, KT3307, KT2226, KT2201	**Meeting Room 3** **Gu Lou** **3F**
	Technical Session 12 - Communication and Signal System **Invited Speaker - Bin Chen** KT1070, KT3267, KT3369, KT2097, KT2103, KT3419	**Meeting Room 5** **Nan Jie** **3F**
	Technical Session 13 - Communication Sensor Computing in Wireless System **Invited Speaker - Qiang He** KT2235, KT1086, KT3444, KT2111, KT2148, KT2245	**Meeting Room 6** **Kuan Xiang** **3F**
	Technical Session 14 - Satellite Communication Network and Signal Transmission **Invited Speaker – Shuai Ma** KT3310, KT2102, KT2243, KT2136, KT3451, KT3372	**Meeting Room 7** **Zhai Xiang** **3F**
	Technical Session 15 - Sensor-based Communication System **Invited Speaker - Shuaishuai Guo** KT7884, KT1065, KT2140, KT2233, KT3346, KT3400	**Meeting Room 9** **Jin Sha** **3F**
	Technical Session 16 - Signal Anti-interference and Suppression Methods **Invited Speaker – Jie Yang** KT2135, KT2172, KT2196, KT2264, KT2256, KT3365	**Meeting Room 10** **Wen Weng** **3F**
	Poster Session 2 - Satellite Communication and Space-Air-Ground Integrated Network KT1035, KT2142, KT2149, KT2150, KT2220, KT2221, KT2240, KT3299, KT3412, KT3439, KT1032, KT1056, KT2120, KT2154, KT2161, KT2170, KT2217, KT2230, KT2231, KT2232, KT2258, KT2261, KT3287, KT3288, KT3289, KT3323, KT3347, KT3351, KT3367, KT3375, KT3385, KT3388, KT3416, KT3420, KT3436, KT7107, KT2237, KT1068, KT2098, KT3354, KT3355	**Poster Exhibition Area** **3F**
14:00-18:00	**Industrial Forum** **Is 6G an evolution or a revolution?**	**Meeting Room 11** **Shi Shi** **3F**
18:00	**Banquet**	**Grand Ballroom 1** **3F**
19:00-21:00	**Awards Ceremony**	

October 20, 2024 | Sunday		
Time	**Activity**	**Venue**
Keynote Speech Host: **Yang Yang,** The Hong Kong University of Science and Technology (Guangzhou), China		
08:30-09:15	**Keynote Speech 1** **Sumei Sun**, Institute for Infocomm Research (I^2R), Agency for Science, Technology and Research (A*STAR), Singapore **Title:** Integrated Sensing, AI, and 6G: Opportunities and Challenges	**GRAND BALLROOM 1** **3F**
09:15-10:00	**Keynote Speech 2** **Fumiyuki Adachi**, Tohoku University, Japan **Title:** User-Centric Distributed Massive MIMO for The Ultimate Cellular Communication System	**GRAND BALLROOM 1** **3F**
10:00-10:20	**Coffee Break**	
Keynote Speech Host: **Gang Feng**, University of Electronic Science and Technology of China, China		
10:20-11:05	**Keynote Speech 3** **Honggang Zhang**, Zhejiang University, China **Title:** Wireless LLM Inference within the Framework of AI-Native NetGPT	**GRAND BALLROOM 1** **3F**
11:05-11:50	**Keynote Speech 4** **Meixia Tao**, Shanghai Jiao Tong University, China **Title:** Learning-based Coding and Transmission for Semantic Communications	**GRAND BALLROOM 1** **3F**
12:00-13:30	**Lunch**	**Café 1933**
13:30-15:20	**Technical Session 17 - Data Transmission and Security in Internet of Vehicles** **Invited Speaker – Yunkai Wei** **Invited Speaker – Meng Xiang** KT2162, KT3291, KT3453, KT3349, KT3465	**Meeting Room 1** **Qin Tai** **3F**
	Technical Session 18 - Communication Positioning Algorithm and Navigation System **Invited Speaker – Jia Ye** KT1050, KT3317, KT2202, KT3322, KT2263, KT3422	**Meeting Room 2** **Gu Li** **3F**

	Technical Session 19 - 5G and Beyond 5G Network and Key Technologies **Invited Speaker - Zhong Zheng** KT1057, KT3441, KT1072, KT2259, KT3333, KT3440, KT3450	**Meeting Room 3** **Gu Lou** **3F**
	Technical Session 20 - Resource Allocation and Management in Mobile Communication Network **Invited Speaker - Dongdong Wang** KT2193, KT2210, KT2209, KT3458, KT7487, KT2137, KT3427	**Meeting Room 5** **Nan Jie** **3F**
	Technical Session 21 - Reconfigurable Smart Surface and System Design **Invited Speaker – Cuiqin Dai** KT3394-A, KT1091, KT3284, KT3359, KT3433, KT2191	**Meeting Room 6** **Kuan Xiang** **3F**
	Technical Session 22 - Millimeter Wave Communication and Beamforming **Invited Speaker - Liwei Yang** KT1048, KT2187, KT1090, KT3286, KT3304, KT3308	**Meeting Room 7** **Zhai Xiang** **3F**
	Technical Session 23 – Electronics and Communication Engineering **Invited Speaker - Xiaoqiang Hua** KT3314, KT2249, KT3432, KT1084, KT2174, KT3319	**Meeting Room 9** **Jin Sha** **3F**
	Technical Session 24 - Digital Signal Detection, Estimation and Analysis **Invited Speaker - Huatao Zhu** KT2227, KT2147, KT3273, KT3455, KT4468, KT2118	**Meeting Room 10** **Wen Weng** **3F**
	Poster Session 3 - Signal Detection, Analysis and Processing KT0568, KT1052, KT1067, KT1075, KT1077, KT1089, KT11003, KT2117, KT2169, KT2205, KT2225, KT2254, KT3269, KT3274, KT3321, KT2236, KT2257, KT3305, KT3391, KT3401, KT3410, KT7898, KT9117, KT9559, KT1031, KT1034, KT1055, KT1071, KT2112, KT2239, KT3366, KT3377, KT2179, KT2242, KT3294, KT2155, KT2176	**Poster Exhibition Area** **3F**
15:20-15:50	**Coffee Break**	
15:50-17:40	**Technical Session 25 - Edge Computing and Network Optimization** **Invited Speaker –Haide Wang** KT1094, KT3337, KT3358, KT3312, KT3435, KT7001	**Meeting Room 1** **Qin Tai** **3F**
	Technical Session 26 - UAV Path Planning and Calculation **Invited Speaker - Tao Yang** **Invited Speaker – Tao Zhang** KT1092, KT3270, KT3353, KT9241, KT3464, KT3271	**Meeting Room 2** **Gu Li** **3F**
	Technical Session 27 - Joint Optimization and Resource Management in Communication System **Invited Speaker - Jian Zhao**	**Meeting Room 3** **Gu Lou** **3F**

	KT3442, KT1080, KT2158, KT3295, KT3320 **2024 高频通信感知一体化技术前沿科普报告会**	
	Technical Session 28 - Deep Learning Theory and Model in Communication System **Invited Speaker - Xinwei Du** KT2222, KT2132, KT2143, KT2195, KT1284, KT3266	**Meeting Room 5** **Nan Jie** **3F**
	Technical Session 29 - Data Network and Network Service Strategy **Invited Speaker - Lin Jiang** KT1087, KT2099, KT2173, KT3293, KT3348, KT3460	**Meeting Room 6** **Kuan Xiang** **3F**
	Technical Session 30 - Artificial Intelligence in Communication System **Invited Speaker - Wenyi Zhang** **Invited Speaker – Hongmei Zhang** KT1059, KT2128, KT2198, KT3297, KT3386, KT3443	**Meeting Room 7** **Zhai Xiang** **3F**
	Technical Session 31 - New Generation IoTs and Key Technologies **Invited Speaker - Zuqing Zhu** **Invited Speaker – Mengyuan Ye** KT2104, KT2152, KT2206, KT2215, KT3379, KT2207	**Meeting Room 9** **Jin Sha** **3F**
	Technical Session 32 - Modern Electronic Equipment Design and Development **Invited Speaker - Lu Zhang** KT2146, KT2153, KT1083, KT2139, KT2200, KT2218-A	**Meeting Room 10** **Wen Weng** **3F**
	Poster Session 4 - Next Generation Mobile Communication Systems and Key Technologies KT1030, KT1082, KT1036, KT1047, KT1069, KT1033, KT1088, KT1537, KT2115, KT2134, KT2138, KT2141, KT2175, KT2189, KT2192, KT2229, KT2260, KT2262, KT2645, KT3278, KT3290, KT3311, KT3324, KT3330, KT3338, KT3387, KT3393, KT3395, KT3415, KT3461, KT5276, KT7853	**Poster Exhibition Area** **3F**
14:00-18:00	**Industrial Forum** **Integrated Communication, Sensing, Computing, and Intelligence Fusion in 6G**	**Meeting Room 11** **Shi Shi** **3F**
18:30	**Dinner**	**Café 1933**

KEYNOTE SPEAKERS

09:20-10:05 | Oct. 19, 2024 | GRAND BALLROOM I

Xuemin (Sherman) Shen

Professor at University of Waterloo, Canada

Biography: Xuemin (Sherman) Shen is a University Professor in Electrical and Computer Engineering at the University of Waterloo, Canada. His research interests include user mobility and network resource management, wireless network security, and for future communication systems. Professor Shen is the Technical Program Committee Chair for IEEE Globecom'24, Globecom'16, IEEE Infocom14, IEEE VTC'10 Fall, and IEEE Globecom'07. He was the Editor-in-Chief of the IEEE Internet of Things Journal, IEEE Network, and IET Communications. Professor Shen served as the 2022-2023 President of IEEE Communications Society. He is a Fellow of the IEEE, Royal Society of Canada, Canadian Academy of Engineering, and Engineering Institute of Canada, a Foreign Member of Chinese Academy of Engineering, and an International Fellow of the Engineering Academy of Japan

Speech Title: Holistic Network Virtualization: AI-Native 6G

Abstract: With the commercialization of 5G communication networks, the global telecommunication community has shifted its focus to R&D for 6G networks. To support disruptive new applications along with growing service demands, it is envisioned that 6G will require agile network architectures in the presence of network dynamics, intelligent network management to address complexity due to extreme connectivity, and customized service provision to meet diverse service requirements. In this presentation, we will discuss potential ideas and solutions towards intelligent network architectures and flexible network management. First, we will briefly introduce network slicing and digital twin, and present how network slicing and digital twin can support flexible network management, taking advantage of advances in artificial intelligence. Then, we will focus on potential realization of intelligent network architectures, followed by our recent work on digital twin empowered resource allocation for collaborative sensing as a case study.

KEYNOTE SPEAKER

10:25-11:10 | Oct. 19, 2024 | GRAND BALLROOM I

Geoffrey Ye Li

Professor at Imperial College London, UK

Biography: Geoffrey Ye Li, FREng (Fellow of Royal Academic of Engineering) and Fellow of IEEE, is a Chair Professor at Imperial College London, UK. Before joining Imperial in 2020, he was a Professor at Georgia Institute of Technology, USA, for 20 years and a Principal Technical Staff Member with AT&T Labs – Research (previous Bell Labs), USA, for five years. He introduced deep learning to communications several years ago, which has become a popular research area now. He made fundamental contributions to orthogonal frequency division multiplexing (OFDM) for wireless communications, which made him win 2024 IEEE Eric E. Sumner Technical-Field Award. He also won several awards from IEEE Signal Processing, Vehicular Technology, and Communications Societies, including 2019 IEEE ComSoc Edwin Howard Armstrong Achievement Award.

Speech Title: Fast Adaptation for Deep Learning based Wireless Communications

Abstract: The integration with artificial intelligence (AI), especially deep learning (DL), is recognized as one of the six usage scenarios in next-generation wireless communication. In this talk, we first provide a brief overview on DL for wireless communications in the past around 10 years and present several critical challenges hinder the widespread applications of DL techniques in wireless communications. Since the existing DL-based wireless communications struggle to address the dynamic environments, we then discuss fast adaptation for DL-based wireless communications by using the few-shot learning (FSL) techniques. After identifying the difference between fast adaptation in wireless communications and traditional AI tasks, we outline two design requirements for applying FSL techniques to wireless communications and provide a comprehensive discussion on FSL techniques in wireless communications that satisfy these two design requirements. In particular, we emphasize the crucial role of domain knowledge in achieving fast adaptation. At the end of this talk, we highlight several open issues for future research.

KEYNOTE SPEAKER

11:10-11:55 | Oct. 19, 2024 | GRAND BALLROOM I

Jianhua Zhang

Professor at Beijing University of Posts and Telecommunications, China

Biography: Jianhua Zhang, a professor at Beijing University of Posts and Telecommunications and Fellow of China Institute of Communications. She is currently the Deputy Dean of the School of Science at BUPT, director of the Joint Innovation Center of Beijing University of Posts and Telecommunications and China Mobile Research Institute, a deputy of the 16th People's Congress of Beijing, an associate of China Institute of Communications, a member of the CCSA Council, the leader of the China' s IMT-2030 (6G) Channel Measurement and Modelling Working Group and the deputy leader of the Frequency Sub-group, and the deputy head of the Frequency Sub-group of the IMT-2020 (5G) Promotion Group, and IEEE ComSoc Channel Modeling subgroup. Her research fields cover broadband mobile communication channel modeling theory and transmission technology. She has won the second prize of the National Technological Invention Award twice, the 18th China Young Women Scientist Award, the First Prize of the Institute of Communication for Technical Invention, the First Prize of Institute of Electronics for Science and Technology, the First Prize of Institute of Radio Management for Science and Technology, Mao Yisheng Youth Science and Technology Award, the Outstanding Science and Technology Worker of the Institute of Electronics, Excellent Young Expert Award from Engineering, Distinguished Corresponding Expert Award from Frontiers of Information Technology & Electronic Engineering, Top 2% Scientists on Stanford Award, and was funded by the National Science Fund for Distinguished Young Scholars, "Gold Medal" at the International Exhibition of Inventions, Geneva, the Science Fund for Outstanding Young Scholars, the New Century Excellent Talents of the Ministry of Education and the Excellent Undergraduate Education Team Award in Beijing.

Speech Title: 6G Channel Research Recent Progress: Modeling, Prediction and Digital Twin

Abstract: With the global commercialization of fifth-generation (5G) communication, research and standardization of sixth-generation (6G) technology have been undertaken worldwide. Channel research is a prerequisite for evaluating and optimizing 6G technology. This report presents research on channel measurement, modeling, prediction and digital twin for 6G. Firstly, it summarizes the significance and trends of 6G channel research, focusing on the discussion of 6G requirements and the challenges that 6G enabling technology poses to channel measurement and modeling. To address these challenges, the report introduces the latest research progress of our group in terms of channel measurement, modeling and simulation on RIS, Massive MIMO, and ISAC, among others. Then, some recent advances on 6G channel predication and digital twin are presented. Finally, open issues for future research are discussed to provide insights into 6G channel research.

KEYNOTE SPEAKER

08:30-09:15 | Oct. 20, 2024 | GRAND BALLROOM I

Sumei Sun

Professor at Institute for Infocomm Research (I^2R), Agency for Science, Technology and Research (A*STAR), Singapore

Biography: Dr Sumei Sun is the Executive Director of the Institute for Infocomm Research (I^2R), A*STAR, Singapore. A*STAR I^2R focuses on multi-disciplinary digital technologies research including artificial intelligence (AI), communications and connectivity, and cyber security. Sumei' s current research interests include next-generation wireless communications, cognitive communications and networks, communications-computing-control integrative design, applied AI, industrial internet of things, and signal intelligence. She also holds a joint appointment with the Singapore Institute of Technology, and an adjunct appointment with the National University of Singapore, both as a full professor.

With strong passion in industry-relevant research and technology creation, Sumei has authored and co-authored more than 300 technical papers and received three best paper awards. She is the inventor/co-inventor of over thirty patented technologies, with most of them licensed to industries. She' s a Fellow of the IEEE and Fellow of the Academy of Engineering Singapore, and recipient of the 2023 IEEE VTS Women' s Distinguished Career Award and Singapore National Day 2022 Public Administration Medal (Bronze)

Speech Title: Integrated Sensing, AI, and 6G: Opportunities and Challenges

Abstract: The IMT-2030 Vision' s four overarching aspects, namely, sustainability, ubiquitous intelligence, security/privacy/resilience, and connecting the unconnected, act as essential design principles applicable to all usage scenarios. Ubiquitous intelligence will on one hand be empowered by 6G and beyond, on the other hand will also transform the design of 6G systems and networks.

In this talk, we will discuss the native integration of AI and sensing in 6G systems and networks, the potential opportunities and performance gains and the design challenges. We will share a few examples in our endeavour and motivate further research.

KEYNOTE SPEAKER

09:15-10:00 | Oct. 20, 2024 | GRAND BALLROOM I

Fumiyuki Adachi

Professor at Tohoku University, Japan

Biography: Fumiyuki Adachi received the B.S. and Dr. Eng. degrees in electrical engineering from Tohoku University, Sendai, Japan, in 1973 and 1984, respectively. In April 1973, he joined the Electrical Communications Laboratories of NTT and started mobile communications research. From July 1992 to December 1999, he was with NTT DOCOMO, leading a research group on wideband/broadband wireless access for 3G and beyond. He contributed to developing the 3G air interface standard, known as W-CDMA. Since January 2000, he has been with Tohoku University, Sendai, Japan. Currently, he is researching resilient wireless communication technology to realize beyond 5G/6G systems as a Specially Appointed Research Fellow/Professor Emeritus at the International Research Institute of Disaster Science (IRIDeS), Tohoku University. His research interests are in the areas of wireless signal processing and networking, including multi-access, equalization, antenna diversity, cooperative transmission, channel coding, and radio resource management. He is IEEE Life Fellow and IEICE Life Fellow. He is the recipient of 2000 IEEE VTS Avant Garde Award, 2002 IEICE Achievement Award, 2004 Thomson Scientific Research Front Award, 2010 Prime Minister Invention Award, 2014 C&C Prize, 2017 IEEE VTS Stuart Meyer Memorial Award, and 2017 IEEE ComSoc RCC Technical Recognition Awar.

Speech Title: User-Centric Distributed Massive MIMO for The Ultimate Cellular Communication System

Abstract: As the high data rate communication services proliferate in mobile communications, there is a demand for very high peak data rates in excess of Gbps is demanded, while the available radio bandwidth is limited. To achieve this goal, we need to improve the spectrum efficiency further and expand the transmission bandwidth. In 5G systems, the mmWave band has been allocated. However, mmWave signals have high pathloss and rectilinear propagation characteristics, resulting in short communication distances and frequent blockages caused by obstacles such as buildings. The utilization of distributed massive MIMO, also known as a cell-free system, is an effective approach to significantly improve spectrum efficiency. This approach turns the disadvantages of the mmWave band into advantages. User-centric ultra-small virtual cells or user-clusters are formed based on user location information, realizing the ultimate cellular system. The same frequencies are reused in all user-clusters. The small-scale multiuser distributed MIMO with interference suppression is simultaneously performed in all user-clusters. In this presentation, we will discuss the system architecture of a user-centric distributed massive MIMO system and share recent performance evaluation results.

KEYNOTE SPEAKER

10:20-11:05 | Oct. 20, 2024 | GRAND BALLROOM I

Honggang Zhang

Professor at Zhejiang University, China

Biography: Honggang Zhang (Fellow, IEEE) is the Chief Managing Editor of Intelligent Computing, a Science Partner Journal (SPJ), as well as a Professor with the College of Information Science and Electronic Engineering, Zhejiang University, Hangzhou, China. He was an Honorary Visiting Professor with the University of York, York, U.K., and an International Chair Professor of Excellence with the Universityé Européenne de Bretagne and Supélec, France. He has coauthored and edited two books: Cognitive Communications: Distributed Artificial Intelligence (DAI), Regulatory Policy & Economics, Implementation (Wiley) and Green Communications: Theoretical Fundamentals, Algorithms and Applications (CRC Press). His research interests include cognitive radio and networks, green communications, machine learning, artificial intelligence, semantic communications, mobile computing, and the Internet of Intelligence (IoI). He is a co-recipient of the 2021 IEEE Communications Society Outstanding Paper Award and the 2021 IEEE Internet of Things Journal Best Paper Award. He was the leading Guest Editor for the Special Issues on Green Communications of the IEEE Communications Magazine. He served as a Series Editor for the IEEE Communications Magazine (Green Communications and Computing Networks Series) from 2015 to 2018 and the Chair of the Technical Committee on Cognitive Networks of the IEEE Communications Society from 2011 to 2012. He is the Associate Editor-in-Chief of China Communications.

Speech Title: Wireless LLM Inference within the Framework of AI-Native NetGPT

Abstract: Large language models (LLMs) have triggered tremendous success to empower information generation and inference. Towards personalized generative inference, a collaborative cloud-edge-terminal methodology is promising, as it facilitates the effective orchestration of heterogeneous distributed communication and computing resources. Recently, we have put forward NetGPT (Network-enabled Generative Pre-Trained Transformer), to capably synergize appropriate LLMs at the edge, user equipment (UE), and cloud based on their different computing capacities. Edge and terminal LLMs could efficiently leverage location-based information for personalized prompt completion, thus benefiting the interaction with the cloud LLM. Also, this talk will highlight the essential changes required for an artificial intelligence (AI)-native network architecture towards NetGPT, with emphasis on deeper integration of communications and computing resources and careful calibration of logical AI workflow. Furthermore, toward efficient wireless LLM inference in edge computing, this talk will analyze the impact of different splitting points in mainstream open-source LLMs. On this basis, this talk introduces a framework taking inspiration from model-based reinforcement learning (MBRL) to determine the optimal splitting point across the edge and user equipment. By incorporating a reward surrogate model, the proposed approach significantly reduces the computational cost of frequent performance evaluations. Extensive simulations demonstrate that this method effectively balances inference performance and computational load under varying radio accessing conditions, providing a robust solution for LLM deployment in decentralized settings.

KEYNOTE SPEAKER

11:05-11:50 | Oct. 20, 2024 | GRAND BALLROOM I

Meixia Tao

Professor at Shanghai Jiao Tong University, China

Biography: Meixia Tao is a Professor in the Department of Electronic Engineering at Shanghai Jiao Tong University, China. Her current research interests include wireless edge learning, semantic communications, integrated communication-computing-sensing, MIMO beamforming, and channel modeling. She has published over 120 journal papers and 140 conference papers. She has received several awards and recognitions, including the 2020 First Prize in Natural Science from the Shanghai Municipality, the 2019 IEEE Marconi Prize Paper Award, and the 2013 IEEE Heinrich Hertz Award for Best Communications Letters. Dr. Tao is currently a Vice-Chair of the Information Theory Society of the Chinese Institute of Electronics. She is a Fellow of IEEE and receives the National Science Fund for Distinguished Young Scholars.

Speech Title: Learning-based Coding and Transmission for Semantic Communications

Abstract: As a new communication paradigm beyond Shannon, semantic communication (SemCom) can significantly reduce the required communication bandwidth and enhance downstream task performance by extracting and transmitting information directly relevant to the receiver's tasks. SemCom is envisioned to have transformative potential in 6G, facilitating a wide range of intelligent services, such as metaverse, smart surveillance, intelligent transportation, and robotic collaboration. In this talk, I will first provide an overview of the deep-learning-enabled SemCom framework. Then I will highlight the main design challenges of SemCom in terms of environmental adaptability, digital compatibility, and performance stability towards practical implementation. After that, I will share our latest research progress on the design of semantic coding and transmission to address these challenges, and also provide some insights for future investigation.

TUTORIALS

Tutorials 1: When Non-Territorial Networks Meet Digital Twins: Challenges, Recent Advances, and Future Research Trends

Chair: **Tony Q.S. Quek**, SUTD, Singapore

13:30-16:00 | Oct. 18, 2024 | Meeting Room 6 - Kuan Xiang

Name	Affiliation
Tony Q.S. Quek	Singapore University of Technology and Design, Singapore
Shengyu Zhang	Singapore University of Technology and Design, Singapore
Feng Wang	Singapore University of Technology and Design, Singapore
Longyu Zhou	Singapore University of Technology and Design, Singapore

SPEAKER 1

Shengyu Zhang, Singapore University of Technology and Design, Singapore

Presentation Title: DT-asisted Predictive Radio Resource Allocation in NTNs

Bio: Shengyu Zhang (Member, IEEE) received the B. Eng. and M. Eng. degrees in communication engineering from Southeast University, Nanjing, China, in 2016 and 2019, respectively, and the Ph.D. degree from the University of Hong Kong, Hong Kong, China, in 2023. He is currently a Post-Doctoral Research Fellow with Information Systems Technology and Design Pillar at the Singapore University of Technology and Design. His research interests include networking, communication and deep learning applications.

SPEAKER 2

Feng Wang, Singapore University of Technology and Design, Singapore

Presentation Title: DT-modeled NTN Mobility Management

Bio: Feng Wang (Member, IEEE) received the B.S. and Ph.D. degrees from University of Electronic Science and Technology of China (UESTC) in 2016 and 2022, respectively. He is currently a Research Fellow with Information Systems Technology and Design Pillar at the Singapore University of Technology and Design (SUTD), where he was an International Research Visitor from September 2021 to September 2022. His research interests include non-terrestrial networking and satellite mobility management. Feng Wang (Member, IEEE) received the B.S. and Ph.D. degrees from University of Electronic Science and Technology of China (UESTC) in 2016 and 2022, respectively. He is currently a Research Fellow with Information Systems Technology and Design Pillar at the Singapore University of Technology and Design (SUTD), where he was an International Research Visitor from September 2021 to September 2022. His research interests include non-terrestrial networking and satellite mobility management.

SPEAKER 3

Longyu Zhou, Singapore University of Technology and Design, Singapore

Presentation Title: Digital Twins Meet NT-UAV Networks: Case Studies and Implementation

Bio: Longyu Zhou received the Ph.D degree with a MD-PhD program in the School of Information and Communication Engineering from University of Electronic Science and Technology of China (UESTC) in 2023. He is currently a Research Fellow working in Information Systems Technology and Design Pillar at Singapore University of Technology and Design. He also worked in Embedded Systems (ES) group, Delft University of Technology, the Netherlands, as a visiting student.

TUTORIALS

Tutorials 2: Channel Measurements and Modeling for 6G and Beyond: From Discrete Local-Space Wireless Propagation Channels to 3D Continuous-Space Radio Channels

13:30-15:45 | Oct. 18, 2024 | Meeting Room 1 - Qin Tai

Name	Affiliation
Cheng-Xiang Wang	Southeast University & Purple Mountain Laboratories, China
Jie Huang	Southeast University & Purple Mountain Laboratories, China
Chen Huang	Southeast University & Purple Mountain Laboratories, China

SPEAKER 1

Cheng-Xiang Wang, Southeast University & Purple Mountain Laboratories, China

Presentation Title: Channel Measurements and Modeling for 6G and Beyond: From Discrete Local-Space Wireless Propagation Channels to 3D Continuous-Space Radio Channels

Bio: Cheng-Xiang Wang is a professor with the School of Information Science and Engineering, Southeast University and Pervasive Communication Research Center, Purple Mountain Laboratories, Nanjing, China. He has authored 4 books, 3 book chapters, and over 560 papers in refereed journals and conference proceedings, including 27 highly cited papers. He has delivered 27 invited keynote speeches/talks and 18 tutorials in international conferences. His current research interests include wireless channel measurements and modeling, 6G wireless communication networks, and electromagnetic information theory. He is a Member of the Academia Europaea (The Academy of Europe), a Member of the European Academy of Sciences and Arts (EASA), a Fellow of the Royal Society of Edinburgh (FRSE), IEEE, IET and China Institute of Communications (CIC), an IEEE Communications Society Distinguished Lecturer in 2019 and 2020, a Highly-Cited Researcher recognized by Clarivate Analytics in 2017-2020. He is currently an Executive Editorial Committee Member of the IEEE TWC.

SPEAKER 2

Jie Huang, Southeast University & Purple Mountain Laboratories, China

Presentation Title: Channel Measurements and Modeling for 6G and Beyond: From Discrete Local-Space Wireless Propagation Channels to 3D Continuous-Space Radio Channels

Bio: Jie Huang received the B.E. degree in Information Engineering from Xidian University, China, in 2013, and the Ph.D. degree in Information and Communication Engineering from Shandong University, China, in 2018. He is an Associate Professor with the School of Information Science and Engineering, Southeast University and Pervasive Communication Research Center, Purple Mountain Laboratories, Nanjing, China. He has authored more than 100 papers in refereed journals and conference proceedings. He received the Best Paper Awards from WPMC 2016, WCSP 2020, and WCSP 2021. He has delivered 12 tutorials in IEEE/CIC ICCC 2021, IEEE PIMRC 2021, IEEE ICC 2022, IEEE VTC-Spring 2022, IEEE/CIC ICCC 2022, IEEE VTC-Fall 2022, IEEE PIMRC 2022, IEEE Globecom 2022, IEEE WCNC 2023, IEEE ICC 2023, IEEE/CIC ICCC 2023, and IEEE WCNC 2024. His research interests include millimeter wave, massive MIMO, reconfigurable intelligent surface channel measurements and modeling, wireless big data, electromagnetic information theory, and 6G wireless communications.

SPEAKER 3

Chen Huang, Southeast University & Purple Mountain Laboratories, China

Presentation Title: Channel Measurements and Modeling for 6G and Beyond: From Discrete Local-Space Wireless Propagation Channels to 3D Continuous-Space Radio Channels

Bio: Chen Huang received the Ph.D. degrees from Beijing Jiaotong University, China, in 2021. He is now an research associate professor in the Pervasive Communication Research Center, Purple Mountain Laboratories, and an extramural supervisor in the National Mobile Communications Research Laboratory, School of Information Science and Engineering, Southeast University, China. He is selected in the Outstanding Postdoctoral Fellow Program in Jiangsu, received 3 times the Best Paper Award from IEEE ICCT2023, WCSP 2018, IEEE/CIC ICCC 2018, and serves as the Technical Program Committee (TPC) member for several conferences, including GlobeCom, ICC, VTC-fall, VTC-spring, etc. His research interests include 6G channel measurements, characterization, and modeling, machine learning-based channel prediction, and localization. He has authored/co-authored 1 book chapters, more than 60 journal and conference papers, as well as 17 patents.

TUTORIALS

Tutorials 3: Artificial Intelligence for 6G: Implementations, Algorithms, and Optimizations

16:15-18:00 | Oct. 18, 2024 | Meeting Room 1- Qin Tai

Name	Affiliation
Chuan Zhang	Southeast University & Purple Mountain Laboratories, China

SPEAKER 1

Chuan Zhang, Southeast University & Purple Mountain Laboratories, China

Presentation Title: Artificial Intelligence for 6G: Implementations, Algorithms, and Optimizations

Bio: Chuan Zhang received the B.E. degree in microelectronics and the M.E. degree in very-large scale integration (VLSI) design from Nanjing University, Nanjing, China, in 2006 and 2009, respectively, and the Ph.D. degree from the Department of Electrical and Computer Engineering, University of Minnesota, Twin Cities (UMN), USA, in 2012.

He is currently the Young Chair Professor of Southeast University. He is also with the LEADS, National Mobile Communications Research Laboratory, Frontiers Science Center for Mobile Information Communications and Security of MoE, Quantum Information Center of Southeast University, and the Purple Mountain Laboratories, Nanjing, China. His current research interests are algorithms and implementations for signal processing and communication systems.

Dr. Zhang serves as an Associate Editor for the IEEE Transactions on Circuits and Systems - II, a Senior Editorial Board (SEB) member for the IEEE Journal on Emerging and Selected Topics in Circuits and Systems (JETCAS), and a Steering Committee member for the IEEE Transactions on Mobile Computing. He served as an Associate Editor for the IEEE Transactions on Signal Processing and IEEE Open Journal of Circuits and Systems, and a Corresponding Guest Editor for the JETCAS three times. He was a Distinguished Lecturer and now is the Chair-Elect of the Circuits and Systems for Communications TC of the IEEE Circuits and Systems Society. He is also a member of the Applied Signal Processing Systems TC of the IEEE Signal Processing Society, and Circuits and Systems for Communications TC, VLSI Systems and Applications TC, and Digital Signal Processing TC of the IEEE Circuits and Systems Society. He received the Best Contribution Award of the IEEE Asia Pacific Conference on Circuits and Systems (APCCAS) in 2018, the Best Paper Award in 2016, the Best (Student) Paper Award of the IEEE International Conference on DSP in 2016, three Best (Student) Paper Awards of the IEEE International Conference on ASIC in 2015, 2017, 2019, and 2023, the Best Paper Award Nomination of the IEEE Workshop on Signal Processing Systems in 2015, three Excellent Paper Awards and two Excellent Poster

Presentation Awards of the International Collaboration Symposium on Information Production and Systems from 2016 to 2018, the Outstanding Achievement Award of the Intel Collaborative Research Institute in 2018, and the Merit (Student) Paper Award of the IEEE APCCAS in 2008. He also received the Three-Year University-Wide Graduate School Fellowship of UMN and the Doctoral Dissertation Fellowship of UMN.

Abstract: This tutorial focuses on the very popular topic “Artificial Intelligence for 6G: Circuits, Systems, and Optimizations”. Due to its undoubted significance, research combining “AI” and “6G” has drawn lots of attentions from both academia and industry. Although some initiatives related to “AI for 6G” have been named, their design, implementation, and optimization are unfortunately not complete and of course in infancy. Having lots of potential for AI’s new innovations, advances are required in network architectures, signal processing solutions, semiconductor technologies as well as in its optimization regarding the overall wireless system design. Much of the research has scattered on the design, implementation, and optimization of the corresponding circuits and systems. This tutorial would like to emphasize its uniqueness on “AI for 5G and B5G” related VLSI/IC designs and help audience to know the cutting-edge progresses from the perspective of circuits and systems. With a focus on bridging the gaps between theory and practical implementations, the goal of this tutorial is to demonstrate the latest research progress on circuits and systems design for efficiently realizing machine learning in wireless communications. The tutorial will bring together academic and industrial aspects to identify technical challenges and recent results related to this area, including Big Data Processing, Artificial Intelligence, Internet of Things, 6G, and Multi-Gigabit Optoelectronics Communications.

TUTORIALS

Tutorials 4: Advancing the Intelligent Internet of Bio-Nano Things via Molecular Communication

13:30-15:45 | Oct. 18, 2024 | Meeting Room 2 - Gu Li

Name	Affiliation
Yu Huang	Guangzhou University, China
Xuan Chen	Guangzhou University, China
Miaowen Wen	South China University of Technology, China

SPEAKER 1

Yu Huang, Guangzhou University, China

Presentation Title: Model-based and Data-driven Signal Processing Schemes in Molecular communication

Bio: Yu Huang received the Ph.D. degree from South China University of Technology, Guangzhou, China. During the Summer vacations of 2018 and 2019, he was a visiting student with Yonsei University, Seoul, South Korea. From January 2020 to March 2021, he visited Cranfield University, Bedford, U.K., for molecular communication techniques. He is currently an Associate Professor with Guangzhou University, Guangzhou, China. His main research interests include model-based and data-driven detectors for molecular communications. He was the Second-prize recipient of the Guangdong Province Electronic Information Science and Technology Award (Natural Sciences), and the winner of the Data Bakeoff Competition (Molecular MIMO) at the IEEE Communication Theory Workshop held in Selfoss, Iceland, in 2019.

SPEAKER 2

Xuan Chen, Guangzhou University, China

Presentation Title: Channel Modeling for Molecular Communication in Confined Spaces

Bio: Xuan Chen received her Ph.D. degree from South China University of Technology in 2022. She is currently a Lecturer with Guangzhou University. In August 2019, she was a Visiting Student for molecular communication with Yonsei University, Seoul, South Korea. From August 2021 to August 2022, she visited York University, Toronto, ON, Canada, for molecular communication techniques. Her main research interests include wireless and molecular communications. She served as a guest editor for Electronics. She was the Winner of the Data Bakeoff Competition (Molecular MIMO) at IEEE Communication Theory Workshop (CTW) 2019, Selfoss, Iceland.

SPEAKER 3

Miaowen Wen, South China University of Technology, China

Presentation Title: The Internet of Bio-Nano Things with Molecular Communication: From Theory to Prototype

Bio: Miaowen Wen received the Ph.D. degree from Peking University, Beijing, China, in 2014. From 2019 to 2021, he was with the Department of Electrical and Electronic Engineering at the University of Hong Kong, Hong Kong, as a Post-Doctoral Research Fellow. He is currently a Professor with the South China University of Technology, Guangzhou, China. His research interests include a variety of topics in the areas of wireless and molecular communications. He was a recipient of the IEEE ComSoc Asia-Pacific Outstanding Young Researcher Award in 2020, and five Best Paper Awards from the IEEE ITST'12, the IEEE ITSC'14, the IEEE ICNC'16, the IEEE ICCT'19, and the EAI QSHINE'22. He was the Winner in data bakeoff competition from the 2019 IEEE Communication Theory Workshop. He is currently serving on the Editorial boards of the IEEE Transactions on Communications, the IEEE Transactions on Molecular, Biological, and Multi-Scale Communications, and the IEEE Communications Letters.

TUTORIALS

Tutorials 5: Wireless Traffic Predition in the Era of Large Language Models

16:15-18:00 | Oct. 18, 2024 | Meeting Room 2 - Gu Li

Name	Affiliation
Haixia Zhang	Shandong University & Shandong Provincial Key Laboratory of Wireless Communication Technologies, China
Chuanting Zhang	Shandong University & Shandong Provincial Key Laboratory of Wireless Communication Technologies, China

SPEAKER 1

Haixia Zhang, Shandong University & Shandong Provincial Key Laboratory of Wireless Communication Technologies, China

Presentation Title: Backgrounds of Wireless Traffic Prediction and Centralized Learning Models

Bio: Haixia Zhang received the B.E. degree from the Department of Communication and Information Engineering, Guilin University of Electronic Technology, Guilin, China, in 2001, and the M.Eng. and Ph.D. degrees in communication and information systems from the School of Information Science and Engineering, Shandong University, Jinan, China, in 2004 and 2008, respectively. From 2006 to 2008, she was with the Institute for Circuit and Signal Processing, Munich University of Technology, Munich, Germany, as an Academic Assistant. From 2016 to 2017, she was a Visiting Professor with the University of Florida, Gainesville, FL, USA. She is currently a Full Professor with Shandong University, Jinan, China. Prof. Zhang is actively participating in many professional services. She is/was an editor of the IEEE Transactions on Wireless Communications, IEEE Internet of Things Journal, IEEE Wireless Communication Letters, and China Communications and serves/served as Symposium Chairs, TPC Members, Session Chairs, and Keynote Speakers of many conferences. Her research interests include wireless communication and networks, industrial Internet of Things, wireless resource management, and mobile edge computing.

SPEAKER 2

Chuanting Zhang, Shandong University & Shandong Provincial Key Laboratory of Wireless Communication Technologies, China

Presentation Title: Decentralized and LLM-based Models

Bio: Chuanting Zhang received the Ph.D. degree in communication and information systems from Shandong University, Jinan, China, in 2019. From 2019 to 2022, he was also a Postdoctoral Fellow with the Computer, Electrical, and Mathematical Science and Engineering Division, King Abdullah University of Science and Technology (KAUST), Thuwal, Saudi Arabia. From 2022 to 2023, he was a Senior Research Associate with the University of Bristol, Bristol, U.K. He is currently an Associate Professor with Shandong University, Jinan, China. His current research interests include spatial-temporal data analysis, federated learning, and AI for networking.

INDUSTRIAL FORUM

Workshop 1: Is 6G an evolution or a revolution?

Chair: **Liu Guangyi,** Professor, Chief Expert, China Mobile, Senior Engineer

14:00-18:00 | Oct. 19, 2024 | Meeting Room 11 - Shi Shi

Time	Guest	Theme
14:00-14:30	Hui Lin (Huawei Technologies Co., Ltd.)	Latest Developments in ITU 6G
14:30-15:00	Li Yang (ZTE Corporation)	Digital Twin Networks
15:00-15:30	Shi Jin/ Chaoyang Zhang/Chenyang Yang	Air Interface AI
15:30-16:00	Hai Tang (OPPO)	Minimized Kernel
16:00-16:30	Li Na/Zhang Shuyuan (China Mobile Communications Corporation)	Service-based RAN
16:30-16:40	Coffee Break	
16:40-17:40	All Guests	Roundtable Forum

Workshop 2: Integrated Communication, Sensing, Computing, and Intelligence Fusion in 6G

Chair: Liu Guangyi, Professor, Chief Expert, China Mobile, Senior Engineer

14:00-18:00 | Oct. 20, 2024 | Meeting Room 11 - Shi Shi

Time	Guest	Theme
14:00-14:30	Dong Wang (China Telecom Group Corporation)	Total Intelligence Fusion
14:30-15:00	Shaoyun Wu (Huawei Technologies Co., Ltd.)	Integration of Communication and Intelligence
15:00-15:30	Gang Wu / Zhi Chen (University of Electronic Science and Technology)	Fusion of Communication and Perception
15:30-16:00	Hongjun He (China Mobile Communications Corporation)	6G Testing Platform
16:00-16:10	Coffee Break	
16:00-17:00	All Guests	Roundtable Forum

2024 高频通信感知一体化技术前沿科普报告会

Organizers: China Institute of Communications,CIC, University of Electronic Science and Technology of China, China

17:25-18:25 | Oct. 20, 2024 | Meeting Room 3 - Gu Lou

Speaker 1

Hao Yang, Zhejiang University, China

Howard H. Yang received the Ph.D. degree in Electrical Engineering from Singapore University of Technology and Design (SUTD), Singapore, in 2017. He was a Postdoctoral Research Fellow at SUTD from 2017 to 2020 and a Visiting Postdoc Researcher at Princeton University from 2018 to 2019. Currently, he is an assistant professor with the ZJU-UIUC Institute, Zhejiang University, China. He is also an adjunct assistant professor with the Department of Electrical and Computer Engineering at the University of Illinois Urbana-Champaign, IL, USADr. Yang serves as an editor for the IEEE Transactions on Wireless Communications. He received the IEEE ComSoc Asia-Pacific Outstanding Young Researcher Award in 2023, the IEEE Signal Processing Society Best Paper Award in 2022, and the IEEE WCSP 10-Year Anniversary Excellent Paper Award in 2019. He was recognized as the '6G Rising Star'; Young Scholar by the Global 6G Conference in 2024

Speaker 2

Weidong Mei, University of Electronic Science and Technology of China, China

Weidong Mei received the B.Eng. degree in communication engineering and the M.Eng. degree in communication and information systems from the University of Electronic Science and Technology of China, Chengdu, China, in 2014 and 2017, respectively, and the Ph.D. degree from the NUS Graduate School, National University of Singapore in 2021. He was a Research Fellow with the Department of Electrical and Computer Engineering, National University of Singapore. He is currently a Professor with the University of Electronic Science and Technology of China. His research interests include reconfigurable MIMO, intelligent reflecting surface, wireless drone communications, physical-layer security, and convex optimization techniques. Dr. Mei has been listed in World's Top 2% Scientists since 2021. He was the recipient of the Outstanding Master's Thesis Award from the Chinese Institute of Electronics in 2017, and the Best Paper Award from the IEEE International Conference on Communications in 2021. He was honored as the Exemplary Reviewer of several IEEE journals. He serves as an Associate Editor for the IEEE Open Journal of the Communications Society and the Co-Chair for the Workshop on Intelligent and Reconfigurable Antennas for Future Wireless Communication and Sensing in IEEE Globecom 2024.

TECHNICAL SESSIONS

T01: Communication Theory and Technology

Chair: **Bo Li**, Ningxia University, China

13:30-15:20 | Oct. 19, 2024 | Meeting Room 1 - Qin Tai

Invited Speaker

Ning Jiang | 13:30-13:50
University of Electronic Science and Technology of China

Speech Title: High-Speed Free Space Chaotic Optical Communication Based on Vector Optical Field Manipulation

Abstract: Laser-based chaotic communication is an important physical-layer secure optical communication technology, and space laser communication is an important supporting technology of space-earth integrated information network. The application of chaotic optical communication technology in space optical communication can significantly enhance the physical layer information security protection capability of space-space-space-integrated network. This report mainly introduces the research progress of joint team of the University of Electronic Science and Technology of China and the Institute of Optoelectronics Technology of Chinese Academy of Sciences in the field of space chaotic optical communication: The joint team jointly proposed to convert the Gaussian optical field chaotic signal into vector optical field for spatial transmission, and realized the anti-turbulence spatial chaotic optical transmission based on vector optical field regulation, effectively enhanced the reliability and information security of spatial optical communication, and provided a new technical idea for constructing a secure and reliable space-earth integrated information network.

Invited Speaker

Congduan Li | 13:50-14:10
Sun Yat-sen University, China

Speech Title: On the Optimality of Superposition Coding for Symmetric MDCS with Linear Computations

Abstract: The rise of artificial intelligence and the increasing computational requirements tend to facilitate the integration of computations and communication networks. Multilevel diversity coding systems (MDCS) are universal models abstracted from the scenarios of diversity coding with higher-priority sources decoded before lower ones. In this paper, the optimality of superposition coding in L-level symmetric MDCS with linear computations (SMDCS-LC) is investigated with linearly independent and dependent coefficient matrices, respectively. In such a system, decoders are only differentiated by the cardinality of the encoders, say α, they are

connected to and can decode the linear combinations of the first α level sources. We prove that the superposition coding achieves the entire coding rate region of SMDCS-LC with linearly independent coefficient matrices, indicating optimality and no savings in transmission. However, this optimality does not hold for the linearly dependent cases, indicating that integrating computations in communication networks such as SMDCS indeed reduces the amount of information transmitted. Future work will focus on characterizing the explicit coding rate region of general SMDCS-LC.

TAIK DETAILS	
Time	**Presentation**
14:10-14:25 KT2252	Title: Secure Directional Modulation Technique Based on Spectrum Division Transmission Author(s): Zetian Chen, Lin Zheng, Chao Yang Presenter: Zetian Chen, Guilin University of Electronic Technology, China Direction modulation (DM) is a physical layer security (PLS) technology that has attracted extensive research. In this article, we propose a directional modulation scheme based on spectrum division transmission (SDT-DM). The original signal is divided into different sub-spectrum signals by filter bank and a phase shift related to the direction angle is added to each sub-spectrum signal. By theotical analysis, the received signal in any non-cooperator direction is proved to be subjected to complex inter-symbol and cross-symbol interference, while the combined signal in the cooperator direction is not affected. Simulation results demonstrate that the proposed SDT-DM scheme can achieve narrow secure zone and confuse constellations for non-cooperator.
14:25-14:40 KT2204	Title: Trust Risk Assessment Technology Based on Collaborative Analysis of Joint User Behavior Author(s): Guoying Zhao, Junyuan Zhao and Aodi Liu Presenter: Guoying Zhao, Information Engineering University, China In the context of the current intensive and shared network environment, the passive security defense system faces challenges such as low security protection capabilities, difficulties in preventing internal threat attacks, and poor stability in system user behavior. To address these issues, this paper proposes a trust risk assessment technology based on collaborative analysis of joint user access behavior. By leveraging the deep learning algorithms of ConvLSTM and MLP, as well as the KNN machine learning algorithm, this approach enables real-time monitoring, collaborative analysis, and assessment of users' network and terminal behavioral deviations within a comprehensive spatiotemporal context. It further identifies potential security threats and anomalies, achieving multi-dimensional continuous security detection and malicious threat alerting within the system. Finally, an experimental optimization and evaluation of the model's threat detection capabilities were conducted. The results demonstrate that the prediction accuracy for terminal behavior exceeds 94%, while the prediction accuracy for network behavior surpasses 96%, providing robust

supplementary support for safeguarding system security and ensuring efficient incident management.

14:40-14:55
KT2244

Title: An Efficient Pulse Shaping Method Based on Wavelet Transform
Author(s): Dejun Zhu, Qingsheng Hu, Weiwei Jiang, Xuwei Duan
Presenter: Dejun Zhu, Southeast University, China

Pile-up discrimination and baseline calibration are two key features of a pulse shaper in nuclear pulse signal processing. To meet the requirement of increased counting rate, an efficient pulse shaping method based on wavelet transform is presented in this paper. First a Mexican Hat wavelet (MHW) shaper is constructed based on wavelet transform. Then the capabilities of pile-up discrimination are investigated under various input intervals and compared with other two traditional shaping methods. At the end of this paper, the counting rate changes with the scale variable s of MHW are discussed. Results illustrate that with the feature of zero baseline, the proposed MHW shaper outperforms other two shapers either in the pile-up discrimination or in the baseline processing and can be used in high counting rate pulse signal processing.

14:55-15:10
KT3130

Title: Quantification and Validation for Degree of Understanding in M2M Semantic Communications
Author(s): Linhan Xia, Jiaxin Cai, Ricky Yuen-Tan Hou and Seon-Phil Jeong
Presenter: Linhan Xia, BNU-HKBU United International College Zhuhai, China

With the development of Artificial Intelligence (AI) and Internet of Things (IoT) technologies, network communications based on the Shannon-Nyquist theorem gradually reveal their limitations due to the neglect of semantic information in the transmitted content. Semantic communication
(SemCom) provides a solution for extracting information meanings from the transmitted content. The semantic information can be successfully interpreted by a receiver with the help of a shared knowledge base (KB). This paper proposes a two-stage hierarchical qualification and validation model for natural language-based machine-to-machine (M2M) SemCom. The approach can be applied in various applications, such as autonomous driving and edge computing. In the proposed model, we quantitatively measure the degree of understanding (DoU) between two ommunication parties at the word and sentence levels. The DoU is validated and ensured at each level before moving to the next step. The model's effectiveness is verified through a series of experiments, and the results show that the quantification and validation method proposed in this paper can significantly improve the DoU of inter-machine SemCom.

15:10-15:25
KT3281

Title: One-Stage SCMA Codebook Design Based on Bit Error Rate Criterion
Author(s): Junxiang Yang, Yuan Zeng, Wei Wan
Presenter: Junxiang Yang, Shanghai Key Laboratory of Collaborative Computing in Spatial Heterogeneous Networks (CCSN), China.

Designing codebooks for high bit rates and overload ratios is a central goal in SCMA codebook design. Traditional designs mainly focus on specific size of factor graphs.

Also, codebooks designed solely based on the minimum euclidean distance criterion do not ensure optimal performance with MPA decoders.This paper introduces a novel one-stage optimization method for SCMA codebook design, prioritizing the bit error rate (BER) of the message passing algorithm (MPA) decoder as the primary optimization criterion. Smaller factor graphs are used to reduce the optimization complexity. By employing a heuristic optimization method, simulation results demonstrate that our method achieves a significant reduction in BER.

TECHNICAL SESSION

T02: Communication Protocol and Technical Standard

Chair: **Zheng Shi,** Jinan University, China

13:30-15:20 | Oct. 19, 2024 | Meeting Room 2 - Gu Li

Invited Speaker

Peng Yu | 13:30-13:50
Beijing University of Posts and Telecommunications, China

Speech Title: Reliable Resource Matching in 6G Computing Power Network for Digital Twin Service

Abstract: Due to the complex and dynamic service demands involved in digital twin services, traditional resource matching methods often fail to meet the requirements. To address this challenge, we leverage Graph Neural Networks (GNN) for task graph matching to enhance the deployment of computing resources. The crux of our approach is an adaptive service decomposition process that breaks down complex services into smaller, more manageable subtasks. These subtasks are then strategically deployed across various nodes within the computing power network (CPN), utilizing distributed resources to maximize efficiency. Moreover, we employ dynamic task scheduling based on Service Level Agreement (SLA) constraints to prioritize tasks, thereby enhancing the quality of computing resource matching. The deployment strategy is grounded in GNN-facilitated low-complexity deep graph matching techniques, aimed at effectively integrating network functionalities with service demands. Our proposed service matching method based on GNN considering dynamic task scheduling (DTSM) has been validated through simulation experiments, with results indicating significant improvements in load balance and overall service processing delay.

Invited Speaker

Xiaoying Tang | 13:50-14:10
Beijing University of Posts and Telecommunications, China

Speech Title: Fast and fair federeted learning on heterogeneous data

Abstract: Partial client participation has been widely adopted in Federated Learning (FL) to reduce the communication burden efficiently. However, an inadequate client sampling scheme can lead to the selection of unrepresentative subsets, resulting in significant variance in model updates and slowed convergence. Existing sampling methods are either biased or can be further optimized for faster convergence. In this talk, I will introduce DELTA, an unbiased sampling scheme designed to alleviate these issues. DELTA characterizes the effects of client diversity and local variance,

and samples representative clients with valuable information for global model updates. In addition, DELTA is a proven optimal unbiased sampling scheme that minimizes variance caused by partial client participation and outperforms other unbiased sampling schemes in terms of convergence. Furthermore, to address full-client gradient dependence, we provide a practical version of DELTA depending on the available clients' information, and also analyze its convergence.

Besides, fairness has become an important concern in FL. An unfair model that performs well for some clients while performing poorly for others can reduce the willingness of clients to participate. In this talk, I will introduce a layer-wise fair Federated Learning algorithm (FedLF), and further provide the theoretical analysis on how FedLF can improve fairness and guarantee convergence. Extensive experiments on different learning tasks and models demonstrate that FedLF outperforms the SOTA FL algorithms in terms of accuracy and fairness.

TAIK DETAILS	
Time	**Presentation**
14:10-14:25 KT2130	Title: A Novel Flying Ad Hoc Network MAC Protocol with Beamforming Antenna Array Author(s): Yin Yu; Xiaofeng Zhong Presenter: Yin Yu, Tsinghua University, China Due to the mobility of flying ad-hoc network (FANET), regular updates of neighbor information are essential. Existing neighbor discovery methods with directional antenna often rely on multi-round full-space scanning, which underutilizes known information and results in considerable network overhead. A novel medium access control (MAC) protocol designed for beamforming antenna array FANET is introduced in this paper, with a focus on network maintenance. The protocol partitions neighbor discovery frames by tasks, effectively reducing frame length and network overhead. Additionally, it employs a beam hierarchy narrowing mechanism to reduce link interference issues. Simulation results show that the protocol achieves lower network overhead and reduced latency, making it ideal for FANET with beamforming antenna array.
14:25-14:40 KT3357	Title: Research on Seismic Security Evaluation Model and Route Reconfiguration Algorithm for Public Communication Networks Author(s): Han Mingchao, Sun Guoliang, Li Xiangping, Zhang Xuezhong, Ji Shuqiang Presenter: Li Xiangping, China Academy of Information and Communications Technology, China Seismic disaster would cause overall performance degradation or even failure of public communication networks. To analyze the security performance of networks responding to seismic disasters scenarios, a nodes-lines evaluation model is proposed based on graph theory and Monte Carlo method, which clarifies the mathematical probability relationship between seismic parameter and performance of the networks. And then, we present a post-disaster route reconfiguration algorithm with optimal recovery time as objective function considering social dimensions.

Finally, two cases analysis are given which verify the feasibility of the proposed evaluation model and route algorithm respectively. This research provides effective methodologies for seismic security evaluation and rapid post-disaster recovery of public communication networks.

14:40-14:55
KT3368

Title: A PageRank Algorithm Based Data Transmission Protocol for FANETs
Author(s): Jun Cai, Xiaodong Yi, Wanqiu Chen, Jian Chen, Lu Gan and Jia Yang
Presenter: Wanqiu Chen, Intelligent Game and Decision Lab (IGDL), China

Broadcast serves as a crucial means for data transmission in wireless ad hoc networks (WANETs), yet it faces challenges such as information redundancy, network congestion, and transmission delay, especially in flying ad hoc networks (FANETs). To address these issues, this paper proposes a PageRank algorithm-based data transmission protocol (PRADTP) with the aim of optimizing data transmission efficiency. The key idea of the protocol draws inspiration from the successful application of the PageRank algorithm in graph theory and search engines. By computing the PageRank value of each node and integrating it with the fuzzy Borda algorithm, the importance score of each node in the network is determined. Based on these scores, the protocol assigns broadcasting probabilities to each node, ensuring that nodes with higher scores have a higher probability of forwarding messages, thus guaranteeing wide data packet coverage. Meanwhile, nodes with lower scores are assigned lower forwarding probabilities to reduce the spread of redundant messages. The experimental results indicate that, under different node scales, various topologies, and degrees of topological sparsity, PRADTP has a promotion of over 10% in packet delivery success ratio, a reduction of over 60% in latency and lower average hop count than that of the compared protocols.

14:55-15:10
KT3383

Title: Evaluating Topology based Routing Protocols with Different Network Node Speeds
Author(s): Feng Yun and Wei Liu
Presenter: Feng Yun, Chongqing University of Technology, China

This paper studies the performance of AODV (Ad hoc On-Demand Distance Vector), DSDV (Destination-Sequenced Distance Vector), and OLSR (Optimized Link State Routing) routing protocols across various scenarios, including pedestrian, vehicular, multirotor UAV, and fixed-wing UAV environments. By evaluating the end-to-end packet delivery rate, end-to-end delay, and throughput of AODV, DSDV, and OLSR routing protocols, it is found that all three protocols perform similarly and effectively in pedestrian and vehicular scenarios. In the multirotor UAV scenario, the OLSR routing protocol performs better than both AODV and DSDV routing protocols. In the fixed-wing UAV scenario, without considering data delay, the AODV routing protocol performs better than both DSDV and OLSR routing protocols.

Title: SRv6-aware Hardware Firewall and SRv6-based SFC
Author(s): Dongjie Lu, Dan Meng, Yuhang Zhao, Peng Ran, Kai Yang, Ding Chen
Presenter: Dongjie Lu, Research Institute of Safety Technology China Mobile Research Institute, China

15:10-15:25
KT1062

SRv6 SFC is a key technology for the integration of computing resources and network resources, and it can flexibly schedule service resources on demand. In this paper, a multi-tenant SRv6-aware hardware firewall has been designed, implemented, and verified. SRv6-aware SFCs with SRv6-aware firewalls were planned and completed to verify the feasibility and effectiveness in an operator's cloud network and resource pool.

TECHNICAL SESSION

T03: Optical Communication and Optical Network

Chair: **Xin Wang**, Beijing Information Science and Technology University, China

13:30-15:20 | Oct. 19, 2024 | Meeting Room 3 - Gu Lou

Invited Speaker

Xin Wang | 13:30-13:50
Beijing Information Science and Technology University, China

Speech Title: A Deep Reinforcement Learning approach: Resource-Efficient 6G Holographic Type Communication with 6DoF in EON enabled 6G RAN

Abstract: A LSTM based viewpoint rotation prediction enabled resource-efficient holographic type communication is investigated in EON enabled 6G RAN. The CensNet enhanced PPO is used for feature extraction based DU-CU deployment and RSA, with 40.1% joint objective reduction than benchmark.

TAIK DETAILS

Time	Presentation
13:50-14:05 KT1066	Title: Compressed Sensing based Detection Schemes for Differential Spatial Modulation in Visible Light Communication Systems Author(s): Zichun Shi, Pu Miao, Peng Chen, Lei Xue, Li-Yang Zheng, Laiyuan Wang, Gaojie Chen Presenter: Pu Miao, Qingdao University, China Differential spatial modulation (DSM) exploits the time dimension to facilitate the differential modulation, which can perfectly avoid the challenge in acquiring of heavily entangled channel state information of visible light communication (VLC) system. However, it has huge search space and high complexity for large number of transmitters. In this paper, a novel vector correction (VC)-based orthogonal matching pursuit (OMP) detection algorithm is proposed to reduce the complexity, which exploits the sparsity and relativity of all transmitters, and then employs a novel correction criterion by correcting the index vectors of the error estimation for improving the demodulation performance. To overcome the local optimum dilemma in the atoms searching, an OMP-assisted genetic algorithm is also proposed to further improve the bit error rate (BER) performance of the VLC-DSM system. Simulation results demonstrate that the proposed schemes can significantly reduce the computational complexity at least by 62.5 % while achieving an excellent BER performance as compared with traditional maximum likelihood based receiver.

14:05-14:20
KT2100

Title: Gaussian Decoupling Based Stochastic Resonance for Weak Optical Signal Detection
Author(s): Zhibei Chen, Renzhi Yuan, Siming Wang, Xinyi Chu, Shijie Di, Junwei Li, Yuchai Li, Kailin Sun and Jia Guo
Presenter: Zhibei Chen, Beijing University of Posts and Telecommunications, China

Weak signal detection methods can improve the SNR by recognizing the effective signals submerged in background noise. However, the existing stochastic resonance (SR) method is confined exclusively to the optimization of potential function parameters. Actually, the bit-error rate (BER) can be optimized by eliminating the correlation among SR output points. In this work, we propose a Gaussian decoupling based SR method to improve the detection performance of weak optical signals. We first perform the SR method on the received weak optical signal and approximate the probability distribution of the SR output points as a multi-dimensional Gaussian distribution. Then we apply a linear transformation based on eigenvalue decomposition of the Gaussian covariance matrix to decouple the correlation among SR output points. Numerical results show that the BER of Gaussian decoupling based SR method can be one order of magnitude lower than that of the ordinary SR method even when the SNR of input signal is -8 dB.

14:20-14:35
KT3301

Title: Few-Mode Erbium-Doped Fiber With Trench And Graded-Index For Mode Gain Equalization
Author(s): Shengchen Bao, Yu Cheng, Chunming Chen, Deng Hong, Shijie Deng, Ming Chen, Hongchang Deng, LiboYuan
Presenter: Shengchen Bao, Guilin University of Electronic Technology, China

With the continuous evolution of communication systems, the research on few-mode erbium-doped fiber amplifier (EDFA) has garnered considerable attention. In this study, a forward-pumped few-mode EDFA is designed using the OptiSystem software. The effects of pump power, fiber length, input signal power, and erbium-doping concentration tolerance on the gain characteristics of the EDFA are comprehensively examined. When the input signal power is set at -20 dBm, the results demonstrate that a 10-meter erbium-doped fiber achieves gain equalization across five spatial modes within the wavelength range of 1535 to 1570 nm, with differential mode gain (DMG) less than 0.2 dB. This research offers unique insights into the design and practical application of few-mode EDFA.

14:35-14:50
KT2251

Title: Time-Varying Path Protection based on in Betweenness Centrality in Optical Satellite Networks
Author(s): Yansong Fu, Wei Wang, Yinji Jing, Shiyu Yang and Yongli Zhao
Presenter: Yansong Fu, Beijing University of Posts and Telecommunications, China

We define the betweenness centrality for dynamic optical satellite networks and present a time-varying path protection algorithm accordingly. Simulation results show the proposed algorithm can reduce network congestion by 15% and increase link participation by 9.5% in optical satellite networks.

Title: DRL-Based User Selection and Bandwidth Allocation in ISAC-Assisted IoV Networks
Author(s): Fangyuan Lin, Chen Xu, Wenfei Yuan
Presenter: Fangyuan Lin, Beijing University of Posts and Telecommunications, China

14:50-15:05
KT3373

With the rapid development of the Internet of Vehicles (IoV), there is an increasing demand for efficient, reliable, and low-latency communication technologies. Integrated sensing and communication (ISAC) technology offers improved resource utilization, enhanced performance, and better support for dynamic and complex traffic environments, increasing the reliability and robustness of vehicular networks. In this paper, we focus on ISAC-assisted IoV networks and formulate a joint user selection and bandwidth allocation problem to maximise the performance of sensing with guaranteeing the performance of communication. We consider the miss detection ratio as the sensing metric, which is defined by the ratio of the number of undetected vehicles to the number of total vehicles in a time duration in the IoV scenario. Given this complex and dynamic temporal coupling problem, we study a clustering-based algorithm for user selection and propose a deep reinforcement learning (DRL) approach based on proximal policy optimization (PPO) algorithm for optimizing bandwidth allocation between sensing and communication. Meanwhile, we generate real-time vehicles and environmental data using Simulation of Urban Mobility (SUMO). Simulation results validate better performance of the proposed algorithm on miss detection ratio compared to other benchmarks.

Title: Carbon-efficient AI Training Workloads Placement in Cloud Datacenters over Optical Networks
Author(s): Genglong Wang, Wei Wang, Yanran Xiao, Yongli Zhao and Jie Zhang
Presenter: Genglong Wang, Beijing University of Posts and Telecommunications, China

15:05-15:20
KT2234

The latest breakthroughs in generative AI have sparked a surge in demand for AI training, posing significant environmental challenges due to its large energy consumption. In this paper, we propose a carbon-aware workload placement (CAWP) algorithm to optimize the distribution of AI training workloads in geographically distributed datacenters and to reduce the overall carbon emissions of AI training workloads, while meeting the communication and time requirements of the workloads. We conducted extensive experiments to compare our proposed algorithm with local placement and random placement algorithm. Compared with other algorithms, our proposed CAWP algorithm can optimize the AI workload distribution based on data center hardware resources, carbon emission coefficients, and data transmission bandwidth between data centers, resulting in a significant reduction in carbon emissions (~20%).

TECHNICAL SESSION

T04: Channel Characterization and Estimation

Chair: **Chenyuan Feng**, EURECOM, France

13:30-15:20 | Oct. 19, 2024 | Meeting Room 5 - Nan Jie

Invited Speaker

Chenyuan Feng | 13:30-13:50
EURECOM, France

Speech Title: Edge Computing Empowered Video Content Delivery Strategy in the Internet of Vehicles

Abstract: With the advancements of mobile communication and autonomous driving technologies, user demand for mobile multimedia services in the Internet of Vehicles (IoV) has been gradually increasing, which has put a great deal of strain on communication and computing. The high mobility of vehicles and the complexity of network scenarios present significant hurdles to the improvement of the quality of in-car entertainment services, even while streaming media transmission technology helps to reduce transmission latency. This paper investigates a video content distribution strategy that combines edge leaning with edge caching, given that video data makes up the great bulk of makes up the great bulk of currently available entertainment information. Specifically, an adaptive bitrate video distribution technique is proposed for the multi-node video stream data transmission problem, which is carefully formulated as Markov decision process (MDP). Our suggested approach optimizes both the selection of video contents with varying compression bitrates and the allocation of vehicle-to-everything (V2X) communication sub-channels based on the communication environment, users' locations and buffering states, and each network node's cache information. The simulation results confirm that our suggested approach is beneficial in terms of cache hit ratio and quality of service (QoS).

TAIK DETAILS

Time	Presentation
13:50-14:05 **KT3336**	Title: Sparse Channel Estimation and Data Detection for AFDM With Superimposed Pilot Scheme Author(s): Zhe Cao, Miaowen Wen, Yu Huang Presenter: Zhe Cao Wen, South China University of Technology, China Affine frequency division multiplexing (AFDM) is a multi-chirp waveform proven to be effective for high-mobility communications in next-generation wireless systems. However, the existing embedded pilot-aided (EPA)

scheme performs transmission surrounded by null guard samples on each side and the spectral efficiency (SE) is limited. To address this issue, we introduce a novel transmission framework, the superimposed pilot (SP) scheme, which aims to enhance the robustness of AFDM systems against time-varying channels and improve SE by fully integrating data symbols with pilots. By leveraging the sparse nature of time-varying channels, we reformulate the channel estimation problem as a sparse signal recovery task. An orthogonal matching pursuit (OMP) algorithm is considered for channel estimation within this framework which exploits AFDM channel sparsity, and consequently has low computational complexity. Additionally, we proposed a strategy by iterating between channel estimation and data detection. Simulation results show that the bit error rate (BER) performance of the SP framework approaches that of perfect channel estimation and significantly surpasses the EPA scheme with the same SE.

14:05-14:20
KT2165

Title: Measurement-Based Channel Characterization in 5G High-Speed-Train Scenarios

Author(s): Peng Zheng, Dan Fei, Chen Chen, Bo Ai

Presenter: Peng Zheng, Beijing Jiaotong University, China

With the rapid development of communication, especially the fifth-generation (5G) technology, the railway communication system has evolved towards intelligence. In this paper, a 5G passive channel measurement scheme was proposed and a corresponding platform was successfully built up. The measurement platform was applied to collect the 5G downlink signals based on the in-service communication network in high-speed-train (HST) scenarios. The channel impulse responses (CIRs) were extracted from the received channel state information reference signals (CSI-RSs) and the key channel characteristics were analyzed. Both the large-scale and small-scale parameters including pathloss, shadow fading, ricean K-factor, and root mean square (RMS) delay spread were analyzed and modeled. The empirical pathloss and estimated shadow fading were close to the proposed model. The cumulative distribution functions (CDFs) of K-factor and RMS delay spread fitted the desired distribution. The empirical channel characteristics in 5G HST scenarios will be useful for future 5G railway communication simulation and performance evaluation.

14:20-14:35
KT2188

Title: Joint Interference Mitigation, Channel Estimation and Data Detection in OFDM Communications

Author(s): Wenfeng Gao, Xiaoyan Kuai

Presenter: Wenfeng Gao, University of Electronic Science and Technology of China, China

In this paper, we investigate the orthogonal frequency division multiplexing (OFDM) system in the presence of impulsive noise (IN) and narrowband interference (NBI). To overcome the performance degradation caused by the IN and NBI, we develop a novel joint estimation scheme based on an iterative processing framework at the receiver, where the modules in this framework incorporate the NBI and IN estimation, channel estimation, and data decoding. In the receiver processing, the linear

estimator is first employed to jointly obtain the minimum mean-square error (MMSE) estimates. Then the denoisers are used for further correction of the estimates. Concretely, we adopt a gridless variational line spectral estimation (VALSE) method to refine the estimate of NBI in the NBI denoiser. Furthermore, we exploit the sparsity of IN in the time domain for accurate estimation in the IN denoiser. After channel estimation, the valid data is forwarded to the soft demodulator for data decoding. All the modules are operated within a turbo iteration framework until the algorithm convergence. Simulation results validate the superiority and robustness of the proposed method.

14:35-14:50
KT2214

Title: Channel Estimation for RIS-Aided MIMO Systems with Low-Resolution ADCs via Three-Dimensional Decoupled Atomic Norm Minimization
Author(s): Qiaozhen Chen, Jie Li, Feng Xi and Shengyao Chen
Presenter: Qiaozhen Chen, Nanjing University of Science and Technology, China

Reconfigurable intelligent surfaces (RISs) have revolutionized the wireless propagation environment, proving instrumental across various communication scenarios. However, their integration significantly increases the system complexity, posing substantial challenges for channel estimation. This paper focuses on developing a computationally efficient channel estimation method for RIS-aided MIMO systems equipped with low-resolution analog-to-digital converters (ADCs). As the effective cascaded channel exhibits a three-dimensional sparse angular structure, we propose a novel cascaded channel estimation method based on three-dimensional decoupled atomic norm minimization. By integrating low-bit quantization constraints, this approach reformulates the estimation problem as a semidefinite programming problem, with angles estimated via Vandermonde decomposition of the resultant Toeplitz matrices. Then, the path complex gains are determined using least squares after pairing the estimated angles. Extensive simulation results validate that the proposed method accurately estimates the cascaded channel from the low-bit quantized data and offers a significant reduction in computational cost compared to existing methodologies.

14:50-15:05
KT3413

Title: Channel Estimation for Extremely Large-Scale RIS-Aided Communication System
Author(s): Bowen Tan, Jiaping Wang, Jun Zhang, Qi Zhang and Yan Cai
Presenter: Bowen Tan, Nanjing University of Posts and Telecommunications, China

In reconfigurable intelligent surface (RIS) assisted wireless communication systems, the complex fading that occurs from the base station (BS) to the RIS and then to the user often necessitates large-scale RIS setups to mitigate these effects. Consequently, extremely large RIS (XL-RIS) configurations are becoming increasingly common. However, due to the large aperture of XL-RIS, scatterers are more likely to be within the near-field region, where planar wave assumptions no longer hold. This discrepancy results in significant performance degradation when far-field channel estimation methods are applied to XL-RIS near-field communications. Moreover, the increase in RIS elements leads to higher pilot overhead. To address these challenges, we first reduce the pilot overhead and obtain independent channel state information for both the BS-RIS and RIS-user links by

utilizing partially active reflecting elements. Secondly, we incorporate near-field effects by adopting a more realistic spherical wave model. Lastly, we exploit the inherent sparsity of the near-field channel in the polar coordinate domain to enable precise reconstruction of the complete channel. Simulation results demonstrate that the proposed modified Polar-domain NOMP algorithm achieves excellent performance.

15:05-15:20
KT3421

Title: Impacts of Channel Parameters on the SER of 6G hRLLC Systems
Author(s): Yusong Huang, Jie Huang, Zhen Lv, and Chengxiang Wang
Presenter: Yusong Huang, Southeast University, China

In this paper, we study the impacts of carrier frequency, user velocity, and frame length on the symbol error rate (SER) in industrial Internet of things (IIoT) scenarios of hyper-reliable and low-latency communication (hRLLC) systems. Specifically, we derive the expression of SER based on the sixth-generation (6G) pervasive channel model (6GPCM) with its time autocorrelation function (TACF) and frequency correlation function (FCF). Additionally, we conduct simulations using the 6GPCM with a Monte-Carlo-based orthogonal frequency-division multiplexing (OFDM) system and compare the simulation and theoretical results. Results show that the carrier frequency and user velocity affect the FCF and TACF, respectively. These statistical properties further influence the SER. Increasing frame length degrades the accuracy of channel estimation and SER. This research clarifies the relationship between channel parameters, channel characteristics, and system performance and provides a foundation for analyzing communication

TECHNICAL SESSION

T05: Channel Capacity and Prediction

Chair: **Wei Jiang**, Nanjing University, China

13:30-15:20 | Oct. 19, 2024 | Meeting Room 6 - Kuan Xiang

Invited Speaker

Wei Jiang | 13:30-13:50
Nanjing University, China

Speech Title: Silicon Modulators and Optical Phased Arrays for Optical Communications

Abstract: Silicon photonics offers a versatile integrated photonics platform for optical communications devices. High-speed silicon electro-optic modulators is a key communications device. For many communications applications, the relatively large size of the conventional Mach-Zehnder modulator is a concern. Miniaturized modulators have been studied. We will review two major miniaturization approaches based on micro-rings and photonic crystals. Other aspects such as the fabrication variation of Mach-Zehnder modulators may be discussed if time allows. Silicon-based optical phased arrays have received much attention in recent years due to their potential applications in LiDAR and wireless optical communications. We will review recent work on half-wavelength pitch optical phased arrays based on waveguide superlattices. An approach to creating multiple independent beams with a silicon-based optical phased array will be demonstrated. More recent work on exploiting optical phased arrays for wireless optical communications will be briefly discussed.

TAIK DETAILS

Time	Presentation
13:50-14:05 KT2250	Title: Degree of Freedom and Channel Capacity Studies of Near-Field Holographic MIMO Author(s): Qingyin Ma, Jie Huang, Yue Yang, Cheng-Xiang Wang, Junling Li Presenter: Jie Huang, Southeast University, Purple Mountain Laboratories, China In the sixth generation (6G) wireless communication systems, holographic multiple-input multiple-output (HMIMO) is expected to have great potential in shaping electromagnetic wave, which has stimulated strong research interest. The HMIMO can be represented as a spatially-continuous aperture with its input being current density and output being electric field. To calculate its channel capacity, the degree of freedom (DoF) is introduced from the electromagnetic information theory (EIT), which

integrates traditional theories applied in communications, such as electromagnetic theory and information theory. In this paper, the distribution of DoF in the near field and channel capacity are investigated. A boundary between the near field and far field is proposed from the view of DoF. A near-field array response for HMIMO is derived to fully extract DoFs in the near field and it is verified to be applicable in scattering environment with multipath components so that DoFs can be studied in a scattering environment. The effect of mutual coupling (MC) on channel capacity and DoF is studied. The results demonstrate that the proposed array response can fully extract DoFs of the channel and enhance channel capacity.

14:05-14:20
KT3378

Title: Channel Correlation Matrix Extrapolation Based on Roughness Calibration of Scatterers
Author(s): Heling Zhang, Xiujun Zhang, Xiaofeng Zhong, Shidong Zhou
Presenter: Heling Zhang, Tsinghua University, China

To estimate the channel correlation matrix (CCM) in areas where channel information cannot be collected in advance, this paper proposes a way to spatially extrapolate CCM based on the calibration of the surface roughness parameters of scatterers in the propagation scene. We calibrate the roughness parameters of scene scatters based on CCM data in some specific areas. From these calibrated roughness parameters, we are able to generate a good prediction of the CCM for any other area in the scene by performing ray tracing. Simulation results show that the channel extrapolation method proposed in this paper can effectively realize the extrapolation of the CCM between different areas in frequency domain, or even from one domain to another.

14:20-14:35
KT3328

Title: Matrix Manifold Precoder Design for Massive MIMO High-Speed Railway Communications with Channel Prediction
Author(s): Rui Sun, Guan-Lin Liu, Chen Sun, Ding Shi, An-An Lu, Xi Qi Gao and Xiang-Gen Xia
Presenter: Rui Sun, Southeast University, China

In high-speed railway (HSR) communications, the channel suffers from severe channel aging effect caused by the high mobility. To address this issue, we investigate the precoder design against channel aging in massive multiple-input multiple-output (MIMO) systems with channel prediction. First of all, we introduce the concept of the quadruple beams (QBs), and establish a QB based channel model with sampled quadruple steering vectors. Then, the upcoming space domain channel can achieve a higher accuracy by channel prediction. We consider the precoder design on the Riemannian submanifold formed by the precoders satisfying the total power constraint (TPC). The Riemannian conjugate gradient (RCG) method is proposed to solve the problem on the manifold. The RCG method mainly involves the matrix multiplication and avoids the need of matrix inversion of the transmit antenna dimension. The simulation results demonstrate the effectiveness of the proposed channel model and the superiority of the RCG method for precoder design against channel aging.

Title: SFedXSL: Semi-Synchronous Federated Cross-Sharpness Learning for UAV Swarm

Author(s): Mingxiong Zhao, Shihao Zhao, Chenyuan Feng, Howard H. Yang, Tony Q.S. Quek

Presenter: Mingxiong Zhao, Yunnan University, China

14:35-14:50
KT1096

Federated learning (FL) emerges as an innovative approach to manage a collection of client UAVs in order to co-train machine-learning models that are readily integrated into an Unmanned Aerial Vehicle (UAV) swarm. However, due to more erratic communication conditions than in terrestrial wireless networks, synchronous aggregation-which is utilized in traditional FL-is no longer feasible in UAV swarm. Additionally, because of the various deployment zones or specifications of UAVs, the data gathered by them are frequently heterogeneous. A significant amount of unlabeled data will be collected by UAV swarm in light of its new flight trajectory and unseen scenarios. To address these issues, we propose a unique Semi-synchronous Federated Cross-Sharpness Learning (SFedXSL) framework to tackle the problems of semisynchronous devices and unlabeled data. This framework incorporates unsupervised pre-training and client UAV clustering scheduling. These proposed techniques aim to unlock the full potential of unlabeled and labeled user data, expediting the training process. Simulation results demonstrate that our proposed algorithm surpasses state-of-the-art FL techniques in terms of objection recognition accuracy and service latency.

Title: An Enhanced Loss Function for 6G Space-Time Domain Predictive Channel Models

Author(s): Kaiyuan Zhang, Chen Huang, Junling Li, Zhongyu Qian and Cheng-Xiang Wang

Presenter: Kaiyuan Zhang, Southeast University, China

14:50-15:05
KT3362

Facing the sixth-generation (6G) technical vision, the machine learning (ML) based channel modeling has drawn a lot of attention. The prediction accuracy of ML-based channel modeling methods depends on the dataset size, model parameter settings, and loss functions. The design of the loss function is critical to improve the accuracy of predictive channel models. This paper proposes a novel space-time-aware weighted loss function that reflects the correlation between space-time domain channel characteristics. The proposed loss function is compared to widely used loss functions, e.g., mean square error (MSE), Huber loss, and log-cosh loss. Based on the channel measurements, the performance of the proposed loss function is evaluated. According to the experiment results, the predictive channel model with the proposed loss function achieves the highest accuracy compared to the channel model with conventional loss functions. The proposed loss function can be used to design more accurate ML-based predictive channel models for 6G wireless channels.

15:05-15:20
KT3276

Title: Deep Learning Based Channel Prediction for Cell-Free Massive MIMO Systems
Author(s): Yongning Qi, Tao Zhou, Liu Liu
Presenter: Yongning Qi, Beijing Jiaotong University, China

This paper investigates the channel prediction model based on deep learning (DL) for cell-free massive multi-input multi-output (CF-mMIMO) systems. The prediction problems which utilizes both spatial and temporal correlation information are formulated. Combining the graph convolutional network (GCN) and the encoder of Transformer with the relative positional encoding, a novel spatial-temporal joint channel prediction model is proposed. A CF-mMIMO system is simulated and datasets are generated according to prediction problems. The hyper-parameters of the proposed model are determined by adjacent matrix generation, autocorrelation analysis and cross-validation. According to the spatial-temporal joint prediction performance evaluation, it is shown that the proposed model has higher prediction performance compared with the traditional DL models in the appropriate range of computational complexity.

TECHNICAL SESSION

T06: Channel Model and Analysis

Chair: **Yongcheng Li**, Soochow University, China

13:30-15:20 | Oct. 19, 2024 | Meeting Room 7 - Zhai Xiang

Invited Speaker

Yongcheng Li | 13:30-13:50
Soochow University, China

Speech Title: Ultra-Low Loss Fiber Deployment in Elastic Optical Networks With Fixed and Variable Topologies

Abstract: Ultra-low loss (ULL) fibers are being widely deployed in optical networks due to their high transmission capacities. Existing studies on ULL fiber deployment have assumed to completely replace old standard single-mode fibers (SSMFs) when deploying new ULL fibers. This may not be practical since many carriers would prefer to continue utilizing the existing SSMFs for their remaining lifespans. This article investigates the problem of ULL fiber deployment while allowing for the utilization of old SSMFs. In the context of an elastic optical network (EON) with fixed and variable topologies, we formulate the problem of ULL fiber deployment as two mixed integer linear programming (MILP) models. Four strategies for selecting links deployed with ULL fibers are considered, which include physical length (PL), shortest route traversed (SRT), traffic demand (TD), and maximum network performance (MNP) strategies. Efficient routing, fiber, modulation format, and spectrum assignment (RFMSA) algorithms are also developed for lightpath establishment in an EON, considering the coexistence of old and new fibers. Simulation results show that the MNP strategy is effective to choose network links deployed with ULL fibers almost the same as those of the MILP models, and it can outperform the other strategies in terms of maximum number of FSs used, regardless of a fixed or variable topology.

TAIK DETAILS

Time	Presentation
13:50-14:05 **KT2133**	Title: On Cylinder- vs. Sphere-Based Stochastic Modeling of Space-Time Correlated UAV-to-UAV Channels Author(s): Linzhou Zeng, Xuewen Liao, Yunzhe Zhu, Zhangfeng Ma, and Hao Jiang Presenter: Linzhou Zeng, Xi'an Jiaotong University, China The two-cylinder model and the two-sphere model are two widely-used geometrical channel models that are both the generalizations of the two-ring model; however, a comparative study between them seems to be missing in literature. In this paper, under the background of unmanned aerial vehicle (UAV) air-to-air propagation

modeling, similarities and differences between the two geometry-based stochastic models (GBSMs) are analyzed by reviewing their respective closed-form space-time correlation functions (ST-CFs). Notably, some interesting properties of the ST-CFs are analytically obtained, which reveals the behaviors of the ST-CF with respect to several UAV-related parameters, including the moving directions and the antenna orientations.

14:05-14:20
KT2213

Title: Performance Analysis of Channel Model Mismatch for RIS-aided Positioning Systems
Author(s): Sheng Hong, Yang Liu, Pengzhen Xu
Presenter: Yang Liu, School of Information Engineering Nanchang University, China

Abstract—It is clear that the next-generation of communication systems will move towards wireless positioning systems based on high frequency and large bandwidth. Moreover, since reconfigurable intelligent surfaces (RIS) have good commercial prospects, RIS-aided indoor near-field (NF) positioning will be a hot topic for future research. Therefore, it is no longer reasonable to use the common stationary narrowband far-field (FF) channel model and FF path loss (FPL) model in the NF region of RIS. And it is necessary to consider the effect of channel spatial non-stationarity (SNS), beam squint effect (BSE), NF path loss (NPL) model and NF spherical wave model (SWM) to build a true channel model. If the FF channel model instead of the true channel model is utilized in the positioning process, the problem of channel model mismatch occurs, and the positioning performance will be degraded. In this work, we evaluate the positioning error bound (PEB) of a true channel model by the Cramer-Rao bound (CRB), the PEB of a mismatched channel model by the misspecified CRB (MCRB), then investigate the performance loss by comparing the CRB and MCRB. Simulations show that the RIS-aided positioning performance is degraded by using the mismatched channel model. Also, in the NF region NPL and SWM have the large affect on model mismatch, and SNS has the smallest affect. In FF region, the impact of BSE is more significant.

14:20-14:35
KT2247

Title: Joint Uplink and Downlink Probe Selection for Bi-directional Channel Emulation in OTA Testing
Author(s): Qingzhou Huan, Haomin Wang, Yuhang Guo, Xiaodong Ji, Yong Li
Presenter: Qingzhou Huan, Beijing University of Posts and Telecommunications, China

Over-the-air (OTA) testing technology is widely utilized for performance testing of massive multiple-input multiple-output (MIMO) devices, particularly fifth-generation (5G) massive MIMO base stations (BSs), due to its simplicity and flexibility. The current multiprobe anechoic chamber (MPAC) OTA testing setup only considers uni-directional channel emulation, which can be well applied to time division duplexing (TDD) systems with the aid of uplink (UL) and downlink (DL) switches. In contrast, frequency division duplexing (FDD) systems, where both the UL and DL operate simultaneously, require bi-directional channel emulation. Furthermore, in beyond fifth-generation (B5G) systems, the introduction of emerging technologies such as integrated sensing and communication (ISAC) and co-frequency co-time full

duplex has made the accurate simultaneous emulation of bi-directional channels even more urgent. In this paper, we propose a novel joint UL and DL probe selection algorithm based on the coordinated hunting method for the emulation of bi-directional channels. Simulation results demonstrate that the proposed algorithm can select appropriate probe positions for both UL and DL channels, respectively, ensuring that their positions are non-overlapping and achieving precise channel emulation of both target UL and DL channels.

14:35-14:50
KT2248

Title: Ray-Tracing Based Channel Modeling and Characteristics Analysis for Maritime Land-to-Ship Communication Systems
Author(s): Pingfan Su, Songjiang Yang, Hengtai Chang, Yinghua Wang, Jie Huang, Cheng-Xiang Wang
Presenter: Cheng-Xiang Wang, Southeast University, China

In this paper, a ray-tracing based maritime land-to-ship channel model is proposed. In this model, a three dimensional (3D) offshore scenario containing the sea surface, shore land, and buildings on shore is modeled. The sea surface is further simplified after modeling with the TEXEL, MARSEN, and ARSLOE (TMA) shallow sea wave spectrum and the Longuet-Higgins model. The ray-tracing algorithm for maritime land-to-ship scenarios also takes scenario update time into account, where scenario update time can be obtained from the derived time autocorrelation function (ACF) of the sea surface wave. The simulation results of path loss are compared with the free-space path loss (FSPL) model and measurement results. Effects of the sea depths and wind speeds on path loss are investigated. Based on the simulation results, an increase in either sea depth or wind speed can increase the path loss.

14:50-15:05
KT1042

Title: 3D Time-Varying UAV-Based Channel Model for THz Air-to-Air Wireless Communications
Author(s): Kai Zhang, Fenglei Zhang, Yongjun Li, Xiang Wang, Guodong Wang, Zhaohui Yang and Qin Tian
Presenter: Kai Zhang, Air Force Engineering University, China

In this paper, a three-dimensional (3D) time-varying channel model is proposed for unmanned aerial vehicles (UAVs) air-to-air (A2A) wireless channels based on geometric channel model theory in terahertz (THz) band. In this proposed channel model, the scattering fading and reflection fading on rough surfaces of propagation environments, and the atmospheric
molecules absorption attenuations are considered in THz band. Moreover, the statistical properties of the proposed channel model, including path loss, time autocorrelation function (T-ACF) and Doppler power spectrum density (PSD), have been derived and analyzed with the several important UAV-related parameters and different carrier frequencies (i.e. millimeter wave (mmwave) and THz bands). Finally, the correctness of the proposed channel model has been verified via simulation, and some useful observations are provided for the system design of THz UAVbased A2A wireless communication systems.

15:05-15:20
KT3438

Title: Efficient 3D Electromagnetic Environment Reconstruction with Fused Data for 6G Digital Twin Online Channel Modeling

Author(s): Yongshan Zhou, Junling Li, Tong Wu, Guogang Su, Chen Huang, Cheng-Xiang Wang
Presenter: Yongshan Zhou, Southeast University, China

With the development of sixth-generation (6G) wireless communication networks, digital twin online channel models (DTOCM) have been proposed to facilitate efficient 6G network optimization. The reconstruction of a three-dimensional (3D) electromagnetic (EM) environment is a critical step in DTOCM, which aids in the accurate characterization of wireless channels. We propose an efficient method for the reconstruction of the 3D twin EM environment in DTOCM, utilizing joint deep learning and image processing with fused data. First, the building environment is reconstructed using digital maps and triangular meshes to obtain precise 3D building models. Next, deep learning networks are used to perform environmental perception from satellite maps, capturing geospatial information and EM parameters. Finally, these models are integrated, and the ray-tracing (RT) method simulates channel characteristics. We evaluate the proposed method using digital and satellite maps of Meishan City, achieving a comprehensive 3D EM environment reconstruction. The RT simulation results based on 3D EM reconstruction closely align with channel measurement data, demonstrating higher accuracy than the 3D building model.

TECHNICAL SESSION

T07: Network Coding and Modulation Technology

Chair: **Shuaishuai Guo**, Shandong University, China

13:30-15:20 | Oct. 19, 2024 | Meeting Room 9 - Jin Sha

Invited Speaker

Ding Wang| 13:30-13:50
Information Engineering University/Institute of Information System Engineering, China

Speech Title: Decoupled Estimation Method for Position and Velocity of Moving Target Based on Passive Radar System

Abstract: In order to locate radio silent target on the Earth surface, a novel positioning method for moving target is proposed based on passive radar system. Unlike most existing positioning methods, this method takes into account the quadratic constraints that the target position vector and velocity vector need to satisfy, and can achieve decoupled estimation of the target position and velocity. Firstly, the nonlinear observation equations based on the passive radar system are transformed into pseudo-linear observation equations. Then, the asymptotic statistical properties of the errors in pseudo-linear equations are derived by applying the first-order error analysis. Subsequently, an optimization criterion is constructed for the joint estimation of the target position and velocity under the two quadratic equality constraints. For the purpose of obtaining the global optimal solution of the target position and velocity, a decoupled optimization algorithm is developed based on the Lagrange multiplier approach. This optimization algorithm requires only the iteration of the target position parameters, and the target velocity parameters can be obtained in a closed form, thus reducing the influence of initial values and the risk of local convergence. Furthermore, the Cramér-Rao bound (CRB) for moving target localization based on passive radar system is deduced under the two quadratic equality constraints, and the performance gain resulting from the equality constraints is quantified. The new estimator is also proved to be asymptotically statistically efficient by using the first-order error analysis as well as the Lagrange multiplier approach. Finally, simulation results verify the advantages of the proposed positioning method.

TAIK DETAILS

Time	Presentation
13:50-14:05 KT2246	Title: Effects of Digital Precoding Schemes on Performance of Holographic MIMO Systems Author(s): Xichen Mao, Jiajun Gao, Chenxuan Gu, Jie Huang, Cheng-Xiang Wang Presenter: Jie Huang, Southeast University, China

Multiple-input multiple-output (MIMO) has made significant contributions to the improvement of system performance. To support increasing connection density, it is promising to deploy more antenna elements with closer spacing on the MIMO array, which is called holographic multiple-input multiple-output (HMIMO). Due to the inevitable coupling effects in HMIMO systems, it needs to determine whether digital precoding can bring performance gains as it did in MIMO systems. In this paper, the system performance of HMIMO systems is investigated based on different digital precoding schemes. Moreover, a radio channel model is utilized to analyze the signal propagation process of HMIMO systems and the antenna coupling effects are considered. Six common digital precoding schemes for HMIMO systems are proposed and the sum rate based on these digital precoding schemes is analyzed. The results show that when the antenna array element density increases, the coupling effect plays a significant role and cannot be eliminated by digital precoding. Hence, digital precoding schemes cannot offer performance improvements in HMIMO systems.

14:05-14:20
KT2178

Title: Research on Multi-Service Concurrent Transmission Control Method for Heterogeneous Networks Based on Adaptive Network Coding
Author(s): Dong Xu, Xiaorong Zhu
Presenter: Dong Xu, Nanjing University of Posts and Telecommunications, China

The continuous rise of bandwidth-demanding and low-latency required services such as high-definition video streaming, along with the growing popularity of multi-homing mobile terminals, has encouraged research into concurrent transmission technologies in heterogeneous networks. Concurrent transmission over heterogeneous networks effectively aggregates bandwidth resources, improving transmission throughput. However, it also faces challenges such as the great dissimilarity of each path leading to head-of-line blocking issues at receiver side. Moreover, in scenarios involving concurrent transmission of multiple services over heterogeneous networks, allocating network resources from the perspective of a single service may lead to the competition for network resources of each service and result in each service failing to meet its Qos. Therefore, this paper proposes a method for multi-service concurrent transmission control over heterogeneous networks based on adaptive network coding(NC). First, the algorithm allocates suitable network resources based on each service's Qos and path characteristics. Then it utilizes the A3C reinforcement learning algorithm to make real-time decisions through interaction with the network environments, determining the optimal encoding density for each encoding packet group, which reduces the decoding delay significantly. Simulation results show that the proposed algorithm can improve application transmission speed and reduce delivery delay, effectively enhancing user experience.

14:20-14:35
KT2182

Title: Polar Coded OFDM with Code-Frequency Index Modulation
Author(s): Jia-Qi Zhang and Si-Yu Zhang
Presenter: Jia-Qi Zhang Beijing Information Science and Technology University, China

In this paper, we introduce a polar coded orthogonal frequency division multiplexing

with code-frequency index modulation (PC-CFIM) scheme, designed to enhance spectral efficiency (SE) while improving error performance. At the transmitter, PC-CFIM divides the information bits into two subsets. One subset is utilized for selecting the spreading code index, and the other is utilized for polar coded OFDM with index modulation (PC-OFDM-IM). In the proposed PC-CFIM framework, the polar-coded sequence is spread using the indices from code domain index modulation. At the receiver, the system employs code index selection coupled with polar decoding to ensure accurate retrieval of information bits. The integration of polar code with hybrid index modulation significantly improves interference resilience, thereby reducing bit error rates (BER). Moreover, the transmission of additional bits via the spreading code index further enhances the system's SE. Simulation results show that compared to the conventional PC-OFDM-IM, the proposed PC-CFIM significantly improves the BER performance with enhanced SE.

14:35-14:50
KT3389

Title: Efficient Data Compression based on Run-length Coding for Electronic Skins
Author(s): Wei Yao, Shengliang Peng, Libo Chen, Zhi-Bin Zhang
Presenter: Wei Yao, Huaqiao University, China

Electronic skin (E-skin) is an advanced wearable technique with great potential in tactile feedback applications. E-skins with a large number of sensors may generate a great amount of data that usually incurs serious difficulties in data processing and transmission. Current research on E-skins mainly focuses on hardware design and sensor development, without considering the issue of data compression. To address the issue, this paper reports efficient compression of data from neuromorphic E-skin using algorithms based on run-length coding. Two run-of-zero-based coding methods, including Golomb coding and frequency-directed run-length (FDR) coding, are exploited to achieve data compression. Experimental results show that both the Golomb coding and FDR coding-based algorithms can compress the E-skin data efficiently with compression ratios over 79%.

14:50-15:05
KT3447

Title: A Partial Parallel Architecture Encoder for QC-LDPC Coding
Author(s): Ruijiang Yin, Jia Ke
Presenter: Ruijiang Yin, Xi'an University of Posts and Telecommunications, China

To meet the demand for quasi-cyclic low-density parity-check (QC-LDPC) codes, this paper proposes an encoder architecture specifically designed for QC-LDPC coding, compatible with the majority of QC-LDPC codes. The encoder is designed based on a forward substitution efficient coding algorithm, implemented in a partially parallel structure for efficient encoding. Furthermore, by utilizing a genetic algorithm (GA) optimization approach, the encoder's performance can be enhanced, with the optimized encoder significantly improving hardware usage efficiency (HUE).

15:05-15:20
KT1051

Title: An End-to-End Network Slicing Resource Allocation Mechanism in Non-Collaborative Mobile Network
Author(s): Ruihan Wen, Zeyu Li, Gang Feng, Shuang Qin, Feng Xie and Chengjie Li
Presenter: Ruihan Wen, University of Electronic Science and Technology of China, China

Network slicing is the key technology for the fifth-generation (5G) mobile network to provide customized services for vertical businesses. In practical end-to-end 5G network slice implementation, core network (CN) slices and radio access network (RAN) slices might be possessed by multiple network operators. Due to the existence of multiple network operators, the exchange of network slice operation information between CN and RAN slice is insufficient. Network slices that implement in such non-collaborative CN and RAN scenario can lead to degradation on SLA and violation of QoS. To address this issue, we propose a network slicing resource allocation mechanism to guarantee the end-to-end network slice performance in non-collaborative mobile network. First, we utilize a heartbeat detective mechanism to enable the orchestrator to proactively perceive the status of CN and RAN and the network slice operation information. Second, the orchestrator adjusts the resource allocation strategy of network slices given the heartbeat packet detection results. Simulation results show that the proposed mechanism guarantees good performance and low error rate of network slices compared with the baseline mechanisms. Additionally, we can accurately estimate the delay in the non-collaborative scenarios of the CN and RAN slices.

TECHNICAL SESSION

T08: Integrated Sensing and Communication System in Massive Mimo

Chair: **Tianming Ma**, Shanghai University of Engineering Science, China

13:30-15:20 | Oct. 19, 2024 | Meeting Room 10 - Wen Weng

Invited Speaker

Tianming Ma | 13:30-13:50
Shanghai University of Engineering Science, China

Speech Title: Interference Analysis and Suppression Scheme of Received Signals in FBMC-QAM Systems

Abstract: This work focuses on the derivation and analysis of interference factors in FBMC-QAM receiver signals under fast time-varying frequency selective fading channels and proposes corresponding suppression schemes. By applying the methods of mapping the time-domain symbols and reducing the correlation of frequency-domain symbols, the presented scheme can eliminate the intrinsic imaginary interference more thoroughly and greatly mitigate residual interference as well as receive a good peak-to-average power ratio (PAPR) mitigation effect. Theoretical analysis and simulation results indicate that compared with the other existing schemes, our adopted scheme can not only obtain better performances on bit error rate (BER) and out-of-band (OOB) emission with no loss of transmission efficiency, but also achieve a good PAPR mitigation effect with a small increase in complexity.

TAIK DETAILS

Time	Presentation
13:50-14:05 **KT2160**	Title: Dictionary Matrix Map in Massive MIMO Systems Author(s): Fuqian Yang, Penghao Cai, Chun Cai, Hanyu Zhu, Xiqi Gao Presenter: Fuqian Yang, Purple Mountain Laboratories, China As the number of base station (BS) antennas increases, conventional massive multiple-input multiple-output (MIMO) channel estimation methods based on the orthogonal pilots become infeasible. To address this issue, channel knowledge map (CKM) has been proposed to enable environment-aware channel estimation. In this paper, we propose to construct a particular type of CKM, namely dictionary matrix map (DMM), based on the dictionary matrices. Specifically, the coverage of the target BS is divided into multiple regions and the DMM is constructed by storing one particular dictionary matrix for each region. The DMM can be constructed based a predefined dictionary matrix or learned dictionary matrices. Based on the DMM, the

DMM-aware least square (LS) estimator and compressive sensing (CS) estimator are proposed to reduce the pilot contamination due to the pilot reuse. Simulations demonstrate that the proposed DMM-aware channel estimators can significantly improve the channel estimation performance.

14:05-14:20
KT2184

Title: Massive MIMO Uplink Transmission for Multi-Satellite Communications
Author(s): Ziyu Xiang, Rui Sun, Xinrui Gong, Xiqi Gao, Ke-Xin Li, Wenjing Liu and Xiang-Gen Xia
Presenter: Ziyu Xiang, Southeast University, China

In this paper, we investigate massive multiple-input multiple-output (MIMO) uplink (UL) transmission for multiple low-earth-orbit (LEO) satellite communications. We establish the system model and reveal that the signals transmitted from the user terminals (UTs), which are intended for different satellites, are typically asynchronous at each satellite. Then, at each UT, we propose linear precoding with time and frequency pre-compensations for each satellite, so that the signals intended for a specific satellite can be synchronized. We formulate the ergodic sum rate maximization problem and propose a Riemannian conjugate gradient (RCG) based precoding vector design algorithm within the manifold optimization framework, which does not include any matrix inversion. Simulation results indicate the effectiveness of our proposed approaches.

14:20-14:35
KT2238

Title: Achievable Rate Optimization of the Multi-layer RIS-Aided Terahertz Ultra-massive MIMO Communications
Author(s): Longwei Duan, Xufang Wang, Qiaoqing Wu, Yi Wu
Presenter: Xufang Wang, Fujian Normal University, China

THz communication, as one of the candidate technologies for 6G, suffers a large path loss, and reconfigurable intelligent surface (RIS) has been regarded as an effective assistant. In this paper, a multi-layer RIS (ML-RIS) aided terahertz (THz) ultra-massive MIMO communication system is proposed. Based on the proposed ML-RIS, we formulate a problem to maximize the achievable rate for ML-RIS-assisted THz communication. Aiming at the non-convexity caused by the RIS multi-layer structure, we design an efficient iterative algorithm to solve the resulting non-convex problem. Numerical simulation results demonstrate that the proposed schemes can greatly enhance the achievable data rate compared to traditional single layer RIS systems.

14:35-14:50
KT3325

Title: Adaptive Expectation Propagation for MIMO Signal Detection
Author(s): Zeliang Ou, Hongwen Yang
Presenter: Zeliang Ou, Beijing University of Posts and Telecommunications, China

This paper studied adaptive Expectation Propagation (EP) for Multiple Input Multiple Output (MIMO) signal detection. For conventional EP, the calculation of the Minimum Mean Squared Error (MMSE) output in each iteration involves matrix inversion operation and occupies the major computational complexity. This paper proposed a low-complexity adaptive EP algorithm based on estimated variance descent. The

proposed method utilizes variance descent during iterations as the judgment basis for symbol cancellation, and the computational complexity of the calculation of the MMSE output decreases dramatically after symbol cancellation. Furthermore, the proposed method can also avoid useless iterations in low signal-to-noise ratio (SNR) region in terms of variance descent. Simulations showed that the proposed method kept the same bit error rate performance as conventional EP, while the computational complexity of the proposed method reduced about 25% ~ 50% at different levels of SNR compared with that of conventional EP. The proposed methods worked well even when Nr<Nt, where Nr and Nt are the number of receive antennas and transmit antennas in a MIMO system respectively.

14:50-15:05
KT3404

Title: Low-Latency Beam-Multiplexing Scheme for Efficient Cell Search in Massive MIMO Systems
Author(s): Yunfei Wang, Fuqian Yang, Jinlin Zhang, Xiqi Gao
Presenter: Yunfei Wang, Purple Mountain Laboratories, China

In massive multiple-input multiple-output (MIMO) systems, highly directional transmissions are widely applied to mitigate the severe path loss during cell search. However, as the number of base station (BS) antennas increases, the large number of directional beams required for the highly directional connections will significantly increase the latency of the cell search. In this paper, we focus on the transmitting and the receiving of the primary synchronization signal (PSS), which is a crucial first step in cell search. To reduce cell search latency, we propose a PSS beam-multiplexing scheme that significantly reduces the time required for the BS to transmit all available beams by transmitting multiple PSS beams simultaneously. Meanwhile, to maximize the benefits of the proposed scheme, we also introduce an optimal beam estimation approach and a PSS detection approach. Simulation results indicate that our beam-multiplexing scheme outperforms the existing beam sweeping scheme in terms of PSS reception and significantly reduces cell search latency, particularly in fast-varying channels.

15:05-15:20
KT3463

Title: Joint Transceiver Design and Mode Selection for NOMA-ISAC in NAFD Cell-Free mMIMO Systems
Author(s): Jilong Wu, Wei Jia, Yiting Chen and Pengcheng Zhu
Presenter: Wei Jia, Southeast University, China

Integrated sensing and communication (ISAC) has garnered considerable attention for its capacity to simultaneously communicate and sense the surrounding environment. To enhance ISAC systems, non-orthogonal multiple access (NOMA) can be leveraged to mitigate interference between communication and sensing functions. This paper explores the transceiver design and mode selection for NOMA-ISAC in network-assisted fullduplex (NAFD) cell-free massive multiple-input multiple-output (mMIMO) systems. We firstly derive expressions for both the data rates of communication users and the sensing signal-tointerference-plus-noise ratios (SINRs) of radar targets. Subsequently, we formulate a joint optimization problem aimed at maximizing the sum sensing SINR while respecting communication constraints. To address this, we propose an algorithm based on sequential convex

approximation (SCA) coupled with simulated annealing (SA) to obtain the optimal solution. Simulation results demonstrate the efficacy of our proposed algorithm in significantly enhancing system performance.

TECHNICAL SESSION

T09: Computer Network Model and Data Transmission

Chair: **Dong Jin,** University of Science and Technology of China, China

15:50-17:40 | Oct. 19, 2024 | Meeting Room 1 - Qin Tai

Invited Speaker

Wei Wang | 15:50-16:10
Nanjing University of Aeronautics and Astronautics, China

Speech Title: Interference Graph Based Two-Stage Dynamic Spectrum Allocation with Adjustable Protect Zone

Abstract: In this paper, we propose a dynamic spectrum allocation model to optimize spectrum allocation between primary users (PUs) and secondary users (SUs). Our model aims to improve both spectrum utilization and economic efficiency by maximizing total social welfare. We introduce an interference graph-based two-stage allocation scheme. In the first stage, we allocate spectrum to high-priority SUs by constructing an interference graph and applying an improved graph coloring algorithm, ensuring minimal interference and maximal benefits. In the second stage, we introduce a protect zone adjustment strategy for low-priority SUs, by adjusting the coverage of low-priority SUs, subject to interference constraints. Simulation results demonstrate that the proposed algorithm performs better in densely user environments compared to other algorithms, enhancing both spectrum utilization and total social welfare

TAIK DETAILS

Time	Presentation
16:10-16:25 KT1029	Title: Effect Evaluation Method of IPv6 OS Fingerprinting based on AHP-TFN Author(s): Mingyue Ren, Lanxin Cheng, Liancheng Zhang, Yi Guo Presenter: Mingyue Ren, Information Engineering University, China In the pivotal realm of IPv6 network asset management, IPv6 operating system (OS) fingerprinting technologies assumes a paramount role. Nevertheless, current evaluation methods for these technologies remain inadequate. In light of this, this paper innovatively constructs a three-tiered effect evaluation index system for IPv6 OS fingerprinting, the analytic hierarchy process (AHP) based on triangular fuzzy numbers is introduced to achieve a precise and quantitative evaluation of the effectiveness of IPv6 OS fingerprinting. To validate the practicality and effectiveness of this evaluation system, three IPv6 OS fingerprinting tools (Nmap, P0f, and OSDetector6) were selected as evaluation subjects and a typical IPv6 network environment was established to conduct comprehensive and in-depth testing and

evaluation on nodes encompassing 15 OS versions. In conclusion, this proposed method not only fills the gap in the field of IPv6 OS fingerprinting effect evaluation but also provides robust technical support and decision-making foundations for the security management and optimization of IPv6 network assets through multi-dimensional and refined evaluation means.

16:25-16:40
KT1038

Title: E-band Quasi-Planar Power Combining Network Based on Multi-Layer SIW
Author(s): Jianlin Zhao, Ran Chu, Linlin Sun, Jia Liao
Presenter: Jianlin Zhao, Nanjing University of Science and Technology, China

This paper designs an E-band four channel quasi-planar power combining network based on multi-layer SIW. The design of quasi plane power combiner is completed by inserting a laminated SIW into a rectangular waveguide, which realizes the miniaturization and lightweight of the power combiner; The transition from SIW to WR-12 rectangular waveguide adopts a vertical transition structure, and the parameters of this structure, such as the coupling hole spacing, coupling hole height, and the length of rectangular metal patch, are optimized, making this combining network more compact and broadband than the traditional binary combining mode. The physical test results show that the return loss of the network is better than -10dB, the insertion loss is less than 1.7dB, and the composite efficiency is more than 85% in 60-90GHz.

16:40-16:55
KT2164

Title: A Variable Forgetting Factor RLS-CMA Algorithm Based on Decision Directed Scheme
Author(s): Kangkang Wang, Yang Feng and Bin Lin
Presenter: Kangkang Wang, Dalian Maritime University, China

In response to the severe distortion of the transmitted signal due to phase rotation after convergence of the RLS-CMA blind equalisation algorithm, a variable forgetting factor RLS-CMA algorithm based on decision-directed scheme is proposed in this paper. This new method adaptively adjusts the forgetting factor based on the mean square error and corrects the equalisation output using the DD algorithm to improve the channel tracking performance. The proposed method converges faster and reduces the steady-state residual error while compensating the phase distortion effectively. In addition, the steady state performance of the algorithm is verified by Taylor series expansion to ensure its accuracy.

16:55-17:10
KT2168

Title: Efficient Application-Layer Scanning with Hybrid-State Lightweight TCP Stack for TLS-based Service Monitoring
Author(s): Chiyu Chen, Yuliang Lu, Guozheng Yang, Yi Xie and Shasha Guo
Presenter: Guozheng Yang, National University of Defense Technology, China

Application-layer scanning is a widely used method for monitoring TLS-based services on the large-scale network for configuration and security. Existing application-layer scanners rely on default TCP protocol stacks designed for general scenarios and are limited on maximizing the utilization of hardware resources for high-speed scanning. To address the limitation, we propose a hybrid-state lightweight TCP working model(HLTCP) which combines stateful and stateless modes. HLTCP

discards redundant features from mainstream TCP protocol stack implementations that are not suitable for high-speed scanning scenarios. It dynamically switches between stateful and stateless modes to minimize unnecessary state maintenance and transitions. We implement this model in an asynchronous scanner as a user-space protocol stack that makes it easily deployable. By providing custom interfaces for application-layer scanning probes, HLTCP can perform various TLS-based service scanning tasks. Our experiments demonstrate that the HLTCP scanner achieves at least 3.5 times the scanning efficiency of current state-of-the-art methods in terms of scan duration on common hardware configurations for TLS-based services in large-scale network, significantly improving the resource utilization rate in serive monitoring and network measurements.

17:10-17:25
KT3303

Title: Cooperative Perception of Connected Autonomous Vehicles: A Stackelberg Game Approach
Author(s): Haozhong Xue, Ke Zhang, Supeng Leng and Jianhua He
Presenter: Haozhong Xue, University of Electronic Science and Technology of China, China

The rise of connected autonomous vehicles demands a wider range of more accurate environment perception information. However, individual perception is hindered by blindspots and limited detection precision. Cooperative perception enhances vehicles' environment perception capacity by sharing data with other vehicles or roadside infrastructure via vehicleto-everything (V2X) communication, effectively addressing individual perception problems. Despite the critical importance of cooperative perception technology, the quality of transmitted data may decrease in environments with limited communication and computation resources, leading to a low coverage area and detection precision. To address the above issues and meet the perception utility demands of all vehicles in the environment, we propose a multi agent cooperative perception framework. Based on this framework, we propose a multi-leader multi-follower Stackelberg game model and design an iterative optimization algorithm to enhance perception utility while reducing system delay and overhead. Numerical results demonstrate that our proposed approach significantly improves the environment perception utility of vehicles compared to benchmark approaches.

17:25-17:40
KT3462

Title: Mixed Traffic Scheduling of URLLC Industrial Automation Under Network Calculus Analysis
Author(s): Zhaoqing Liu, Kang Li, Zhiyu Yan, Yan Wang, Pengcheng Zhu
Presenter: Kang Li, Southeast University, China

Ultra-reliable and low-latency communications (URLLC) holds significant potential in the wireless industrial automation, especially for increasing flexibility while guaranteeing stringent quality-of-service (QoS) requirements. Inspired by the traffic shaper in time-sensitive networking (TSN), this paper proposed a mixed traffic scheduling scheme in URLLC-enabled industrial automation, where time-triggered (TT) traffic and event-triggered (ET) traffic are separated into different queues and shaped by the gate-control lists (GCLs) and the credit-based shaper (CBS). Due to the preemption of TT traffic, the end-to-end (E2E) latency of ET traffic may exceed its

requirement. To characterize the effect of TT traffic on the latency of ET traffic, we derive the delay violation probability bound for ET traffic using network calculus with the guarantee of transmission of TT traffic. On the other hand, since URLLC requires conservative resources to ensure high reliability within short latency, it is challenging to achieve bandwidth-saving scheduling for mixed traffic. To minimize the total downlink bandwidth while ensuring the QoS requirements, a two-step method is proposed to find the global optimal solution of the send slope and idle slope of CBS, bandwidth allocation, subchannel assignment and preemption duration. Simulation results validate our analysis and show the bandwidth-saving performance gain by optimizing CBS parameters and PHY layer resources with the proposed TSN-based scheduling scheme.

TECHNICAL SESSION

T10: UAV Communication and System Performance Optimization

Chair: **Bo Li,** Ningxia University, China

15:50-17:40 | Oct. 19, 2024 | Meeting Room 2 - Gu Li

Invited Speaker

Zhaopeng Xu | 15:50-16:10
Pengcheng Laboratory, China

Speech Title: Advanced Neural Network-Based Equalization Techniques for IMDD Systems

Abstract: Intensity-modulated direct-detection (IMDD) links dominate short-reach optical communication applications such as data center interconnects. However, the intrinsic nonlinear IMDD channel and the non-ideal response of low-cost devices introduce severe performance penalty. In recent years, neural networks (NNs) have become popular solutions for IMDD links due to their excellent system performance. This talk reviews various types of NN-based receivers that have been applied to IMDD optical systems and pinpoints the performance-complexity trade-off. Targeting real-time receiver implementation, this talk also provides several complexity reduction techniques for hardware-efficient NN-based equalization, including multi-symbol equalization, pruning and quantization.

TAIK DETAILS

Time	Presentation
16:10-16:25 KT3331	Title: Temperature-Constrained Computation Time Minimization for Integrated Tasks in UAV-Assisted MEC Networks Author(s): Yuyu Hao, Lingyan Bao, Hai Li and Mingxiong Zhao Presenter: Mingxiong Zhao, Yunnan University, China In emergency or temporary communication scenarios, deploying unmanned aerial vehicle base stations (UAV-BSs) to provide access for ground terminals is a potential networking solution. Due to the diversity of application scenarios, the deployment of UAV-BSs is a primary and open issue, and especially, it is a challenging problem for UAV-BSs to maximize coverage and maintain a self-organizing connected backbone network. In this paper, we propose a maximum coverage (Max-Cover) model, which is a nonlinear constrained optimization model. Considering a certain number of UAV-BSs, backbone network connectivity and co-channel interference, the deployment of these UAV-BSs is optimized to cover the maximum number of ground terminals by Max-Cover model. Max-Cover model is transformed into an unconstrained 0-1 nonlinear programming problem through penalty function, and

then solved based on genetic algorithm.

16:25-16:40
KT2216

Title: INFER-Planner: Information Elapse Rate Planner for AoI-Minimal Data Collection by Heterogeneous Multi-UAV
Author(s): Chen Xie, Binbin Wu, Wenfeng Ma and Daoxing Guo
Presenter: Binbin Wu, Army Engineering University of PLA, China

In the application of multi-UAV assisted ground sensing node data collection, the timeliness represented by age of information is one of the most crucial indicators for evaluating the effectiveness of data collection. Given the heterogeneity of UAVs and ground sensing nodes in this scenario, firstly, each UAV needs to collect data from specific types of nodes, secondly, the information urgency of different nodes is described by the information elapse rate. The planning problem encompasses two aspects including data collecting task allocation and UAV trajectory generation. Consequently, a two-stage planning method is proposed. In the first stage, a topological 3D roadmap is established to precisely calculate the cost of flight time, taking into account ground obstacles and other safety threats. In the second stage, the problem is rephrased as the Heterogeneous Asymmetric Colored Traveling Salesman Problem (HAC-TSP) and then solved using an improved genetic algorithm. The numerical results demonstrate the enhancements achieved by this effort.

16:40-16:55
KT3280

Title: Energy-Efficient Deployment and Power allocation for VLC-enabled Unmanned Aerial Vehicles Communications
Author(s): Liyuan Pang, Pu Miao, Chong Huang, Xiufeng Xu, Peng Chen, Gaojie Chen
Presenter: Liyuan Pang, Qingdao University, China

Deploying unmanned aerial vehicles (UAV) enabled visible light communication (VLC) networks to accommodate both the illumination and communication requirements of all users presents a serious challenge. In this paper, the UAV-VLC network deployment is investigated by the joint optimization of user association, UAV placement and power allocation, which is mathematically formulated as a minimization of energy consumption problem. The original problem is decoupled into two subproblems and sequentially solved by the proposed two-stage optimization scheme. To elaborate, the K-means algorithm is employed to cluster the users firstly, thereby establishing the user association indirectly. Then, the deep reinforcement learning (DRL) based technique is employed to determine the optimum UAV placement and power allocation as considering the specific requirements of illumination and communications for all users. Simulation results demonstrate that the proposed scheme can achieve the superior performance and can reduce the total transmit power consumption at least by 74.39% and 67.62% as compared with the conventional schemes.

16:55-17:10
KT3361

Title: Joint Communication Bandwidth and Computing Frequency Allocation for Control-Oriented UAV-Robot Rescue Systems
Author(s): Daohong Shen, Xinran Fang, Wei Feng, Yunfei Chen and Zhibo Pang
Presenter: Daohong Shen, Tsinghua University, China

In post-disaster scenarios, field robots and unmanned aerial vehicles (UAVs) are effective tools to provide an on-demand response and guarantee the safety of humans. The devices equipped by field robots and UAVs, such as sensors, base stations (BSs), and mobile edge computing (MEC) servers, can be jointly deployed to form a sensing-communication-computing-control (SC3) closed loop, which could be used to complete dangerous tasks without human intervention. In this paper, we jointly optimize the communication bandwidth and computing frequency for a UAV-robot rescue system, aiming to improve the control performance of the SC3 loop. We introduce the linear quadratic regulator (LQR) cost to measure the control performance. We use the successive convex approximation (SCA) method and propose an iterative algorithm to solve the non-convex problem effectively. Numerical results are given to corroborate the superiority of our proposed scheme over existing communication-oriented ones. The results also indicate that the joint optimization of communication bandwidth and computing frequency is essential to improve the system. This joint optimization shows the intrinsic relationship among communication, computing, and closed-loop control.

17:10-17:25
KT3390

Title: An Enhanced Resilience and Throughput BBV-based Method for UAV Networks
Author(s): Jinghong Sun, Yueyan Chu, Ce Shi, Wenbin Guo
Presenter: Jinghong Sun, Beijing University of Posts and Telecommunications, China

In harsh environments such as battlefield operations and emergency communications, communication rate and network resilience significantly impact the performance of UAV swarm networks. This paper proposes a scalable UAV network construction scheme named UMBTO, which aims to maximize communication rates while enhancing network resilience. By considering the communication range of UAVs and introducing triangular linking methods to improve the Barrat, Barthelemy, and Vespignani (BBV) model, suitable links are established for each new UAV, endowing the network with stronger resilience against random failures. Furthermore, considering the existing links and relative positions between UAVs, we formulate a system-wide link communication rate (SLCR) maximization problem. By dynamically adjusting the deployment positions of UAVs to maximize SLCR, the scheme ensures effective information exchange within the swarm, enhancing collaborative efficiency. The constructed network is scalable, allowing new UAVs to be seamlessly integrated without the need for cumbersome steps to rebuild the network topology. Evaluation and simulation results demonstrate that the proposed scheme constructs UAV networks with stronger resilience and better link communication rates compared to traditional BBV networks.

17:25-17:40
KT3434

Title: 6G Lean Radio Access Network Architecture and Key Technologies
Author(s): Yuhong Huang, Xin Sun, Shuyuan Zhang, Zecai Shao, Na Li and Siqi Chen
Presenter: Xin Sun, China Mobile Research Institute, China

With the rapid development of technologies such as mobile internet, multi-access edge computing, and artificial intelligence, the 6G network is facing unprecedented challenges and opportunities. In the future, 6G will carry more diversified service

requirements. If the protocol stack overlay method continues to be used, the functions of the 6G protocol stack will become more complex, making it difficult to adapt to the development needs of future networks. In response to this challenge, this paper proposes a lean Radio Access Network (RAN) architecture design scheme. This scheme integrates multiple similar or repetitive functions to achieve functional integration and optimization, thereby simplifying the protocol layer structure and sinking some control functions closer to the edge side. This design not only reduces the signaling process but also effectively reduces network complexity and improves data processing efficiency.

TECHNICAL SESSION

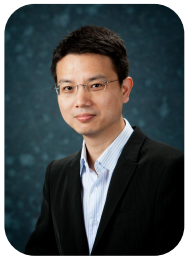
T11: Radar Signal Detection Technology and Application

Chair: **Xiaojun Yuan**, University of Electronic Science and Technology of China, China

15:50-17:40 | Oct. 19, 2024 | Meeting Room 3 - Gu Lou

Invited Speaker

Xiaojun Yuan | 15:50-16:10
University of Electronic Science and Technology of China, China



Speech Title: Scalable Near-Field Localization Based on Partitioned Large-Scale Antenna Array

Abstract: Positioning is a critical component in wireless networks, playing a pivotal role in enabling various applications. MIMO-assisted wireless positioning, in particular, offers unique advantages, such as enhanced spatial resolution and the ability to support multiple users simultaneously. As antenna arrays in wireless systems evolve towards Extremely Large Antenna Arrays (ELAAs) with increased size and operating frequency, the need for accurate positioning in near-field scenarios becomes more pronounced. Traditional near-field positioning algorithms often exhibit cubic complexity growth with the number of array antennas, making them impractical for ELAAs. Moreover, in near-field scenarios, targets may need to be modeled beyond point sources, requiring joint estimation of their position and attitude. To address these challenges, we propose a series of near-field positioning techniques based on array partitioning. Our approach leverages the subtle differences in the angle of arrival (AoA) across different regions of the receiving array, known as the AoA drifting phenomenon, to achieve accurate positioning. We formulate the near-field positioning problem within a Bayesian inference framework and introduce message passing and variational inference techniques for efficient solutions. The proposed algorithm demonstrates linear complexity growth with the number of antennas in the receiving array. Simulation results show that the proposed near-field positioning algorithm outperforms existing methods in both positioning accuracy and computational efficiency. Furthermore, we extend our approach to the joint positioning and attitude estimation of multiple targets, where our algorithms continue to exhibit superior performance.

TAIK DETAILS	
Time	**Presentation**
16:10-16:25 **KT2163**	Title: A Generalized Maximum Distance Separable Coded Framework Design for Vehicular RadCom Author(s): Yiqian Huang, Ping Yang, Vladimir Mordachev, Gang Wu Presenter: Yiqian Huang, University of Electronic Science and Technology of China, China

	For achieving joint radar and communication (RadCom) as well as improving communication quality in vehicular networks, this paper designs a generalized maximum distance separable (MDS) coded framework, which is suitable for the conventional communication waves, such as orthogonal frequency division multiplexing (OFDM), also for the radar sensing waves, such as frequency modulated continuous wave (FMCW). In the framework, an MDS coded amplitude and phase modulation (MDS-APM) scheme is utilized in order to correct the burst error in channels and hence achieve reliable communication, while the efficient two-dimensional fast fourier transform (2D-FFT) algorithm is employed for multi-target sensing. To exploit the potential benefits of different waveforms, we further compare the MDS-based OFDM design and MDS-based FMWC design. Numerical simulations are conducted to evaluate their performances, which prove that both waveforms have attractive radar performances, while their communication qualities differ in distinct scenarios.
16:25-16:40 **KT3306**	Title: Performance Optimization of 3D Human Body Reconstruction Technology Based on mmWave Radar Author(s): Suxin Hou, Zhaohui Yang, Lijie Yang, Chen Zhu, Minghui Wang, Zhaoyang Zhang Presenter: Suxin Hou, Zhejiang University, China Wireless Sensing Technology utilizes radio waves, microwaves, infrared and other wireless signals to sense and detect the environment. Millimeter wave(mmWave) radar is widely applied in the field of wireless perception due to its high stability and adaptability. Therefore, the 3D body reconstruction technology based on mmWave radar can adapt to extreme environments better than other sensors. However, the performance of existing 3D human body reconstruction methods with mmWave radar is not particularly ideal, especially the accuracy of the limbs is not good. In this paper, we improve the 3D human body perception and reconstruction performance of mmWave radar by improving the loss strategy and using multi-frame joint correction. By using loss strategies that are more adaptable to abnormal data and by detecting and correcting abnormal frames through differences between adjacent frames, we improve the accuracy of human reconstruction. The effectiveness of our method is verified by the comparative analysis of many metrics and the intuitive feeling of the visualization effects. Analysis and visual comparison clearly show that our method achieves superior performance.
16:40-16:55 **KT2652**	Title: Trade-off between Radar Sensing and Energy Consumption in Integrated Sensing, Computing, and Communication UAV Network Author(s): Yige Zhou, Xin Liu and Yuemin Liu Presenter: Yige Zhou, Dalian University of Technology, China In this paper, a multi-UAV enabled integrated sensing, computing, and communication (ISCAC) model is proposed, in which multi-UAV senses ground Users and offloads sensing data to a high altitude platform (HAP) for processing through mobile edge computing (MEC) technology.

To maximize sensing data acquisition while minimizing energy consumption, we formulate our optimization problem as a trade-off between UAV radar sensing and energy consumption. We transform the established non-convex problem into three subproblems: sensing scheduling optimization, UAV transmit power optimization, and UAV-HAP trajectory optimization. We solved these subproblems using successive convex approximation (SCA) and relaxation methods and proposed a three-layer iterative optimization algorithm to solve the original optimization problem. Simulation results demonstrate that, compared to the benchmark scheme, the algorithm proposed in this paper can significantly improve system performance.

16:55-17:10
KT3307

Title: Spatial-Temporal Mapping CFAR Detection Method for Radar Target Detection
Author(s): Qi Yang, Kai Liu, Zhibo Zhang, Leyan Chen, Qiang Gao and Zhaobai Wen
Presenter: Qi Yang, Beihang University, China

In order to make full use of spatial-temporal information for target detection, a spatial-temporal mapping constant false alarm rate (STM-CFAR) detection method is proposed in this paper. First, based on the clutter map (CM) from radar echo frames, the clutter power of each cell under test (CUT) is estimated in temporal domain. Second, we derive the relationship of the threshold factor and the probability of false alarm (PFA) to obtain the optimal temporal detection threshold (TDT) table. In addition, we establish the spatial detection threshold (SDT) table obtained from adaptively adjusting CFAR methods to reflect the spatial statistical characteristic of clutter in spatial domain. According to the clutter condition, the values of TDT and SDT are weighted to get the final detection threshold of STM-CFAR, which can achieve better detection performance. Simulation results show that the proposed method outperforms other traditional CFAR detection methods in terms of detection probability under different clutter backgrounds.

17:10-17:25
KT2226

Title: Radar Spectrum Allocation for Vehicular Networks with QMIX-LSTM Network
Author(s): Yuxin Fan, Xinyi Wang, Jingxuan Huang, Zesong Fei and Yiqing Zhou
Presenter: Yuxin Fan, School of Information and Electronics, Beijing Institute of Technology (BIT)

To ensure driving safety, radar detection is an essential function of autonomous vehicle. However, with the increasing number of automotive radars and limited spectrum resources, the co-channel interference among radars seriously affects the detection performance. Spectrum allocation is a representative method for interference elimination. However, the centralized scheme suffers from long latency and is not applicable to delay-sensitive scenarios. In this paper, we construct a noval signal mutual interference model and build the Decentralized Partially Observable Markov Decision Process (Dec-POMDP) framework. In particular, the QMIX-LSTM algorithm based on Centralized Training with Decentralized Execution (CTDE) architecture is used for spectrum allocation to mitigate the mutual interference and improve the detection probability. Simulation results show that the proposed scheme achieves a higher radar detection probability compared with myopic scheme.

17:25-17:40
KT2201

Title: NTN-CSInet: Joint design of CSI feedback and prediction in NTN scenario
Author(s): Zhuofan Pang, Hui Zhao and Xinli Feng
Presenter: Zhuofan Pang, Beijing University of Posts and Telecommunications

In non-terrestrial networks (NTN) scenario, long transmission delays induce channel aging and result in outdated channel state information (CSI) feedback. Meanwhile, codebook- based CSI feedback schemes face the challenge of codebook complexity and feedback overhead in massive MIMO systems. To address these issues, this paper proposes a joint-design deep learning based model for CSI feedback and prediction in NTN scenario, called NTN-CSInet. An encoder is implemented on the user equipment (UE) side to compress the CSI, while the decoder and predictor are implemented on the base station (BS) side to both recover and predict the future CSI, considering the time dependence of the channel. A ConvLSTM network is employed to construct a predictor that processes the spatiotemporal features in the time series data and predicts the subband feature matrix of future slots. The effectiveness of this scheme in mitigating the adverse effects of satellite communication channel aging is verified by simulation experiments, with its performance compared with that of classical DL-based feedback schemes and traditional codebook schemes. The results show that the NTN- CSInet can improve the accuracy and timeliness of CSI in NTN systems, so as to improve the system performance.

TECHNICAL SESSION

T12: Communication and Signal System

Chair: **Qiuming Zhu,** Nanjing University of Aeronautics and Astronautics, China

15:50-17:40 | Oct. 19, 2024 | Meeting Room 5 - Nan Jie

Invited Speaker

Bin Chen | 15:50-16:10
Shenzhen University, China

Speech Title: A Study of Semi-Fungible Token based Wi-Fi Access Control

Abstract: Current Wi-Fi authentication methods face issues such as insufficient security, user privacy leakage, high management costs, and difficulty in billing. To address these challenges, a Wi-Fi access control solution based on blockchain smart contracts is proposed. Firstly, semi-fungible Wi-Fi tokens (SFWTs) are designed using the ERC1155 token standard as credentials for users to access Wi-Fi. Secondly, a Wi-Fi access control system based on SFWTs is developed to securely verify and manage the access rights of Wi-Fi users. Experimental results demonstrate that SFWTs, designed based on the ERC1155 standard, along with the SFWT access right verification process, can significantly reduce Wi-Fi operating costs and authentication time, effectively meeting users' needs for safe and convenient Wi-Fi access.

TAIK DETAILS

Time	Presentation
16:10-16:25 KT1070	Title: Real-Time Hardware Emulation for Spatial – Temporal Correlated Multiple Access Channels Author(s): Ling Yang, Sheng Fang, Yongfeng Zheng, Yuetian Xie, Yuan Ding, Longjun Wang, Boyu Hua, Qiuming Zhu Presenter: Ling Yang, Nanjing University of Aeronautics and Astronautics, China To reduce hardware consumption and improve the emulation accuracy of spatial-temporal correlated channel fading, this paper presents a novel emulation scheme based on the sum-of-cisoids (SOC) idea and develops a real-time hardware generation algorithm for complex harmonic frequencies (CHF). Specifically, this algorithm introduces random offsets to the parameters generated by the method of equal areas (MEA), ensuring the generation of multiple independent Gaussian random variables. Hardware measurement results demonstrate that the hardware resource consumption is lower than that of traditional methods. Furthermore, the

spatial-temporal correlation of the generated channel fading closely matches the theoretical one, thereby validating the algorithm's effectiveness.

16:25-16:40
KT3267

Title: Statistical CSI-Based Two-Stage Beamforming Scheme for Massive MIMO with Channel Aging
Author(s): Xiaozhe Jing, Yunchao Song and Huibin Liang
Presenter: Xiaozhe Jing, Nanjing University of Posts and Telecommunications, China

In this paper, we propose a two-stage beamforming (TSB) scheme for frequency division duplex (FDD) massive MIMO systems with channel aging. The proposed scheme utilizes statistical channel state information (CSI) and the channel aging coefficient to design the prebeamforming matrix to sparsify the channel matrix, so as to reduce pilot overhead while enhancing spectral efficiency. Specifically, a Gauss-Markov fading model is used to describe channels with aging effects. We derived the formulas for received energy of each user from each beam per slot. In the first stage of TSB, the prebeamforming matrix design is modeled as a 0-1 integer programming problem. The problem is used to maximize the received energy and solved using the branch-and-bound method. Subsequently, in the second stage of TSB, the beamforming matrix is designed with zero-forcing criterion, significantly reducing inter-user interference. Simulation results demonstrate that the proposed scheme effectively mitigates the impact of channel aging on system performance.

16:40-16:55
KT3369

Title: Multi-scenario time-domain channel extraploation: A Transformer-based approach
Author(s): Wenjun Yu, Jun Jiang, Yuan Gao and Shugong Xu
Presenter: Yuan Gao, Shanghai University, China

Time-domain channel prediction offers a promising solution for obtaining Channel State Information (CSI) in high-mobility communication systems, while minimizing overhead. However, current deep learning-based channel prediction models face significant challenges in generalization, often performing poorly when applied to scenarios different from their training data. To address this limitation, we propose a novel transformer-based time-domain channel prediction framework that generalizes effectively across multiple scenarios. Extensive simulations demonstrate that our proposed framework substantially outperforms conventional models in terms of generalization capability across various scenarios and signal-to-noise ratios (SNR). The models we compared include Long Short-Term Memory (LSTM) networks, Gated Recurrent Units (GRUs), Bidirectional GRU (BiGRU), and standard Transformer architectures. Our results underscore the potential of this approach to significantly advance the field of channel prediction in dynamic communication environments.

16:55-17:10
KT2097

Title: Analysis of factors affecting wireless propagation signals in projectile-carried communication jamming environments
Author(s): Jie Zhang, Haifei Deng
Presenter: Jie Zhang, PLA Army Academy of Artillery and Air Defense, China

The core of the communication jamming projectile's ability to complete combat tasks depends on the normal transmission of communication jamming signals from the

projectile to the receiving end of the jammed frequency hopping radio station. In order to clarify the wireless signal propagation environment that projectile-carried communication jamming signals may face during the transmission process, the signal transmission characteristics in the projectile-carried communication jamming environment were clarified from two aspects: ground wave transmission and sky wave transmission. Based on the specific transmission environment of projectile-carried communication jamming signals, the signal transmission losses in different situations were summarized, and the application scenarios of different signal transmission loss formulas were sorted and classified. Finally, a summary of the experience in the transmission process of short wave and ultra short wave signal bands was made. The relevant conclusions can provide reference for further improving the simulation granularity of projectile-carried communication jamming models and conducting in-depth research on the projectile-carried communication jamming performance in different wireless signal propagation environments.

17:10-17:25
KT2103

Title: Honeypot-based defense strategy in IoT networks using Signaling game
Author(s): Haoyuan Liu and Hao Wu
Presenter: Haoyuan Liu, Beijing Jiaotong University, China

In the context of the flourishing Internet of Things (IoT) technology, the extensive deployment of IoT devices, alongside their limited defense capabilities, renders them vulnerable targets for malicious hacker attacks. In order to deal with some powerful hackers, honeypot technology is often applied in IoT security defense. However, since running and maintaining honeypot technology will bring some overhead, finding a secure and efficient strategy to apply it has been a major challenge. In this paper, we model the interaction between an attacker and a defender as a signaling game, aiming to examine how the network defender selects the optimal defense strategy when faced with resource constraints. We develop a Dynamic Defense Strategy algorithm tailored to the capabilities of diverse attackers drawing on perfect Bayesian Nash equilibrium. Extensive simulation experiments demonstrate that our proposed dynamic strategy, based on the signaling game model, outperforms the traditional random or maximum defense strategy in terms of both defense effectiveness and cost.

17:25-17:40
KT3419

Title: Direction-of-Arrival Estimation for Terahertz Massive MIMO Systems under Non-Stationary Noise Environment
Author(s): Mengyao Sun, Chaoyi Wang, Sai Li and Yunhang Lin
Presenter: Mengyao Sun, Nanjing University of Aeronautics and Astronautics, China

The Terahertz band supports ultra-wide bandwidth and ultra-high-speed transmission rates. Hybrid dynamic arrayof-subarrays (DAoSA) beamforming in massive multiple-input multiple-output (mMIMO) systems offers advantages such as high beamforming gain and low hardware complexity. It is a crucial factor in achieving milli-degree accuracy in estimating the direction-of arrival (DOA). However, in non-stationary noise environments, the various subcarriers of ultra wideband signals may encounter beam-squint issues, which present signiffcant challenges for DOA estimation. Addressing this challenge, this paper investigates the DOA estimation problem in Terahertz mMIMO systems employing DAoSA architecture. The

Pre-Whitening noise and Beam-squint Canceller method for Multiple Signal Classiffcation (PWBC-MUSIC) has been proposed. Initially, it employs pre-whitening of the array data's covariance matrix using an estimated noise covariance matrix. Subsequently, it employs a linear transformation matrix to mitigate beam- squint. Furthermore, the paper includes derivation of the Crame´r-Rao lower bound (CRLB) to substantiate the algorithm's performance. The simulation results demonstrate that the proposed algorithm can effectively suppress the interference of non-stationary noise, particularly at low signal-to-noise ratios, and can achieve millidegree level DOA estimation under ultra-wideband conditions.

TECHNICAL SESSION

T13: Communication Sensor Computing in Wireless System

Chair: **Zhang Hongmei,** Guilin University of Electronic Technology, China

15:50-17:40 | Oct. 19, 2024 | Meeting Room 6 - Kuan Xiang

Invited Speaker

Qiang He | 15:50-16:10
Northeastern University, China

Speech Title: A Blockchain-based Scheme for Secure Data Offloading in Healthcare with Deep Reinforcement Learning

Abstract: With the widespread popularity of the Internet of Things and various intelligent medical devices, the amount of medical data is rising sharply, and thus medical data processing has become increasingly challenging. Mobile edge computing technology allows computing power to be allocated at the edge closer to users, which enables efficient data offloading for healthcare systems. However, existing studies on medical data offloading seldom guarantee effective data privacy and security. Moreover, the research equipping data offloading architectures with Blockchain neglect the delay and energy consumption costs incurred in using Blockchain technology for medical data offloading. Therefore, in this paper, we propose a data offloading scheme for healthcare based on the Blockchain technology, which achieves optimal medical resource allocation and simultaneously minimize the cost of offloading tasks. Specifically, we design a smart contract to ensure secure data offloading. And, we formulate the cost problem as a Markov Decision Process, solved by a policy search-based deep reinforcement learning (Asynchronous Advantage Actor-Critic) approach, where we jointly consider offloading decisions, allocation of computing resources and radio transmission bandwidth, and Blockchain data security audits. The security of our smart-contract-based mechanism is theoretically and empirically proved, while extensive experimental results also show that our solution can obtain superior performance gains with lower cost than other baselines.

TAIK DETAILS

Time	Presentation
16:10-16:25 KT2235	Title: STAR-RIS Assisted Opportunistic Cognitive Radio Networks Author(s): Bowen Cai, Jungang Ge and Ying-Chang Liang Presenter: Ying-Chang Liang, University of Electronic Science and Technology of China (UESTC), China To support the ever-increasing wireless traffic, cognitive radio (CR) has been

identified as one of the most promising spectrum-sharing technologies in future wireless networks. In this paper, we study a simultaneously transmitting and reflecting reconfigurable intelligent surface (STAR-RIS) assisted opportunistic CR network, where the primary transmitter, secondary transmitter, and secondary receiver are located on one side of the STAR-RIS while the primary receiver is located on the other side. To improve the spectrum efficiency, we investigate a reflection and transmission coefficient optimization problem to maximize the average achievable rate of the secondary user (SU) while satisfying the rate requirement of the primary user (PU). Particularly, we propose a two-stage reflection and transmission coefficient optimization framework to decouple the considered optimization problem in the sensing and transmission stages. Specifically, in the sensing stage, the reflection and transmission coefficients are optimized to assist the transmission of the PU while realizing target detection and false alarm probabilities. In the transmission stage, the reflection and transmission coefficients are optimized to maximize the average achievable rate of the SU while satisfying the rate requirement of PU. Finally, extensive simulation results are provided to evaluate the performance of the STAR-RIS-assisted opportunistic CR network.

16:25-16:40
KT1086

Title: On Design of Monostatic MIMO OFDM Integrated Communication and Sensing System
Author(s): Jiaying Ren, Shawn Tsai
Presenter: Jiaying Ren, MediaTek USA Inc., USA

We propose a novel monostatic multiple-input multiple-output (MIMO) integrated sensing and communication (ISAC) system to provide high resolution 4D information of sensing targets with a low proportional communication capacity loss. This system colocates the ISAC transmitter and radar receiver, using unified orthogonal frequency division multiplexing (OFDM) signals for both communication and sensing tasks. We introduce a frequency resource allocation strategy that sets aside sparsely distributed blocks of subcarriers for ISAC and reserves the remaining subcarriers for conventional communication tasks. The cyclic-shift-based port virtualization technique is utilized on ISAC subcarrier blocks to synthesize a large 2D virtual array, enhancing angle resolution for sensing, and broadcast data with spatial diversity. Additionally, to ensure both sensing accuracy and high communication data rates, we present an ISAC subcarrier block selection method that optimizes the sparse placement of blocks through specific design constraints. Numerical examples demonstrate that our proposed monostatic MIMO ISAC system effectively balances communication and sensing performance, showing significant potential for future sixth-generation (6G) applications.

16:40-16:55
KT3444

Title: Less is More: Channel-Aware Semantic Satellite Access Network Slicing
Author(s): Chaoqun You, Xingqiu He, Peng Yang, Yueyue Dai, Kun Guo, Tony Q. S. Quek
Presenter: Chaoqun You, Fudan University, China

Satellites equipped with computing capabilities play a crucial role as access platforms for 5G and NextG (beyond 5G) non-terrestrial networks (NTNs). They facilitate the

continuous execution of resource-intensive edge-assisted deep learning (DL) tasks offloaded from user equipment (UEs) in remote areas. To manage this effectively, satellite access network (SAN) resources must be carefully ``sliced'', taking into account both the limited energy availability and the inherent scarcity of SAN resources. Existing SAN slicing approaches tend to use semantic communications for UE data transmission but overlook the impact of varying channel qualities between UEs and satellites. A cyclic dependency between the inter-slice and intra-slice resource schedulers makes it challenging to incorporate channel awareness at both levels. Armed with this insight, in this paper, we propose channel-aware semantic SAN (CASemSAN), a semantic SAN slicing algorithm that considers the channel conditions for NextG AI-native NTNs. It not only compresses tasks' data according to their semantics but also exploits the channel conditions of a SAN to support more tasks while still minimizing overall energy consumption. After analyzing the characteristics of this optimization problem, we propose an online greedy CASemSAN slicing algorithm to approximate its optimal solution. Extensive experiments verify the effectiveness of CASemSAN in energy saving and its ability to support a substantial number of tasks, compared with other baselines.

16:55-17:10
KT2111

Title: Large-scale distributed architecture for wireless communication network simulation
Author(s): Zhongqiu Xiang, Xuecheng Liu, Xuemin Huang, Yunjing Wang, Pei Zhao, Shumin Jiang, Xirui Dang, Zhihao Zhu, Xueying Li, Gang Qin
Presenter: Zhongqiu Xiang, China Mobile Group Design Institute Co., Ltd., China

Wireless network simulation is the main method to evaluate network performance and communication equipment to access the network. It plays an important role in the whole life cycle of wireless network.Wireless network high-precision simulation is based on electromagnetic wave principle and geometric optics principle, and accurately simulates various propagation paths of wireless electromagnetic signal in space. It is characterized by accurate calculation but high complexity. Efficient wireless network simulation technology architecture is the basis of wireless network simulation industry application.This paper presents a large-scale distributed technology architecture for wireless network simulation. The technical solution adopts the key technologies of distributed computing, service orchestration technology and balanced scheduling algorithm. This scheme realizes efficient wireless network simulation. The wireless simulation efficiency of this scheme can be increased to 0.11s in a single cell, and the simulation efficiency is increased by 63 times. It has reached the international leading level, laying a solid foundation for the large-scale application of wireless network simulation.

17:10-17:25
KT2148

Title: The Application of a Novel FPMA Algorithm in Wireless Blockchain Communication
Author(s): Junzhu Huang, Cuifeng Du, Yinbin Cai, Huiping Li, Qingjie Xie and Chun Shi
Presenter: Junzhu Huang, Guangdong Polytechnic Normal University, China

This paper proposes an innovative Fixed Mean Rebasing Algorithm (FMRA) aimed at significantly enhancing the communication efficiency of wireless blockchain networks,

particularly in reducing conflicts and network delays during blockchain transactions. The FMRA employs a strategy of dynamically adjusting backoff times, discarding the fixed minimum contention window setting of traditional algorithms. Instead, it periodically updates the mean backoff time based on an equilibrium function that maximizes expected benefits, enabling flexible adaptation to dynamic changes in network conditions. Through simulation experiments, the performance of FMRA was compared with that of Binary Exponential Backoff (BEB), Fixed Backoff Algorithm (FBA), and Linear Backoff Algorithm (LBA). The results demonstrate that FMRA exhibits clear advantages in reducing block dropping rates and shortening average network delays, showcasing its stability and efficiency under various network load conditions. This validates the effectiveness and broad application prospects of the FMRA in blockchain-based wireless communications.

17:25-17:40
KT2245

Title: Research on Automatic Intelligent Planning of Wireless Communication Network
Author(s): Binjie Li, Zhongqiu Xiang, Zhiwen Li, Fan Chen, Feng Gao, Jieying Qi, Qihao Liu, Wenxin Xu, Yao Li, Xingyan Liu
Presenter: Zhongqiu Xiang, China Mobile Group Design Institute Co., Ltd., China

Network planning is the core of communication network operation and maintenance, which is directly related to network performance, user perception and investment income. For a long time, wireless communication network planning is mainly to do addition, which leads to problems in the communication network architecture. In turn, resources will be wasted. This paper analyzes the key factors of coverage, capacity and structure in wireless network planning. Based on the analysis, a multi-objective joint optimization model of network planning is established. The high precision network simulation method is studied to improve the simulation accuracy.AI algorithms such as sliding window clustering and particle swarm optimization are integrated to realize automatic site planning (ASP) and automatic cell planning (ACP). It enables us to achieve a high level of self-intelligence in wireless network planning. Through the actual verification of the live network, the joint iteration of ASP and ACP can save about 25% of the base station resources under the constraint of network planning. The efficiency of network operation and maintenance is greatly improved.

TECHNICAL SESSION

T14: Satellite Communication Network and Signal Transmission

Chair: **Yunlong Lu,** Beijing Jiaotong University, China

15:50-17:40 | Oct. 19, 2024 | Meeting Room 7 - Zhai Xiang

Invited Speaker

Shuai Ma | 15:50-16:10
Peng Cheng Laboratory, China

Speech Title: Semantic Feature Division Multiple Access for Multi-user Digital Interference Networks

Abstract: With the ever-increasing user density and quality of service (QoS) demand, 5G networks with limited spectrum resources are facing massive access challenges. To address these challenges, we propose a novel discrete semantic feature division multiple access (SFDMA) paradigm for multi-user digital interference networks. Specifically, by utilizing deep learning technology, SFDMA extracts multi-user semantic information into discrete representations in distinguishable semantic subspaces, which enables multiple users to transmit simultaneously over the same time-frequency resources. Furthermore, based on a robust information bottleneck, we design a SFDMA based multi-user digital semantic interference network for inference tasks, which can achieve approximate orthogonal transmission. Moreover, we propose a SFDMA based multi-user digital semantic interference network for image reconstruction tasks, where the discrete outputs of the semantic encoders of the users are approximately orthogonal, which significantly reduces multi-user interference. Furthermore, we propose an Alpha-Beta- Gamma (ABG) formula for semantic communications, which is the first theoretical relationship between inference accuracy and transmission power. Then, we derive adaptive power control methods with closed-form expressions for inference tasks. Extensive simulations verify the effectiveness and superiority of the proposed SFDMA.

TAIK DETAILS

Time	Presentation
16:10-16:25 **KT3310**	Title: Adaptive Decentralized Federated Learning in LEO Satellite Networks Author(s): Dong Li, Zhigang Yan, Yuyu Hao, Dusit Niyato and Tony Quek Presenter: Zhigang Yan, Macau University of Science and Technology, China In Federated Learning (FL) for the low Earth orbit (LEO) satellite networks with parameters aggregated by a ground station, the communication overhead is a substantial concern. To circumvent this limitation and alleviate the latency within the FL for the satellite-ground communication, Decentralized Federated Learning (DFL)

has appeared as an effective solution. However, considering the heterogeneity of satellites, the problem on how to efficiently leverage the limited resources available to enhance the model performance of DFL has drawn little attention, which motivates this work. Specifically, the proposed solution involves optimizing the number of local training rounds across diverse satellites with varying resource budgets to enhance the DFL performance by utilizing the resource more efficiently. Simulation results show that, the proposed scheme achieves a much better performance than the conventional schemes with fixed rounds of local training.

16:25-16:40
KT2102

Title: Multi-attribute Decision Satellite Access Algorithm Based on User Priority and Business Requirements
Author(s): Zijie Han, Liu Liu, Zhaoyang Su, Xianglong Duan, Yuchen Cai and Yi Yin
Presenter: Yuchen Cai, Beijing Jiaotong University, China

In the satellite ground fusion communication system, the rapid relative movement between low earth orbit (LEO) satellites and ground terminals can lead to frequent switching between the satellite and the ground. Choosing different satellites for access can also have an impact on access performance. Therefore, this paper proposes a multi-attribute decision satellite access algorithm in the scenario of multi-satellite coverage of LEO satellites in the satellite ground fusion architecture. Real time network quality and wireless channel quality are considered as decision attributes for business requirements, and an improved secondary decision algorithm based on an analytic hierarchy process algorithm (AHP) and technique for order preference by similarity to an ideal solution algorithm (TOPSIS) is used for satellite decision-making, reducing call blocking rate and forced interruption rate. Furthermore, considering the priority of switching users further reduces the probability of switching failure and improves the performance of satellite access.

16:40-16:55
KT2243

Title: Energy-Allocation for Hybrid RF/FSO Satellite to Ground Station Down Links in Integrated SatelliteTerrestrial Networks
Author(s): Zijian Cui, Wei Wang, Xin Li, Zhenghao Yang, Yinji Jing and Yongli Zhao
Presenter: Zijian Cui, Beijing University of Posts and Telecommunications, China

Hybrid RF/FSO technology addresses high-capacity transmission demands between satellites and ground stations. In this paper, we propose an energy-allocation scheme, which activates RF/FSO links concurrently. Results show the scheme enhances links capacity by 112.7% and 85% compared to RF or FSO-only settings, with minimal power increasing of 14.5%. This indicates that our energy-allocation scheme not only boosts transmission capacity but also maintains efficiency in power usage, making it a viable solution for modern satellite communication systems.

16:55-17:10
KT2136

Title: Toward Physical Layer Security in Satellite Communication: A WFRFT-based Non-Orthogonal Multicarrier Scheme
Author(s): Yulin Li, Yan Yang
Presenter: Yulin Li, Beijing Jiaotong University, China

In satellite communications, physical layer security (PLS) techniques based on beamforming have been widely studied. However, the large satellite-terrestrial

distance results in broad satellite beam coverage, increasing the likelihood that both the eavesdropper (Eve) and the legitimate user (Bob) are covered by the same beam, which creats security vulnerabilities. This paper proposes a novel modulation scheme based on Weighted Fractional Fourier Transform (WFRFT) and a non-orthogonal multicarrier modulation method, Spectrally Efficient Frequency Division Multiplexing (SEFDM), to ensure communication security. The proposed method exploits the constellation scrambling properties of WFRFT and the inter-carrier interference (ICI) characteristics of SEFDM to generate signals with a quasi-Gaussian distribution. Additionally, a symbol scrambling module is designed to mix SEFDM redundant data with effective data, allowing Bob to recover the original signal while introducing extra symbol interference for Eve. Theoretical analysis provides a closed-form expression for the secrecy capacity of the WFRFT-SEFDM system. Simulation results show that this method achieves good secrecy capacity and superior bit error rate (BER) performance compared to OFDM systems.

17:10-17:25
KT3451

Title: Research on Inter-Layer Link Switching Methods in Dual-Layer Satellite Networks
Author(s): Yuqi Wang, Ningxuan Guo, Ningyuan Wang, Liang Liu, Xiaoqing Zhong and Xiaodong Han
Presenter: Yuqi Wang, China Academy of Space Technology, China

The entire satellite constellation is connected through inter-satellite links, allowing for the transmission of information in space with low latency. However, inter-satellite links between satellites at different altitudes face high-dynamic switching issues. To address this, we have proposed a multi-objective optimization method for inter-layer link switching based on multi-window synchronization. This method aims to efficiently connect dual-layer constellation networks. Firstly, we considered the differences in the dual-layer network's structure, satellite visibility between layers, and constraints of switchable inter-layer links to establish a system model for inter-layer links. In response to the frequent switching issues of high-dynamic network topologies, we designed a multi-objective optimization method for inter-layer link switching based on window synchronization. Finally, we conducted simulation verification of the proposed method. The simulation results demonstrate that our method can reduce the frequency of topology switching in high-dynamic networks by 60% to 90% over a long period, thereby reducing the maintenance overhead of network topology updates compared to time or distance optimization methods.

17:25-17:40
KT3372

Title: Efficient and Secure Federated Dynamic Spectrum Access for LEO Satellite Internet-of-Things
Author(s): Bowen Shen, Si Qi Goh, Kwok-Yan Lam, Feng Li
Presenter: Bowen Shen, Nanyang Technological University, Singapore

The explosive growth in demand for Internet of Things (IoT) and significant satellite-to-ground latency have anticipated the transition from 5G to 6G communication. Thus, LEO satellites became a crucial element to the terrestrial network due to their ability to achieve seamless and energy-efficient services even in remote areas. However, the integration of LEO satellites into the broader IoT ecosystem presents significant challenges due to their rapid movement which causes

frequent changes in spectrum availability leading to interference. In this paper, we propose a federated dynamic spectrum access (FDSA) scheme. First, bi-level KMeans clustering (Bi-KMeans) is utilized to cluster the terrestrial users (TUs) to improve the training efficiency in federated learning (FL). To address the interference caused by frequent changes in location of TUs, we then design a federated PPO-based algorithm to obtain an optimal strategy to work even under an interactive environment for efficient resource allocation. FL contributes to efficient aggregation while preserving the privacy of users' data during the training. The simulation results demonstrate the effectiveness and improved performance of the proposed FDSA scheme.

TECHNICAL SESSION

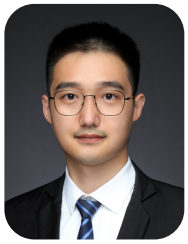
T15: Sensor-based Communication System

Chair: **Congduan Li**, Sun Yat-sen University, China

15:50-17:40 | Oct. 19, 2024 | Meeting Room 9 - Jin Sha

Invited Speaker

Shuaishuai Guo | 15:50-16:10
Shandong University, Cihna



Speech Title: Task-Oriented Semantic Communications: Research Challenges and Possible Solutions

Abstract: Traditional communication systems are designed primarily for accurate signal or data recovery without considering the specific task that the transmitted data is meant to fulfill. However, with the rapid advancements in artificial intelligence (AI) and its widespread integration across diverse applications, there is an increasing need to shift from data-centric to task-oriented communication paradigms. Task-oriented semantic communication focuses on transmitting information that is directly relevant to the intended task, thereby improving efficiency and reducing the transmission of irrelevant data. This talk explores the research challenges and possible solutions in this emerging area, focusing on how to mathematically model semantics to quantify task-specific information, design privacy-presenting joint source-channel coding strategies for reliable transmission, and address transceiver data mismatches that may arise due to differences in data distributions or task requirements. Additionally, the talk discusses the development of adaptive communication systems capable of supporting dynamic data rates in varying wireless environments while maintaining optimal task performance. Through these discussions, the talk provides a comprehensive view of how task-oriented semantic communications could reshape the future of wireless networks by aligning communication processes more closely with the specific objectives of AI-driven applications.

TAIK DETAILS

Time	Presentation
16:10-16:25 **KT7884**	Title: Flexible Beamforming for Movable Antenna-Enabled Integrated Sensing and Communication Author(s): Wanting Lyu, Songjie Yang, Yue Xiu, Zhongpei Zhang, Chadi Assi, Chau Yuen Presenter: Wanting Lyu, University of Electronic Science and Technology of China, China

This paper investigates flexible beamforming design in an integrated sensing and communication (ISAC) network with movable antennas (MAs). A bistatic radar system is integrated into a multi-user multiple-input-single-output (MU-MISO) system, with the base station (BS) equipped with MAs. This enables array response reconfiguration by adjusting the positions of antennas. Thus, a joint beamforming and antenna position optimization problem, namely flexible beamforming, is proposed to maximize communication rate and sensing mutual information (MI). The fractional programming (FP) method is adopted to transform the non-convex objective function, and we alternatively update the beamforming matrix and antenna positions. Karush–Kuhn–Tucker (KKT) conditions are employed to derive the close-form solution of the beamforming matrix, while we propose an efficient search-based projected gradient ascent (SPGA) method to update the antenna positions. Simulation results demonstrate that MAs significantly enhance the ISAC performance when employing our proposed algorithm, achieving a 59.8% performance gain compared to fixed uniform arrays.

16:25-16:40
KT1065

Title: Integrated Sensing and Communications with Multiple Targets and Multiple Users in Mixed Field
Author(s): Yun Xiao, Enhao Wang, Yunfei Chen
Presenter: Yun Xiao, Durham University, United Kingdom

Integrated sensing and communications (ISAC) plays a crucial role in the next-generation wireless systems. Owing to the deployment of high carrier frequencies and/or large-scale antenna arrays, targets and communications users in the ISAC systems may follow different propagation models. However, most existing works assume the same propagation model for both communications and sensing. This work considers a practical scenario where multiple targets and communications users are in different fields. Beamforming design is proposed to optimize the sensing signal-to-clutter-plus-noise ratio (SCNR) of each target. Specifically, a sensing performance fairness profile optimization (FPO) problem is formulated, and a Dinkelbach-type algorithm is proposed to solve the problem. Numerical results show the tradeoff between mixed-field communications and sensing, the effects of antenna size and model mismatch between near field and far field on the sensing performance of the mixed-field ISAC.

16:40-16:55
KT2140

Title: Enhancing Doppler Resilience for Integrated Sensing and Communication Systems through Low Ambiguity Zone Complementary Sequences
Author(s): Xinyi Yuan, Zhifan Ye and Liuguo Yin
Presenter: Xinyi Yuan, Tsinghua University, China

Integrated sensing and communication in the high-frequency bands is emerging as a promising technology, enabling high-rate data transmission and millimeter-level radar sensing in a spectrum- and cost-efficient manner by sharing both frequency and hardware resources. However, high-frequency communications face significant challenges, such as high analog-to-digital (A/D) converters and substantial Doppler frequency offset effects. Considering the sensing range is typically much smaller than

the length of the waveform since the high path loss limits the coverage range of terahertz bands, an integrated waveform generation and transceiver framework based on multi-subcarrier resource allocation technology is proposed in this paper. Furthermore, to align with the framework and effectively mitigate the influence of the Doppler effect, a design method for multi-subband sequence joint optimization is introduced. This method leverages the complementary ambiguity function characteristics of multiple sequences and the Limited-memory Broyden-Fletcher-Goldfarb-Shanno (LBFGS) optimization method to suppress sidelobes in the delay-Doppler region of interest, ultimately producing an integrated waveform with anti-Doppler characteristics. Through simulation tests, the proposed scheme can significantly reduce the sensing false alarm rate compared to traditional integrated waveform designs based on Zadoff-Chu (ZC) sequences within the range of interest, while maintaining robust communication performance.

16:55-17:10
KT2233

Title: Beamforming Design Optimization Utilizing Frequency-Controlled Arrays for Terahertz Near-Field Integrated Sensing and Communication
Author(s): Qiaoqing Wu, Xufang Wang, Longwei Duan, Yi Wu
Presenter: Xufang Wang, Fujian Normal University, China

In this paper, a novel integrated sensing and communication (ISAC) scheme with frequency diversity technique for near-field terahertz (THz) system is proposed by applying different carrier frequency offsets to each transmitting array element of the terahertz array, which introduces an additional distance dimension and provides new design freedom for the THz near-field ISAC system as compared to the conventional system. Various beamforming design strategies under different conditions are also discussed in the scenarios involving multiple users and targets. By integrating the frequency diversity techniques, the proposed scheme demonstrates effective target detection. The weighting factors are also adopted to balance radar and communication performance and the optimization method is proposed. Simulation results validate the effectiveness of the proposed beamforming design strategy.

17:10-17:25
KT3346

Title: Phase Optimization for PAPR Reduction in OFDM-LFM-CPM Waveform for Integrated Sensing and Communication
Author(s): Bohan Liu, Jie Li, Wei Wang, Yazhou Yue, Xiaodong Zhang and Qi Zhou
Presenter: Bohan Liu, Xi'an Flight Automatic Control Research Institute, China

This study addresses the high peak-to-average power ratio (PAPR) challenge in orthogonal frequency division multiplexing-linear frequency modulation-continuous phase modulation (OFDM-LFM-CPM) integrated sensing and communication (ISAC) waveforms. To address this issue, we develop a particle swarm optimization (PSO)-based algorithm for PAPR reduction, which involves using PSO to iteratively optimize phase factors applied to the waveform, significantly improving PAPR performance. Simulation results demonstrate that this PSO-based optimization effectively reduces PAPR without degrading radar detection accuracy or increasing communication bit error rate (BER). Compared to the traditional partial transmit sequence (PTS) algorithm, it shows more stable and effective performance, highlighting its potential to enhance the overall performance of ISAC systems.

17:25-17:40
KT3400

Title: Performance Optimization in IRS-Aided Maritime Joint Sensing and Communication Systems
Author(s): Gerile Ge, Xueyan Cao, Xiaolong Wu, Shubin Wang
Presenter: Gerile Ge, Inner Mongolia University, China

Intelligent reflecting surface (IRS) aided maritime joint sensing and communication (JSAC) can effectively avoid signal attenuation challenges caused by sea surface fluctuations. To improve the maritime JSAC performance further, a sensing signal-to-noise ratio maximization problem is proposed by optimizing active and passive beamforming while maintaining regular maritime communication. Due to the coupled variables of the non-convexity problem and the high complexity and overhead of the channel estimation and beam scanning, a two-phase performance optimization scheme with two sub-problems, the angle estimation sub-problem, and the joint active and passive beamforming sub-problem is developed. Accordingly, the minimum variance distortionless response-based angle estimation algorithm and the alternating optimization beamforming algorithm are proposed. Numerical results show the convergence and effectiveness of the proposed algorithms compared to other benchmark algorithms. In addition, the effect of IRS key parameters on the algorithms' performance is investigated.

TECHNICAL SESSION

T16: Signal Anti-interference and Suppression Methods

Chair: **Shufeng Li,** Communication University of China, China

15:50-17:40 | Oct. 19, 2024 | Meeting Room 10 - Wen Weng

Invited Speaker

Jie Yang (Presenter: Di Chen) | 15:50-16:10
Nanjing University of Posts and Telecommunications

Speech Title: Task Offloading and Resource Allocation based on Enhanced Artificial Hummingbird Algorithm in NOMA-Assisted Mobile Edge Computing

Abstract: Mobile edge computing (MEC) is a key technology of the Internet of Vehicles (IoV). Applying non-orthogonal multiple access (NOMA) technology to MEC can improve spectrum and avoid serious computing delay. This paper studies the optimization problem of task offloading and resource allocation under the NOMA-MEC system. By jointly optimizing the task partition ratio, transmit power allocation and computing resource allocation on the MEC server, the goal is to minimize the weighted total delay of the system. An enhanced artificial hummingbird algorithm (EAHA) is proposed to solve the optimization problem. Considering the task priority weights of each vehicle user, the SIC decoding mechanism of the NOMA technology is improved, and the chaos map, Levy flight strategy and whale algorithm are added to improve the population initialization and migration strategy in the AHA algorithm. The problem of uneven population distribution and repeated individuals in the original algorithm is solved, and the limitation of the algorithm that it is easy to fall into the local optimal solution is improved. Finally, the optimization solution of task offloading and resource allocation problems is realized, so that vehicle users can obtain the optimal offloading strategy. Simulation results show that the algorithm proposed in this paper can effectively reduce the total delay of the system and has considerable convergence speed and accuracy.

TAIK DETAILS

Time	Presentation
16:10-16:25 KT2135	Title: Deep Reinforcement Learning-Driven Analog Self-Interference Cancellation for LEO Navigation Augmentation Systems Author(s): Fan Lu, Zhanchun Fan, Cong Hu, Chao Ma, Yuanxiang Chen and Hua Jiang Presenter: Fan Lu, Beijing Institute of Spacecraft System Engineering, China LEO navigation augmentation systems have garnered significant attention in recent years due to their ability to revolutionize global navigation services. In LEO navigation

augmentation systems, the satellite constellations offer advantages such as lower latency, wider coverage, and reduced costs. However, the signals are significantly hindered by self-interference (SI). To solve SI problems within limited resources, a novel self-interference cancellation (SIC) scheme is proposed based on deep reinforcement learning (DRL). This scheme employs a deep Q network (DQN) and a deep deterministic policy gradient (DDPG) unit to precisely estimate the delay and attenuation of the SI channel. Simulation results demonstrate that the proposed scheme could reduce the SI to the noise level while maintaining the comparable performance.

16:25-16:40
KT2172

Title: Research on Methods for Interference Suppression in Satellite Internet
Author(s): Zixi Fang, Shilei Shan, Tian Li and Chenhua Sun
Presenter: Zixi Fang, Academy for Network & Communications of CETC, China

Aiming at the impact of Low Earth Orbit (LEO) satellite constellation interference to the downlink of Geosynchronous Orbit (GEO) satellites in Satellite Internet, this paper proposes interference suppression methods for terrestrial terminals based on signal processing. The overall operational process is divided into three parts, namely, high-resolution spatial filtering, interference margin estimation, and interference suppression algorithm. Firstly, an improved multiple signal classification (i- MUSIC) algorithm is used in spatial filtering to solve the problem of heteroscedasticity. Secondly, the interference margin of the receiver is defined combined with satellite link characteristics. It provides the prerequisite for an interference suppression algorithm.
Next, the symbol weight extensive cancellation algorithm in the frequency domain (FD-SW-ECA) based on Cyclic Prefix Orthogonal Frequency Division Multiplexing (CP-OFDM) is proposed to suppress the co-frequency interference. The simulation results show that using the proposed methods in this paper can significantly reduce errors, and the FD-SW-ECA algorithm is effective for interference suppression.

16:40-16:55
KT2196

Title: A Low-Complexity Constructive Interference Exploitation Scheme in IRS-NOMA Systems
Author(s): Yanqing Xu, Donghong Cai, Shuai Wang, Zhou Wang, Weixi Zhou, Zhicheng Dong
Presenter: Yanqing Xu, The Chinese University of Hong Kong, China

In this paper, we study the symbol-level precoding design problem in an intelligent reflecting surface (IRS)-assisted downlink non-orthogonal multiple access (NOMA) system. Conventional symbol-level design schemes perform symbol-by-symbol design, which can incur high computational complexity, limiting their practical applications. To address this, we propose a
low-complexity symbol-level design scheme for the IRS-NOMA system. Specifically, the proposed scheme consists of two steps. The first step performs block-level design to obtain the precoders
and reflection matrix, which are reused across all symbols. In the second step, we design an individual coefficient for each user based on the obtained precoders and reflection matrix to

guarantee that the interference signal fall within the decoding region of desired signal. This approach significantly reduces computational complexity, as the block-level design is performed
once for multiple symbols, and a simple problem is solved for each symbol to optimize the coefficients. Simulation results demonstrate the efficacy of the proposed scheme.

16:55-17:10
KT2264

Title: An Iterative Interference Cancellation Detector for STLC-OFDM Systems with Multiple CFOs
Author(s): Qi Wang, Chaowu Wu, Juan Zhang, Yue Xiao and Xiaxia Cui
Presenter: Qi Wang, University of Electronic Science and Technology of China, China

Space-time line code (STLC) represents a novel space-time code (STC) that achieves full spatial diversity by encoding symbols from two adjacent time slots using channel state information (CSI). The unique feature of STLC lies in its ability to be decoded at the receiver without requiring knowledge of CSI, thereby greatly reducing computational complexity. When combined with orthogonal frequency division multiplexing (OFDM), STLC can fully exploit the robustness to multipath fading inherent in the former and the diversity gain inherent in the latter, making it an appealing transmission scheme. However, the sensitivity of OFDM systems to carrier frequency offset (CFO) cannot be overlooked, particularly when CFOs vary among different transceiver antennas. Therefore, this paper introduces an iterative interference cancellation detector tailored for STLC-OFDM systems with multiple CFOs. Drawing inspiration from the maximum likelihood (ML) detector used in conventional multiple-input multiple-output (MIMO) systems, the proposed detector considers the characteristics of the STLC encoder and the impact of CFOs. Simulation results demonstrate the efficacy of the proposed detector in effectively mitigating the effects of multiple CFOs and delivering notable performance improvements.

17:10-17:25
KT2256

Title: Performance Analysis and Solutions for Interference Leakage in FFH/DS Systems
Author(s): Guangyuan He, Jinpeng Song, Shixun Luo, Xuanhe Yang
Presenter: Guangyuan He, Beijing Institute of Technology, China

Fast Frequency Hopping/Direct Sequence (FFH/DS) hybrid spread spectrum is an effective technology for satellite communications in complex electromagnetic environments, and higher hopping rates ensure the system's anti-interference and anti-interception capabilities. This study finds that in FFH/DS systems, strong interference in the channel can cause leakage due to the convolution tailing of filters and frequency switching rectangular pulses, leading to signal distortion and deterioration in symbol error rate (SER) performance. However, this phenomenon becomes more severe as the hopping rate increases. This paper proposes a parallel two-path ping-pong dehopping method to avoid the interference leakage. Compared with the conventional dehopping structure of the single local oscillator, it allows FFH/DS systems to maintain SER performance at higher hopping rates by doubling the resource complexity for dehopping and filtering.Base on this, this paper reveals the trade-off relationship between the hopping rate, SER performance, and resource

complexity.Simulations show that in an environment with strong Multi-Tone Interference (MTI), the SER performance deteriorates with increasing hopping rate, even after removing frequency bins affected by interference. Moreover, using the parallel two-path ping-pong mixing for dehopping can restore the ideal SER performance at high hopping rates, thus verifying the findings of this study.

17:25-17:40
KT3365

Title: GNSS Interference Classfication Using Federated Reservoir Computing
Author(s): Ziqiang Ye, Yulan Gao, Xinyue Liu, Yue Xiao, Ming Xiao, and Saviour Zammit
Presenter: Ye Ziqiang, University of Electronic Science and Technology of China, China

The expanding use of Unmanned Aerial Vehicles (UAVs) in vital areas like traffic management, surveillance, and environmental monitoring highlights the need for robust communication and navigation systems. Particularly vulnerable are Global Navigation Satellite Systems (GNSS), which face a spectrum of interference and jamming threats that can significantly undermine their performance. While traditional deep learning approaches are adept at mitigating these issues, they often fall short for UAV applications due to significant computational demands and the complexities of managing large, centralized datasets. In response, this paper introduces Federated Reservoir Computing (FedRC) as a potent and efficient solution tailored to enhance interference classification in GNSS systems used by UAVs. Our experimental results demonstrate that FedRC not only achieves faster convergence but also sustains lower loss levels than traditional models, highlighting its exceptional adaptability and operational efficiency.

TECHNICAL SESSION

T17: Data Transmission and Security in Internet of Vehicles

Chair: **Lei Feng,** Beijing University of Posts and Telecommunications, China

13:30-15:20 | Oct. 20, 2024 | Meeting Room 1 - Qin Tai

Invited Speaker

Yunkai Wei | 13:30-13:50
Yangtze Delta Region Institute (Quzhou), University of Electronic Science and Technology of China, China

Speech Title: Minimizing Age of Information in Multi-party UAV-Assisted Data Collection with Overlapping Areas

Abstract: Unmanned Aerial Vehicles (UAV) are widely used to assist the data collection in the Internet of Things (IoT), especially when IoT devices are deployed in critical environments without infrastructures. In such scenarios, the Age of Information (AoI) is a key metric to evaluate the performance of the UAV-assisted IoT data collection system. However, current studies usually consider all IoT devices and UAVs belong to one institution. In practice, there may be IoT devices and UAVs belonging to different institutions are deployed in an overlapping area, where the UAVs only collect the data from the IoT devices of its own institution. Actually, the cooperation among different institutions can substantially improve the performance of the whole system. Based on Graph Neural Networks (GNN) and Transformer, this paper proposes a cooperative optimization method to minimize the average AoI in multi-institutional UAV-assisted data collection with common areas. By leveraging GNNs to capture and encode the positional features of IoT devices, and then passing the encoded features to a Transformer decoder using an attention pointer mechanism, we generate optimized UAV trajectory for efficient IoT data collection with the minimum average AoI. Simulation results show our proposed scheme significantly improve the system performance. Compared to the benchmark schemes, our proposed scheme can reduce the average AoI by up to 23.6%, and shorten the UAV trajectory length by up to 21.0%.

Invited Speaker

Meng Xiang | 13:50-14:10
Guangdong University of Technology, China

Speech Title: Digital Signal Processing for Performance Enhanced Multi-Subcarrier Optical Transmissions

Abstract: This talk will present the digital sigital processing techiques for multi-subcarrier signals

TAIK DETAILS	
Time	**Presentation**
14:10-14:25 KT2162	Title: Distance Uncertainty Aided Covert Transmission in Internet of Vehicle Networks Author(s): Yuming Han, Rui Chen, Zeqing Chen, Xiaojun Liu, Shurui Peng, Liping Fan and Dong Yu Presenter: Yuming Han, China Three Gorges University, China This paper aims to enhance the privacy of users in the Internet of Vehicles (IoV) networks by utilizing covert communication technique that conceal the existence of communication. Specifically, we conceive a covert IoV network, where a mobile vehicle (Alice) opportunistically initiates information transmission without Willie's knowledge. Meanwhile, a fullduplex receiver (Bob) transmits artificial noise (AN) to against Willie's eavesdropping attack. Furthermore, the closed form theoretical expression for the minimum detection error probability (DEP) at Willie and the suboptimal solution for Alice's covert transmission power have been obtained. The simulation outcomes demonstrate that the combined impact of distance uncertainty and jamming power is remarkable for Willie's DEP, covert rate as well as covert outage probability (COP). These findings reveal that an appropriate jamming power does have a positive impact on covert performance, while distance uncertainty can still significantly enhance DEP when Alice is far away from Willie or the jamming power is relatively large.
14:25-14:40 KT3291	Title: LSSDVC: A Location-based VANET Caching Method with Semi-SDN Paradigm Author(s): Yuanchen Li, Lin Guan, Ziyang Zhang and George Vogiatzis Presenter: Yuanchen Li, Loughborough University, United Kingdom Vehicular Ad Hoc Networks (VANET) are anticipated to support a wide array of future applications, including accident warnings, traffic information exchange, and real-time navigation updates. However, as VANETs have evolved from Mobile Ad Hoc Networks (MANET), traditional communication methods in VANET face significant challenges due to the limited signal transmission range. Moreover, the highly dynamic topology of VANETs further complicates communication, requiring additional overhead for the successful delivery of communication packets to their intended destination nodes. This overhead can significantly impair both network performance and efficiency. To address these challenges, this paper introduces a novel caching method for VANETs that leverages the physical state of communication nodes and the popularity of data items, within the framework of the Semi-Software Defined Networking (Semi-SDN) paradigm. The proposed method, termed Location and Popularity-based Semi-SDN Vehicular Caching (LSSDVC), seeks to reduce communication overhead and enhance system Quality of Service (QoS). By integrating the Semi-SDN communication model into traditional VANETs and jointly considering the physical state of vehicle nodes and the popularity of data, LSSDVC improves the efficiency of data dissemination. Empirical experiments demonstrate that the proposed caching method outperforms existing benchmarks in terms of link load, delay, and one-hop hit ratio in both urban and highway environments.

Title: MEDA: MoE-based Concept Drift Adaptation for In-vehicle Network Intrusion Detection
Author(s): Gang Yang, Weifeng Mou, Tao Xia, Linna Fan
Presenter: Gang Yang, National Univeristy of Defense Technology, China

14:40-14:55
KT3453

Recent years have witnessed the increasing popularity of Internet of Vehicles (IoV), meanwhile the number of cyber threats have surged significantly.
Various approaches have been previously proposed to mitigate the potential cyber threats within in-vehicle network.
However, the concept drifts derived from ever-evolving offensive tactics bring challenges to the pre-builit detection system, resulting in the degradation of detection performance under real-world setting.
In this paper, we propose a concept drift adaptation framework MEDA based on Mixture of Experts (MoE) method for constructing a real-time self-updating intrusion detection system on in-vehicle network data.
We use the combinations of several drift detection and adaption methods as individual experts, and leverage a gating function to determine the probability and weights of adopting each expert module.
Experiments conducted on two publicly available datasets demonstrate the effectiveness of our proposed method in comparison to state-of-the-art approaches.

Title: JVECORA: A Joint Game Theory-Based Algorithm for Efficient Offloading and Load Balancing in Vehicular Networks
Author(s): Liangwei You, Heba Dawoud, Muhammad Imran, Olaoluwa Popoola
Presenter: Liangwei You, James Watt School of Engineering, University of Glasgow, Glasgow, UK

14:55-15:10
KT3349

This study focuses on a game theory-based resource allocation technique for the Internet of Vehicles (IoV) in sixth generation (6G) technology. We propose a Joint Vehicle-Edge-Cloud Offloading and Resource Allocation (JVECORA) algorithm based on game theory and queuing models, that involves multiple vehicles, two edge nodes, and one cloud server. This algorithm is deployed and designed to find the optimal offloading decisions for vehicles, minimizing the system's total overhead by considering latency, energy consumption, and subscription fees. Based on a potential game theory, vehicles act as players competing and updating their offloading decisions among local, edge, and cloud computing under various traffic conditions and constraints. Through several iterations, we demonstrate that our proposed method outperforms the conventional techniques by 19.88%. The JVECORA algorithm significantly reduces the overhead and converges to a Nash equilibrium. Additionally, the M/M/1 queuing model is used to optimize resource allocation and achieve load balancing between edge nodes.

15:10-15:25
KT3465

Title: A Multi-state Sensing Scheme Based On OTFS for Vehicular Networks
Author(s): Ziyang Cai, Zhigang Cong, Liang Wu, Zaichen Zhang and Jian Dang
Presenter: Ziyang Cai, Southeast University, China

This paper proposes a multi-state sensing scheme based on orthogonal time

frequency space (OTFS) to realize the accurate Doppler and angle estimation in vehicular networks. The proposed scheme involves designing a fractional dictionary matrix that facilitates a joint estimation through the reconstruction of dictionary matrices. Besides, we efficiently reduce the computational complexity of the angle estimation compared to traditional methods like orthogonal matching pursuit (OMP). Furthermore, in the two path environment, the position of the vehicle can be determined based on the estimated Dopplers and angles. Simulation results demonstrate that, by leveraging the unique features of OTFS signals and the OMP algorithm, the proposed scheme can achieve more precise angle and position estimation compared to benchmark methods.

TECHNICAL SESSION

T18: Communication Positioning Algorithm and Navigation System

Chair: **Jia Ye**, Chongqing University, China

13:30-15:20 | Oct. 20, 2024 | Meeting Room 2 - Gu Li

Invited Speaker

Jia Ye | 13:30-13:50
Chongqing University, China

Speech Title: Retroreflective Optical ISAC Using OFDM and CCR

Abstract: We propose and investigate a retroreflective optical integrated sensing and communication (RO-ISAC) system using orthogonal frequency division multiplexing (OFDM) and corner cube reflector (CCR). To accurately model the reflected sensing channel of the RO-ISAC system, both a point source model and an area source model are proposed according to the two main types of light sources that are widely used. Detailed theoretical and experimental results are presented to verify the accuracy of the proposed channel models and evaluate the communication and sensing performance of the considered RO-ISAC system.

TAIK DETAILS

Time	Presentation
13:50-14:05 KT1050	Title: An Innovative Radiation Source Localization Algorithm by Bayesian Theory Based on Electromagnetic Map Author(s): Haojin Li, Hongjun Wang, Zhexian Shen, Yanping Zha and Yixiao Zhang Presenter: Haojin Li, College of Electronic Engineering, National University of Defense Technology, China Using electromagnetic maps to locate radiation sources can achieve spectrum analysis and management of target areas, optimized allocation of communication resources, and optimized network design, thereby reducing the waste of spectrum resources, communication resources, and network resources, and achieving the goal of green communication. This article studies an innovative electromagnetic map supported radiation source localization algorithm based on Bayesian theorem. Firstly, the Kriging interpolation method is used to reconstruct the electromagnetic map of the target area. Then, the key areas of the radiation source position and the distribution probability of the radiation source are determined based on the reconstructed electromagnetic map. The movable sensing nodes are used to observe the key areas and construct a likelihood function. Finally, the Bayesian theorem is used to combine the likelihood function with the distribution probability to obtain the

updated distribution probability of the radiation source position, thereby achieving inference of the radiation source position. The effectiveness and progressiveness of the algorithm are verified by experimental simulation and comparison.

14:05-14:20
KT3317

Title: Optimized Genetic Algorithm-Based Multi-UAV Cooperative TDOA Localization for Complex Multipath Scenarios
Author(s): Feng Chen, He Li, Zhipeng Lin, Qiuming Zhu, Weizhi Zhong, Xiaomin Chen, Jun Zhou, Hongyu Li
Presenter: Feng Chen, Nanjing University of Aeronautics and Astronautics

Radiation source positioning is vitally important in electromagnetic environment monitoring activities. However, most current positioning methods cannot achieve high accuracy complex multipath scenarios. In this paper, we propose an optimized genetic algorithm based time difference of arriva (GA-TDOA) multiple unmanned aerial vehicle (UAV) cooperative positioning method. We first propose a multipath signal identification algorithm based on path loss analysis. This algorithm can eliminate the effect of non-line-of-sight (NLOS) signals, thus, improving the positioning accuracy in multipath scenarios. Then, we design an optimized GA to select the UAV nodes that are little influenced by noises. The optimized GA has fast convergence and low complexity. By using the selected UAV nodes to locate radiation sources, the robustness and positioning accuracy of the positioning method can be improved. Experimental results show that the GA-TDOA positioning method can effectively identify LOS signals in complex multipath scenarios, and the positioning accuracy is increased by about 40% compared with the existing positioning methods.

14:20-14:35
KT2202

Title: Fiber Eavesdropping Detecting and Locating Based on Multi-Channel Joint Polarization Estimation
Author(s): Yuang Li, Bozhong Li, Ruyi Zhang, Li Li, Can Li, Xuejing Qiu, Ming Zhou, Peizhe Xin, Zhiyi Chen, Mingrui Zhang, Yajie Li, Yongli Zhao, Jie Zhang
Presenter: Yuang Li，Beijing University of Posts and Telecommunications, China

To protect the confidentiality of optical networks, we analyze the influence of fiber eavesdropping on the state of polarization and propose a multi-channel joint polarization estimation scheme to detect and locate fiber eavesdropping. By modeling the fiber eavesdropping as the rotation of the state of polarization through experiment data, the scheme's effectiveness is further verified in the simulation of multi-span WDM system.

14:35-14:50
KT3322

Title: Near-Field Coherent Source Localization for Two Closely Located Sources
Author(s): Shaohui Lv, Jingjing Pan, Huimin Pan, Yuehe Ning and Yide Wang
Presenter: Shaohui Lv, Nanjing University of aeronautics and astronautics

Near-field (NF) coherent source localization represents a significant importance in the field of signal processing. However, most current algorithms can't be used to localize near-field coherent sources. In this paper, a near-field coherent source localization method that utilizes the focusing and alternating oblique projection (AOP) techniques for two closely located sources is proposed. Through the application of focusing

technique, the NF signal model is approximated as a far-field model. Following this, spatial smoothing pre-processing (SSP) and estimation of signal parameters using rotational invariance techniques (ESPRIT) are employed to decorrelate and obtain coarse estimates. Subsequently, AOP technique is iteratively used to achieve fine estimation. Numerical and simulation results confirm the efficiency of the proposed method to localize NF sources.

14:50-15:05
KT2263

Title: Low-cost Granary Vehicles Positioning Using a Distributed LED Network
Author(s): Jingya Liu, Pengtao Ma, Lingmin Zhang, Yu Geng, Lei Yan
Presenter: Jingya Liu, Northeastern University at Qinhuangdao, China

To address the safety hazards and inefficiency of traditional manual grain depot management, the application of granary vehicles has emerged as a promising solution. However, the absence of GPS signals indoors and the cumulative errors inherent in inertial navigation system (INS) make it difficult for vehicles to achieve the required positioning accuracy for operations. To achieve accurate positioning in the grain depot work area, this paper proposes a distributed auxiliary positioning scheme based on a light emitting diode (LED) network, combined with a attitude angle-oriented variable state dimension (AAVSD)-Kalman filter to achieve low-cost and high-precision positioning. The scheme selects the positioning method according to the vehicle's attitude angle: LED network positioning is used when the attitude angle is within the certain threshold range. Simulation results show that the proposed scheme effectively solves the problem of INS cumulative error and significantly improves the positioning accuracy of granary vehicles without excessive budget.

15:05-15:20
KT3422

Title: Three-Dimensional Near-Field Source Localization for EMVS Array with Arbitrary Sensor Geometry
Author(s): Chaoyi Wang, Mengyao Sun, Yunhang Lin and Sai Li,
Presenter: Chaoyi Wang, Nanjing University of Aeronautics and Astronautics, China

In this paper, a novel spatial-temporal algorithm for three-dimensional near-field source localization with arbitrary geometry electromagnetic vector sensor (EMVS) array is proposed,
which provides closed-form solution to two-dimensional direction-of-arrival (2D-DOA), range and polarization parameter estimation. The core idea of the proposed algorithm is to construct a specific cross-correlation matrix using spatial and temporal information of the incident signals, then 2D-DOA arriving at each EMVS can be estimated by exploiting the rotational structure in the constructed matrix. Numerical and simulation results demonstrate that compared to the existing method based on cumulant, the proposed algorithm has lower computational cost and the same degree of freedom, it achieves better parameter estimation performance, especially at low signal-to-noise ratios.

TECHNICAL SESSION

T19: 5G and Beyond 5G Network and Key Technologies

Chair: **Weijie Tan**, Guizhou University, China

13:30-15:20 | Oct. 20, 2024 | Meeting Room 3 - Gu Lou

Invited Speaker

Zhong Zheng | 13:30-13:50
Beijing Institute of Technology, China

Speech Title: Design of Simplified Cooperative Transceivers for Cell-Free Networks

Abstract: In a cell-free network that adopts a "user-centric" approach, the concept of cells is eliminated, addressing issues such as poor edge user performance, frequent handovers, and severe cell interference common in traditional cellular networks. Additionally, it leverages extra macro diversity gains to enhance user spectral efficiency. To achieve cooperative access and transmission, a substantial amount of information exchange among multiple access points is required, making practical deployment of cell-free networks challenging. To address the issue of limited interaction, this talk proposes a cooperative transceiver design method with reduced signaling interaction. Based on free probability theory, the proposed method effectively reduces the information exchange overhead while ensuring user spectral efficiency.

TAIK DETAILS

Time	Presentation
13:50-14:05 KT1057	Title: Unified Access and Control RAN for 6G: Motivation, Concept, Solution and Key Technologies Author(s): Zecai shao, Na Li, Qixing Wang, Siqi Chen, Xin Sun, Guangyi Liu, Yuhong Wang Presenter: Xin Sun, China Mobile Research Institute, China Network architecture plays a critical role in achieving the objectives of IMT-2030 and beyond. RAN serves as the foundation for diverse capabilities of 6G. This paper analyzes the evolution of RAN from 3G to 5G NR and proposes a novel RAN architecture for 6G named Unified Access and Control RAN (UACRAN). UACRAN facilitates efficient integration of communication, sensing capabilities, computing, and big data technologies in a cost-efficient manner with reduced complexity. Following an analysis of usage scenarios and requirements of IMT-2030 and beyond, the paper outlines the design principles of 6G RAN, the UACRAN architecture and its underlying concept and its key enabling technologies. UACRAN offers significant advantages: low complexity, lean design, compatible and lowcost. Finally, the paper

identifies research areas for academia and industry to explore further

14:05-14:20
KT3441

Title: 6G Dynamic Channel Map Construction Based on AI and Image Processing
Author(s): Lixiang Song, Junling Li, Tong Wu, Xiaoyu Chen, Chen Huang, Cheng-Xiang Wang
Presenter: Lixiang Song, Southeast University, China

Channel map construction has garnered significant attention due to its ability to optimize channel estimation and assist in beam alignment by obtaining channel information in advance. However, traditional channel map construction methods for fixed base stations cannot indicate the channel state in the dynamic electromagnetic (EM) environment. In this work, we establish a dynamic channel map construction method by importing the historical channel maps to infer the temporal variations in the channel map. The proposed method introduces the self-attention mechanism, enhancing its ability to extract movement information from the transmitter. We also design the mask-pooling encoder to enable the neural network to learn channel characteristics at multiple scales. To evaluate our model′s accuracy, we compare the mean absolute error (MAE) and root mean square error (RMSE) of the constructed channel maps in both known and unknown environments. The results demonstrate that our model outperforms the widely adopted machine learning methods and exhibits better generalization.

14:20-14:35
KT1072

Title: 5G Core Network Traffic Prediction Based on NWDAF Multi-Model Fusion
Author(s): Mingchuang Zhang, Hongbo Tang, Wei You, Xingxing Liao, Jie Yang, Qiwei Zhao
Presenter: Mingchuang Zhang, Information Engineering University, China

Large-scale device access in 5G may exceed core network resource constraints, affecting user demand. Analyzing and predicting core network traffic is vital to optimise network configuration, improve quality of service and reduce costs. However, accurately predicting network traffic while ensuring data privacy is a challenging task due to the diversity, complexity, and sensitivity of core network traffic data. Inspired by Network Data Analytics Function (NWDAF) and ensemble learning, we propose NWDAF-MMF, a multi-model fusion network traffic prediction framework based on NWDAF. In NWDAF-MMF, NWDAF obtains data from Network Functions (NFs), reducing the need for numerous data transmissions and storage. Additionally, multi-model fusion can process different types of data provided by NFs. Our method comprises three submodules: the data preprocessing module, the multi-model training and analysis module, and the multi-model fusion module. The data processing module is responsible for data aggregation, data cleaning, feature selection, and dataset division provided by NFs. The multi-model training and analysis module is responsible for training the base model and obtaining its prediction results. The multi-model fusion module is responsible for integrating, optimizing, and outputting the final prediction results. We evaluate the proposed method using real network datasets. The experimental results show improved performance in MAE, RSME, and MAPE by 12.32%, 6.40%, and 12.66% compared to the single model,

respectively.

14:35-14:50
KT2259

Title: Knowledge-Enabled Intent-Driven Network Configuration Generation for 5G Core Networks
Author(s): Qiuying Li, Jiajun Cai, Ji'ang Xu, Ruosi Liu, Caixia Yuan, Hui Gao
Presenter: Qiuying Li, Beijing University of Posts and Telecommunications, China

Automating the configuration of 5G core networks (CNs) is crucial for meeting increasingly diverse and specialized application requirements. In this paper, we propose an intent-driven automation model for configuring 5G CNs. Our approach leverages existing 5G CN equipment manuals and extracts the underlying configuration knowledge to enable intent translation. Unlike traditional methods, the proposed model employs a knowledge fusion approach that computes the semantic correlation between user intents and equipment configuration commands. Specifically, the proposed model integrates graph neural networks and pre-trained language models, exhibiting strong reasoning capabilities. Moreover, by converting complex texts into structured knowledge graphs, the proposed model provides precise command suggestions, significantly enhancing the degree of automation in 5G CN configurations. Simulation results show that the generated commands achieve high accuracy across various scenarios, validating the effectiveness of our approach.

14:50-15:05
KT3333

Title: Attack Graph-Based Security Assessment Method and Tool Design for MC equipment in the 5G-R Core Network
Author(s): Ming Dong, Congtang Dong, Hang Xu, Bin Sun, Wei Wang
Presenter: Congtang Dong, Beijing Jiaotong University, China

As the core of railway intelligent dispatching communication service realization, MC equipment can analyze, process,
and forward signaling and media streams of voice, video, data, and
other related services, and MC service assumes an important role
in guaranteeing the safe and efficient operation of railway transportation. Therefore, studying the vulnerability of MC equipment
in the 5G-R core network and constructing a corresponding security assessment method for MC equipment is an important part of
improving the system of 5G-R cyber security protection measures,
analyzing the cyber security status, and guaranteeing the safe operation of railways. In this paper, we first study the possible attack
paths of MC equipment in the 5G-R core network, and based on
this, we construct a security assessment methodology system of MC
equipment based on the attack graph and then realize a visual MC
equipment security assessment tool with the main functions of flexibly constructing the attack graph, interactively evaluating the indexes, and automatically calculating the assessment results and outputting them. The security assessment methodology proposed in
this paper can provide program guidance for the subsequent research on MC equipment security in 5G-R core networks

15:05-15:20
KT3440

Title: A Low-complexity I/Q Imbalance Calibration and DC Offset Calibration Method in 5G Millimeter-Wave Communication
Author(s): He Lv, Xueqin Zhu, Qin Wei, Qingsheng Hu
Presenter: He Lv, Southeast University, China

RF receiver has a wide range of application scenarios in 5G millimeter-wave communication, but its non-ideal characteristics of devices and circuits will affect the subsequent signal processing, of which I/Q mismatch and DC offset are the two most important influencing factors. The proposed method enables the completion of power-on calibration immediately after the antenna array receiver starts up. With the presented circuit, the impact of receiver DC offset can be reduced significantly, and the amplitude mismatch and phase mismatch parameters can be accurately determined, leading to effective suppression of the mirror signal. The I/Q mismatch utilizes a digital blind estimation calibration method, and the mirror image rejection ratio(IRR) after calibration can typically exceed 50dB.

15:20-15:35
KT3450

Title: Combining Scheme Design for the User Multi-Antenna Cell-Free Massive MIMO System
Author(s): Siyao Fan, Shu Xu, Shengqing Zhang
Presenter: Wei Jia, Southeast University, China

Federated learning has emerged as a research hotspot in communication scenarios due to its potential to enable efficient, privacy-preserving model training over resource-constrained and unreliable networks. In this paper, we investigate a federated learning task in user multi-antenna Cell-Free massive MIMO (CF mMIMO) system. Through theoretical analysis, we point out that the design based on the maximum ratio combining (MRC) scheme, as discussed in existing works, suffers from significant performance degradation in scenarios with multiple antennas and multi-stream transmission, due to the lack of effective suppression of data stream interference across different antennas of the same user. Therefore, without assuming a predefined combining scheme, we perform a convergence analysis of federated learning algorithm under the CF mMIMO system and conclude that the optimal combining scheme corresponds to the minimum mean square error (MMSE) detector. Through the simulation results of the federated learning task under the investigated system, we confirm the validity of the convergence analysis, demonstrating that optimizing the MMSE can improve the convergence of federated learning.

TECHNICAL SESSION

T20: Resource Allocation and Management in Mobile Communication Network

Chair: **Bo Li**, Ningxia University, China

13:30-15:20 | Oct. 20, 2024 | Meeting Room 5 - Nan Jie

Invited Speaker

Dongdong Wang | 13:30-13:50
Academy for Network & Communications of CETC, China

Speech Title: Beam Hopping Random Access Scheme for the Next Generation LEO Satellite Internet

Abstract: This paper focuses on the design of random access scheme for FR2 band beam hopping scenario. Aiming at the problem that it takes a long time for users to access the network when a single signaling beam completes the 4-step random access under the condition of serving large number of beam footprints, a random access scheme based on the cooperation of signaling beam and service beam is proposed, which avoids the waiting time of beam sweeping and can significantly reduce the waiting time required for users to access the network.

TAIK DETAILS

Time	Presentation
13:50-14:05 KT2193	Title: Multiple Task-Oriented Intelligent Optimization of Computation, Communication and Caching Resource in MEC-Enabled Heterogeneous Networks Author(s): Yuan Zhi, Xiaona Jiang, Jie Tian, Chenxu Huang, Tiantian Li Presenter: Jie Tian, Shandong Normal University, China Mobile edge computing and caching technologies are emerged as promising paradigm for reducing the task computing delay and content acquisition delay in heterogeneous networks. However, due to the limited communication, computation and caching (3C) resources, how to jointly optimize the 3C resources to guarantee the heterogeneous quality of service (QoS) for different types of tasks is still a challenge. In this paper, we aim to minimize the sum of cost of all the users with different types of tasks in each small cell by jointly designing computation offloading, resource allocation strategies for computation-request tasks and cooperative edge caching strategies for content-request tasks in heterogeneous networks. To this end, we propose a multi-agent deep deterministic policy gradient (MADDPG)-based multi-dimensional resources optimization algorithm with centralized training and distributed execution. Simulation results show that the proposed scheme can achieve better performance compared with other baseline schemes.

14:05-14:20 KT2210	Title: Multi-Temporal Resource Slicing and Scheduling Algorithm for 6G Networks Based on MPNN-DQN Author(s): YiFei Wang, XiaoRong Zhu Presenter: YiFei Wang, NanJing University of Posts and Telecommunications, China This paper proposes a dynamic network slicing and resource scheduling algorithm for 6G networks, combining Message Passing Neural Networks (MPNN) and Deep Q-Learning (DQN). The algorithm uses MPNN to extract features from network nodes and links, updating their states through a messagepassing mechanism. DQN then predicts the Q-value of each action based on these features, enabling ffne-grained resource allocation. This approach dynamically adjusts both intra-slice and inter-slice resource allocations, signiffcantly enhancing network resource utilization and service quality. Extensive simulations demonstrate the algorithm's ability to maintain stable resource allocation over longer time scales while improving real-time service performance on shorter time scales. Results indicate that the algorithm signiffcantly outperforms existing methods in resource utilization, task completion rate, and service quality.
14:20-14:35 KT2209	Title: Optimizing Wireless Resource Allocation for Enhanced Semantic Communication System Reliability with Mismatched Background Knowledge Bases Author(s): Tianhang Sun, Yu Zhou, Lei Feng, Fanqin Zhou, Kunpeng Xu and Xianhui Wang Presenter: Tianhang Sun, Beijing University of Posts and Telecommunications, China Semantic communication is considered as a breakthrough beyond the Shannon paradigm, with the objective of achieving maximal semantic fidelity while minimizing the utilization of communication resources. In contrast to Shannon's information theory, the fidelity of semantic communication is contingent upon shared background knowledge. Any mismatch between the background knowledge bases (KBs) of the transmitter and receiver can impede the receiver from decoding accurate semantic information. Consequently, resource allocation for semantic communication, taking into account the degree of knowledge matching, becomes a pivotal issue to ensure the reliability and efficiency of semantic transmission. In this paper, we establish a wireless semantic communication system tailored for text data transmission under conditions of mismatched background KBs. We introduce a novel metric, termed the Semantic Communication System Reliability (SCSR), which integrates semantic reliability with transmission reliability. Furthermore, we employ a deep reinforcement learning (DRL) algorithm to intelligently and dynamically allocate communication resources among users, with the ultimate goal of maximizing the system reliability of the wireless semantic communication system. Comparative experiments conducted subsequently confirm the advantages of the proposed algorithm in enhancing SCSR performance.
14:35-14:50 KT3458	Title: Traffic-Aware Resource Scheduling With Carrier Aggregation for 230MHz Wireless Private Network Author(s): Minda Shi, Zhi Ling, Yingli He, Lanxin Qiu, Xinjia Wang, Zhenqi Fan, Rui

Liu
Presenter: Rui Liu, State Grid Electric Power Research Institute, NARI Information & Communication Technology Co.,Ltd, China

With the growing demand for high-frequency data collection and interactive services in the distribution substation areas, local wireless communication networks face significant challenges in capacity, coverage, security, and reliability. Although existing 230 MHz wireless private networks have adopted carrier aggregation, adaptive modulation and other technologies to improve spectrum utilization, the effectiveness is limited due to the characteristics of distribution area services. To address this issue, this paper proposes a traffic-aware approach for resource scheduling with carrier aggregation in 230 MHz wireless private networks. The approach first calculates the average arrival time and size of historical data for different users (or terminals) and then uses Q-Learning algorithm to activate component carriers and allocate resource blocks based on the actual needs of different users. Simulation results show that the proposed approach could achieve better spectrum utilization and lower power consumption of terminals while meeting the differentiated requirements of users.

14:50-15:05
KT7487

Title: Joint Trajectory and Resource Allocation Optimization for Mobile Vehicles in UAV Assisted Secure ISAC system
Author(s): Wenyi Yang, Xin Liu, Zechen Liu
Presenter: Wenyi Yang, Dalian University of Technology, China

Unmanned aerial vehicles (UAVs) are widely used for their flexibility and versatility, offering integrated sensing and communication (ISAC) services to mobile vehicles. However, the line-of-sight (LoS) links provided by the UAV are vulnerable to eavesdroppers. This paper designs a UAV-assisted ISAC secure model for mobile vehicles, where the source UAV (SUAV) detects
vehicles and transmits information to RSUs, while the jamming UAV (JUAV) disrupts eavesdroppers (EVE) continuously. To measure the performance of detection, the radar estimation rate is presented from an information theory perspective. The worst-case secrecy rate is maximized by jointly optimizing ISAC task scheduling, power allocation, and SUAV trajectory under them constraints of anti-collision and signal-to-interferenceplus- noise ratio (SINR).

15:05-15:20
KT2137

Title: User-Centric Machine Learning for Resource Allocation in MPTCP-Enabled Hybrid LiFi and WiFi Networks
Author(s): Han Ji, Declan Delaney and Xiping Wu
Presenter: Han Ji, University College Dublin

As an emerging paradigm of heterogeneous networks (HetNets) towards 6G, the hybrid light fidelity (LiFi) and wireless fidelity (WiFi) networks (HLWNets) have potential to explore the complementary advantages of the optical and radio spectra. Like other cooperation-native HetNets, HLWNets face a crucial load balancing (LB) problem due to the heterogeneity of access points (APs). The existing literature mostly formulates this problem as joint AP selection and resource allocation (RA), presuming that each user equipment (UE) is served by one AP at a time, under the constraint of the traditional transmission control protocol (TCP). In contrast, multipath

TCP (MPTCP), which allows for the simultaneous use of multiple APs, can significantly boost the UE's throughput as well as enhancing its network resilience. However, the existing TCP-based LB methods, particularly those aided by machine learning, are not suitable for the MPTCP scenario. In this paper, we discuss the challenges when developing learning-aided LB in MPTCP-enabled HLWNets, and propose a novel user-centric learning model to tackle this tricky problem. Unlike the conventional network-centric learning methods, the proposed method determines the LB solution for a single target UE, rendering low complexity and high flexibility in practical implementations. Results show that the proposed user-centric approach can greatly outperform the network-centric learning method. Against the TCP-based LB method such as game theory, the proposed method can increase the throughput of HLWNets by up to 40%.

15:20-15:35
KT3427

Title: A High-Speed Implementation of Open FEC Decoder Based on Optimized Storage Strategy
Author(s): Xinyuan Qiao, Changfu He, Yuxing Chen, Suwen Song and Zhongfeng Wang
Presenter: ChangFu He, Nanjing University, China

Following the proposal of 400G fiber-optical communication standard, the next-generation systems with throughput up to 800 Gbps have gained wide interest. This work presents a decoder implementation of the open forward error correction (oFEC) adopted by the Open ROADM standard for high-speed fiber-optical communications.
To meet the demand for high speed, a fully pipelined decoding architecture is designed. However, the special coding scheme of oFEC poses great challenges to the memory design, in which potential structural and data hazards can cause pipeline stalls and hence decrease the throughput.
In this paper, an optimized storage strategy and several methods are proposed to completely solve those hazards. Equipped with these methods, a hazard-free pipelined decoder for the oFEC is developed and implemented under 28-nm technology. Synthesis results demonstrate that the proposed decoder can achieve a throughput of 902 Gbps, making it suitable for 800G fiber-optical communication systems.

TECHNICAL SESSION

T21: Reconfigurable Smart Surface and System Design

Chair: **Cuiqin Dai**, Chongqing University of Posts and Telecommunications, China

13:30-15:20 | Oct. 20, 2024 | Meeting Room 6 - Kuan Xiang

Invited Speaker

Cuiqin Dai | 13:30-13:50
Chongqing University of Posts and Telecommunications, China

Speech Title: Secrecy Rate Optimization for Active-RIS Assisted LEO Satellite Communications

Abstract: The low earth orbit (LEO) satellite communications (SatComs) have been viewed as a flexible and effective solution for global connectivity and reliable data delivery. However, signals of the satellite-terrestrial links may be intercepted or eavesdropped, resulting in compromised secrecy performance of LEO SatComs. In this paper, the active-reconfigurable intelligent surface (RIS) is introduced into LEO SatComs, and the secrecy rate (SR) is optimized by means of terrestrial user signals to interfere with eavesdroppers to ensure information security for users served by satellites. Firstly, an active-RIS assisted LEO satellite network is presented, and reflection channels are modeled by introducing azimuth and elevation angles to distinguish signals from the satellite and terrestrial networks. Following that, aiming at the vulnerability of signal eavesdropped, the maximized SR function is constructed by jointly considering total ground power consumption, transmission power, and reliable communication threshold. After that, an alternating optimization (AO) algorithm is proposed to decouple the above non-convex problem via optimizing the beamforming vector at the base station (BS), satellite transmit power, and the reflection coefficient matrix of active-RIS. Simulation results show that the proposed active-RIS assisted LEO SatComs scheme can mitigate the impact of "double fading" effect, and enhance the security performance compared with passive-RIS and without RIS designs.

TAIK DETAILS

Time	Presentation
13:50-14:05 **KT3394-A**	Title: Reconfigurable intelligent surfaces for intelligent sensing, imaging and computing Author(s): Qian Ma, Ze Gu, Zi Rui Feng, Qian Wen Wu Presenter: Qian Ma, Southeast University, China Reconfigurable intelligent surfaces (RISs) have inspired worldwide interest in the recent two decades due to their extraordinary performance in controlling material

parameters and electromagnetic properties. The concepts of digital coding and programmable metasurfaces proposed in 2014 have opened a new perspective to characterize and design RISs in a digital way, and made it possible to control electromagnetic fields/waves and process digital information simultaneously, yielding the birth of a new direction of information RISs. We first show the intrinsic natures and advantages of information RISs, including information operations, programmable and real-time control capabilities, and space – time-coding strategies. We present intelligent sensing RISs, AI-based intelligent imagers, and programmable AI machines based on RISs. Finally, we indicate the challenges, applications, and future directions of reconfigurable intelligent surfaces for communications and intelligent sensing.

14:05-14:20
KT1091

Title: Energy Efficiency Optimization of STAR-RIS Empowered RSMA System with SWIPT
Author(s): Chang Gao, Xiaonan Hui, Chongwen Huang, Zhao Wang, Xianmin Zhang ,Yulin Zhou
Presenter: Chang Gao, Zhejiang University,China

This paper first incorporates the concept of simultaneous wireless information and power transfer (SWIPT)into simultaneous transmitting and reflecting reconfigurable intelligent surface (STAR-RIS) empowered rate-splitting multiple access (RSMA) system to improve the energy efficiency (EE).On the basis of the power limit at the BS, a multi-user resource optimization problem of maximizing EE is studied by jointly optimizing the transmission-reflection coefficients (TRCs) at the STAR-RIS, the active beamforming vectors at BS, the power splitting (PS) ratios, and the common message rates.To solve the non-convex optimization problem, we decompose the optimization problem into three sub-problems: amplitude coefficient optimization, phase optimization, and common rate PS ratio optimization. Two optimization schemes are proposed: fractional programming and semidefinite relaxation (FP-SDR) based scheme and successive convex approximation and FP (SCA-FP) based scheme. By iteratively optimizing the three subproblems using alternating optimization (AO), we can obtain the suboptimal solution to original optimization problem. Simulation results show that the STAR-RIS-RSMA scheme with SWIPT can achieve better EE performance than other multiple access technologies.

14:20-14:35
KT3284

Title: Beamforming Design for ISCC Systems with Reconfigurable Intelligent Surfaces
Author(s): Ruihang Yang, Dezhi Wang, Chen Zhu, Boyu Ning, Zhengyu Zhu, Chongwen Huang and Zhaohui Yang
Presenter: Dezhi Wang, Zhejiang University, China

The deployment of various emerging wireless services has necessitated that sixth-generation (6G) wireless networks integrate sensing, computing and communication within the same radio spectrum. However, it is challenging to improve the performance of the integrated sensing, communication, and computation~(ISCC) systems in complex propagation environment. In this paper, we investigate the beamforming design problem in reconfigurable intelligent surfaces~(RIS)-aided ISCC systems, where an RIS can provide additional spatial degree of freedom. To this end,

we first formulate a joint beamforming problem for RIS-aided ISCC, aiming to concurrently improve the performance for multiple target sensing, multi-dimensional computation, and multi-stream communication. Then we present joint optimization of various performances (JOVP) algorithm that minimizes the sum mean square error (MSE) of various demands under power constraints. Next, we analyze the impact of key system parameters on the overall performance of ISCC, providing valuable guidelines for system design. Finally, simulation shows that the sensing error of JOVP algorithm is reduced by at least 46.7\% compared with the existing popular algorithms, while the computation rate and communication rate are increased by more than 49.1\% and 22.2\%, respectively.

14:35-14:50
KT3359

Title: Weighted Sum-Rate Maximization by Dynamic Reconfigurable Intelligent Surface Deployment
Author(s): Zuohong Lv, Jun Xiao, Jianhua Tang
Presenter: Zuohong Lv, South China University of Technology, China

Reconfigurable intelligent surfaces (RIS) are emerging as one of the key technologies that will drive next-generation wireless communications, primarily due to their capacity to reconfigure the wireless propagation environment. This paper investigates an RIS-assisted wireless communication system in which the RIS is mounted on a slide rail, allowing for dynamic adjustment of its location. Recognizing that the RIS channel is dependent on its location, we propose a joint optimization of the base station's (BS) transmit beamforming, the RIS's passive beamforming, and the RIS's location, with the objective of maximizing the system's weighted sum-rate (WSR). To address this joint optimization problem efficiently, we first employ a one-dimensional search method to determine the optimal RIS location. Subsequently, the problem is decomposed into two subproblems using the block coordinate descent (BCD) method, which are then solved through reduced weighted minimum mean-square error (R-WMMSE) and Riemannian manifold optimization, respectively. Extensive numerical simulations demonstrate the critical role of RIS location optimization and show that the proposed algorithm significantly enhances the system's WSR.

14:50-15:05
KT3433

Title: A STAR-RIS-Segmented Parasitic AmBC System
Author(s): Chenglin Feng, Haiyang Ding, Zhen Wen, Zhongwei Liu, Chau Yuen , and Jules M. Moualeu
Presenter: Chenglin Feng, National University of Defense Technology, China

In this paper, we present a simultaneous transmitting and reflecting reconfigurable intelligent surface (STARRIS) segmented parasitic ambient backscatter system, where the STAR-RIS is composed of an enhancing primary signal (EP) zone and a backscatter device (BD) zone. It is proposed to adaptively adjust the transmit power of the source instead of the transmission/reflection coefficients of the STAR-RIS to guarantee the concurrent transmission of the primary system and backscatter system, realizing a low-power and low-complexity STAR-RIS. To evaluate the overall transmission reliability of the considered parasitic system, we derive the closed-form expressions for the coexistence outage probability (COP) under three typical coverage scenarios. Moreover, the transmit power constraint at source is also considered and the corresponding COP is then derived. Both analytical and

numerical results show that the proposed power-adaptive system has a superior COP performance to that of the fixed power setup. Additionally, a larger transmit power limit at the source leads to a superior COP performance.

15:05-15:20
KT2191

Title: RIS-assisted Near-Field Integrated Sensing and Symbiotic Radio Systems
Author(s): Zhengyu Zhu, Mengke Ning, Sun Gangcan, Qingqing Guo, Zheng Chu, Inkyu Lee
Presenter: Ning Mengke, Zhengzhou University, China

To facilitate the growth of Internet of Things (IoT), future networks are promising to offer sensing capabilities and provide support for low-power communications. This paper investigates a reconfigurable intelligent surface (RIS) assisted near-field integrated sensing and symbiotic radio (SR) communication system, in which the base station (BS) not only improves symbiotic communication quality by RIS, but also performs target sensing based on the detection of target echo signals, and the BS antenna considers fully-digital and DMA architecture. An optimization problem is formulated under constraints of Cramer-Rao Bound (CRB) and signal to interference plus noise ratio (SINR) for decoding the signals of the primary user and IoT devices. An alternating optimization (AO) algorithmic framework based on semidefinite relaxation (SDR) is proposed to solve the problem, while for the matrix of the DMA, we choose the Riemannian Manifold Optimisation (RMO) algorithm to solve it. Numerical results show that near-field framework enables accurate location and DMA requires less transmission power than fully-digital antennas.

TECHNICAL SESSION

T22: Millimeter Wave Communication and Beamforming

Chair: **Liwei Yang**, China Agricultural University, China

13:30-15:20 | Oct. 20, 2024 | Meeting Room 7 - Zhai Xiang

Invited Speaker

Liwei Yang | 13:30-13:50
China Agricultural University, China

Speech Title: Performance Analysis for DCO-OFDM Underwater Visible Light Communication System

Abstract: Applying DC-biased optical orthogonal frequency division multiplexing (DCO-OFDM) technology in underwater visible light communication (UVLC), systems can improve the underwater anti-interference ability and information transmission rate. However, the DCO-OFDM system has the problem of a high peak-to-average power ratio (PAPR), and the linear operating voltage range of the Light Emitting Diode (LED) is limited, which can cause severe signal distortion and degrade the communication performance of the system. Therefore, this paper proposes a joint PAPR suppression algorithm based on a Hadamard matrix-improved selective mapping algorithm and clipping method (H-SLM-Clipping) to address this issue. Firstly, the frequency domain signals are precoded using a Hadamard matrix to reduce the autocorrelation between the signals before adopting the SLM algorithm. Then, the signals selected through the SLM algorithm are clipped to minimize the nonlinear distortion caused by the LED. Simulation results show that the proposed joint algorithm performs better in reducing PAPR than the original algorithm.

TAIK DETAILS

Time	Presentation
13:50-14:05 KT1048	Title: Impact of Ice Cloud in Dual Polarized Millimeter Wave Air-to-ground MIMO Communication Author(s): Zeyuan Zhang, Shuangqing Tang, Ran Yang, Ning Wei Presenter: Zeyuan Zhang, University of Electronic Science and Technology of China, China Recently, Millimeter Wave (mmWave) Air-to-ground (ATG) communication system has received great interest due to their potential to improve connectivity in modern space-air ground integrated networks in 6G. However, the signal quality of mmWave ATG link is severely influenced by atmospheric distortions. In this paper, in order to study the influence of single layer ice cloud in Dual Polarized (DP) mmWave ATG Multi-input Multi-output (MIMO) channel, the effect of ice cloud is jointly evaluated in

terms of depolarization and random phase distortion based on the Stochastic Model of Clouds (SMoC) method in meteorology science. The impact of these effects with respect to the resulting DP MIMO capacity and to the complementary cumulative distribution function (CCDF) of the channel capacity is investigated. Simulations suggest that the presence of ice clouds in the link can be a double-edged sword, while it offsets the channel from optimal capacity, it also potentially compensates for capacity loss beyond the Rayleigh distance.

14:05-14:20
KT2187

Title: Spatial Non-Stationary Extremely Large-Scale MIMO with Sub-Connected Hybrid Beamforming: User-Subarray Pairing and Zero-Forcing Precoding
Author(s): Xiuyu Zhang, Jianping Zheng
Presenter: Xiuyu Zhang, Xidian University,China

In this paper, we study the downlink transmission of spatial non-stationary extremely large-scale multiple-input multiple-output in the near-field. The line-of-sight channel with uniform spherical wave is assumed in typical mmWave/THz communications, and the sub-connected hybrid beamforming is employed to reduce the energy consumption. Based on these assumptions, we first study the user-subarray pairing. Concretely, the optimal allocation method to maximize the sum-rate is presented, and the signal-to-leakage-ratio based greedy method is presented to maximize the minimal rate. Furthermore, we present a heuristic two-stage hybrid BF optimization with emphasis on the digital beamforming calculation based on the zero-forcing principle. Finally, the effectiveness of the proposed method is verified by computer simulations.

14:20-14:35
KT1090

Title: Energy Prediction Network-based Beam Selection for mmWave Communication Scenarios
Author(s): Haowen Jin, Weizhi Zhong, Junzhi Wang, Qiuming Zhu, Zhipeng Lin and Kai Mao
Presenter: Jin Haowen, Nanjing University of Aeronautics and Astronautics, China

The quality and reliability of millimeter wave (mmWave) communication systems heavily rely on the effectiveness and efficiency of beam alignment. The paper presents a rapid beam alignment method based on energy prediction network (EPN) for dynamic mmWave communications. The proposed approach transforms the process of beam selection into a beam energy prediction (BEP) problem, eliminating the need for prior knowledge of channel conditions and requiring only a limited number of active beam energy samples in the selection process. The novel multi-layer perceptron (MLP) framework employed in this study is trained on data generated through the ray tracing (RT) method in dynamic scenarios. Simulation results demonstrate that the proposed beam alignment approach exhibits superior performance with respect to accuracy, cost-effectiveness, and robustness.

14:35-14:50
KT3286

Title: Joint Beamforming and Trajectory Design for Space-Ground-Sea Integrated Maritime Communications
Author(s): Zhehan Zhou, Xiaoming Chen, Ming Ying, Zhaohui Yang, Chongwen Huang, Yunlong Cai, Zhaoyang Zhang
Presenter: Zhehan Zhou, Zhejiang University, China

The rapid growth of maritime activities has promoted the need for reliable maritime communication technologies. Fortunately, the unmanned surface vessel (USV) with agile deployment and adaptive capability has shown its potential in maritime communications. To this context, this paper proposes a space-ground-sea integrated maritime communication system combining satellite, USV and terrestrial base station (TBS). According to the offshore distance, the system divides the marine space into coastal area, offshore area and opensea area, the maritime users in which are served by TBS, USV and satellite, respectively. Then, a joint beamforming and trajectory optimization algorithm is developed with the objective of maximizing the minimum transmission rate of all users. Finally, both theoretical analysis and simulation results confirm the feasibility and effectiveness of the proposed algorithm.

14:50-15:05
KT3304

Title: Passive Beamforming Optimization for 3D Beam Coverage in IRS-Aided Communications
Author(s): Shiduo Zhao, Jie Feng, Xing Zhang, and Fangjiong Chen
Presenter: Jie Feng, South China University of Technology, China

Intelligent reflecting surface (IRS) has emerged as a promising technology to improve wireless communication performance. In this paper, we aim to maximize the minimum (i.e., max-min) received signal-to-noise ratio (SNR) over all locations in the target area, by optimizing the IRS passive beamforming. The formulated problem includes 1) a non-convex constant-modulus constraint and 2) a non-convex and semi-infinite beamforming gain constraint, which is difficult to solve. To solve this problem, we propose an efficient passive beamforming scheme by first decoupling the original problem to two similar max-min beamforming gain subproblems corresponding to the x- and z-dimension, respectively, and then propose an efficient solution to solve them efficiently. Specifically, both of them are reformulated to be finite and convex in the lifted matrix space with an additional rank-one constraint, and difference-of-convex (DC) and successive convex approximation (SCA) techniques are used to solve the reformulated problem.
Our simulation results show that the proposed passive beamforming scheme achieves a three-dimensional (3D) passive coverage beam for the target area with nearly received SNR and outperforms the existing algorithms in terms of the minimum received SNR.

15:05-15:20
KT3308

Title: A Real-time Radio Frequency Mismatch Calibration Method for TDD massive MIMO Base Station
Author(s): Min Tan, Weixia Zou, Haiyan Liu
Presenter: Min Tan, Beijing Information Technology College, China

To realize efficient precoding, accurate channel state information (CSI) is essential. Although the wireless propagation channel is reciprocal, the mismatches of transceiver Radio Frequency (RF) circuits disable the reciprocity of the whole communication channel, which is the key condition for applying uplink channel estimation results to downlink precoding. Furthermore, the discrepancies between paths directly lead to inaccurate beam direction and large sidelobe level in massive multiple-input multiple-output (MIMO) beamforming system. Hence, to avoid RF gain

mismatch leading to a severe performance degradation of the system, RF mismatch calibration is necessary. In this paper, we propose a real-time RF mismatch calibration method for TDD base station (BS) with the hybrid beamforming structure in hardware-based way for the first time, adopting channel estimation method. The analytical expressions for RF mismatch module of TDD hybrid beamforming system are derived at first. Then specific program designs are presented, which consists of two stages, digital beamforming chains calibration (DBCC) and analog beamforming transceivers calibration (ABTC). Simulations are provided to verify the effectiveness of our schemes.

TECHNICAL SESSION

T23: Electronics and Communication Engineering

Chair: **Yijing Liu,** University of Electronic Science and Technology

13:30-15:20 | Oct. 20, 2024 | Meeting Room 9 - Jin Sha

Invited Speaker

Xiaoqiang Hua | 13:30-13:50
National University of Defense Technology, China

Speech Title: MIG Detectors: Basic theory and applications

Abstract: Matrix information geometry is the study of intrinsic properties in the space of Riemannian manifold composed of positive-definite matrices. Matrix information geometry has been successfully applied to radar signal processing, image processing, computer vision, and other inter-disciplinaries. This report gives a brief introduction of the theory of matrix information geometry, and summaries some applications of signal detection in homogeneous and nonhomogeneous clutter. The further work on MIG detectors is also pointed out.

TAIK DETAILS

Time	Presentation
13:50-14:05 KT3314	Title: Real-Time Ultraviolet Communication System with SPAD as the Receiver Author(s): Yifan Ding, Xian-Song Zhao, Yuan Ren, Weijie Liu, Chen Gong, Jun Zhang, Hai Lu and Zhenyuan Xu Presenter: Yifan Ding, University of Science and Technology of China, China The novel ultraviolet photodetector single-photon avalanche diode (SPAD) boasts high integration, robust shock resistance, and elevated sensitivity. In contrast to the bulky and fragile photomultiplier tube (PMT), SPAD presents a wider spectrum of practical utility. In this study, we will investigate a newly developed SiC SPAD to explore its signal output characteristics and, for the first time, implement the construction of a real-time ultraviolet communication system using SPADs.
14:05-14:20 KT2249	Title: An Improved QPSO Material Calibration Algorithm for Ray-Tracing at Terahertz Band Author(s): Hongyu Yan, Songjiang Yang, Yinghua Wang, Jie Huang, Cheng-Xiang Wang Presenter: Cheng-Xiang Wang, Southeast University, China In real scenarios, the electromagnetic parameters of materials play a critical role in determining the accuracy of ray-tracing (RT) simulations. Due to the incomplete

terahertz (THz) frequency material libraries for RT simulations, accurate material calibration is essential for improving simulation precision at THz frequencies. In order to fill this gap, an improved quantum-behaved particle swarm optimization (QPSO) algorithm, referred to as the OSQPSO algorithm, is proposed to calibrate the material parameters for THz bands. The algorithm incorporates opposition-based learning (OBL) and simulated annealing (SA) algorithms in the initialization and particle updating processes of the QPSO algorithm, thereby increasing particle diversity and enhancing global search capability. The modified QPSO algorithm calibration performance is validated in an outdoor canyon scenario at 140 and 220 GHz, demonstrating superior calibration accuracy while maintaining a similar convergence rate compared to traditional swarm optimization algorithms.

14:20-14:35
KT3432

Title: Symbiotic Backscatter System: OMA Backscatter versus NOMA Backscatter
Author(s): Zhen Wen , Haiyang Ding , Chenglin Feng , Chau Yuen , Jules M. Moualeu , and Zhongwei Liu
Presenter: Zhen Wen, National University of Defense Technology, China

In this paper, we make a comparative study of symbiotic backscatter system with orthogonal multiple access (OMA) backscatter signaling and the non-OMA (NOMA) backscatter signaling, where the backscatter device (BD) conducts the backscatter modulation. To characterize the system achievable performance, we derive the closed-form expression of the coexistence outage probability (COP) and the sum throughput efficiency (TE) for the considered system, respectively. It is analytically shown that the COP of the proposed system with OMA/NOMA backscatter signalings obeys the scaling law of ln(Ps)/Ps, where Ps is the total transmit power. More importantly, our theoretical and simulation results show that the sum TE performance of the proposed system with NOMA backscatter signaling is significantly superior to the counterpart with OMA backscatter signaling.

14:35-14:50
KT1084

Title: Flexible Antenna Arrays for Wireless Communications: Modeling and Performance Evaluation
Author(s): Songjie Yang, Jianchen An, Yue Xiu, Wanting Lyu, Boyu Ning, Zhongpei Zhang, Debbah Merouane and Chau Yuen
Presenter: Yang Songjie, University of Electronic Science and Technology, China

This paper investigates the potential of flexible antenna arrays (FAAs), capable of dynamically adjusting antenna positions and orientations, for wireless communications. To this end, we develop a mathematical model that elucidates the relationship between the variations in antenna positions and orientations as the array transitions from a flat to a rotated, bent, and folded state, all contingent on the flexible degree-of-freedom. Then, we solve the FAA-enhanced sum-rate problem in the multi-sector base station with both omni-directional and directional antenna patterns that covers the 360° communication area. In our numerical analysis comparing the optimized FAA to the fixed uniform planar array, we find that FAAs can enhance the sum-rate performance. For instance, the bendable FAA achieves a remarkable 156% sum-rate improvement compared to the fixed planar array with the directional pattern.

Title: Robust Beamforming and Power Allocation for Multi-Antenna C-V2X Networks
Author(s): Yanxiu Huang, Weihua Wu, Qi Zhang, Wei Teng, Wenchao Xia, Runzi Liu
Presenter: Yanxiu Huang, Shaanxi Normal University, China

14:50-15:05
KT2174

In this paper, we study the beamforming and power allocation problem in the scenario of multi antenna C-V2X networks with uncertain channel state information (CSI). We attempt to minimize the beamforming vector of base station and the transmit powers of vehicle users, whilst ensuring probabilistic form constraints of quality of service (QoS). Then, a support vector clustering (SVC)-based uncertain set learning approach is developed to model the uncertain CSI into solvable convex set shapes. Based on the modeled convex set, a robust counterpart transformation approach is proposed to transform the highly intractable probability constraints into solvable polyhedral constraints. Then, a generalized equivalent transformation approach is developed to transform the probability constraint problem into a semi-definite resource management problem. To improve the solving efficiency of the resource management problem, we further propose an Enhanced SVC (ESVC) algorithm to simplify the spatial structure of the polyhedral constraints. Finally, the experiments are simulated to compare our proposed algorithms with other traditional and non-robust algorithms.

Title: Concurrent Transmission for Low-Power Symbiotic Backscatter Communications: Spatial Modulation and Detector Design
Author(s): Jing-Kai Zhang, Gang Yang, Xianbing Zou, Qingqing Wu, Cheng Zhong
Presenter: Jing-Kai Zhang, University of Electronic Science and Technology of China (UESTC), China

15:05-15:20
KT3319

Abstract—Backscatter communication, which enables a battery-free backscatter tag to transmit information by using incident radio frequency (RF) signal as the carrier, is a promising solution for future green Internet of Things. In this paper, we consider a symbiotic backscatter communication system with multiple tags, in which the multi-antenna tags employ spatial modulation for concurrent transmission to improve spectral efficiency. We propose a joint message passing detector to recover both the RF source signal and the multiple tag signals simultaneously. Simulation results verify that the proposed algorithm achieves better bit error rate performance, compared with the existing detection algorithm based on successive interference cancellation.

TECHNICAL SESSION

T24: Digital Signal Detection, Estimation and Analysis

Chair: **Huatao Zhu**, National University of Defense Technology, China

13:30-15:20 | Oct. 20, 2024 | Meeting Room 10 - Wen Weng

Invited Speaker

Huatao Zhu | 13:30-13:50
National University of Defense Technology, China

Speech Title: Optical Covert Communication in Wavelength-Division Multiplexing Optical Network

Abstract: Wavelength division multiplexing (WDM) optical network is the backbone of the ground-based communication network, and the information transmission process is highly susceptible to malicious attacks, eavesdropping, interception and other security threats, which is crucial for the security protection of optical communication networks in the commercial, financial and other sectors. Optical covert communication technology in WDM optical network is based on the characteristics of optical signals and noise in the public transmission channel, and utilizes all-optical processing to load confidential information onto noise-like carriers and transmit them hidden under the noise of the public transmission channel, which has the advantages of compatibility with encryption means, imperceptibility, and so on. For the optical covert light source, the research of super-contnuum optical pulse light has been carried out, and the conversion mechanism between optical frequency comb and continuous spectrum has been analyzed. For optical covert modulation, the complementary modulation and coding research of amplified spontaneous radiation light has been carried out, and the code-shift-keyed modulation of amplified spontaneous radiation light signals as well as fast coding reconfiguration have been realized by using a polarization modulator. Then, all-optical thresholding has been carried out, and the point-to-point error-free optical covert communication in the WDM system with 80km and 200GHz-grid has been realized.

TAIK DETAILS

Time	Presentation
13:50-14:05 KT2227	Title: Vandermonde Decomposition Reconstruction for DOA Estimation with Sparse Arrays Author(s): Zhenhui Wang, Qiang Li, Xiaopeng Li and Lei Huang Presenter: Zhenhui Wang, Shenzhen University, China In this work, we propose a novel direction-of-arrival (DOA) estimation algorithm for sparse linear array via Vandermonde decomposition reconstruction. Unlike virtual array interpolation algorithms, the suggested method performs interpolation directly

on the physical array, that is, Nyquist spatial filling. By utilizing the Vandermonde decomposition of the covariance matrix of a uniform linear array (ULA), this filling process is formulated as a structured matrix completion problem via matrix factorization, where the factor matrix is encouraged to exhibit a Vandermonde structure. Subsequently, an iterative approach is developed to solve the resultant problem using the alternating direction method of multipliers (ADMM). Finally, DOAs are retrieved from the reconstructed covariance matrix using subspace-based algorithms. Simulation results demonstrate the superiority of our algorithm over the existing methods.

14:05-14:20
KT2147

Title: An Enhanced Synchronization Algorithm Based on Multi-Differential Cross-correlation for Burst Signal
Author(s): Peng Jiangwang, Chu Yueyan, Shi Ce and Guo Wenbin
Presenter: Peng Jiangwang, Beijing University of Posts and Telecommunications, China

Synchronization is a critical step in burst communication. However, existing methods often perform inadequately under conditions where low signal-to-noise ratio (SNR) and highly dynamic scenarios coexist. To address this issue, this paper proposes an enhanced synchronization algorithm, demonstrating that the joint estimation of multi-branch differential cross-correlation values can significantly improve the SNR of the communication system. Based on this finding, the received signal is initially processed differentially to mitigate the impact of frequency offset. Subsequently, multiple branch paths with varying delay period differentials are generated. The differential sequences are then computed through cross-correlation, and a comprehensive analysis of all cross-correlation values is conducted to enhance the algorithm's performance. Both theoretical analysis and simulation results indicate that the proposed algorithm effectively improves SNR, and enhance the burst signal synchronization performance.

14:20-14:35
KT3273

Title: Demodulation Analysis Technique of OFDM Signal with Non-uniform CP Structure
Author(s): Siyu Cao, Tianyun Li, Mankun Xu, Kaiyuan Yang
Presenter: Siyu Cao, Information Engineering University, China

This paper focuses on the analysis of demodulation of non-uniform cyclic prefix structure orthogonal frequency division multiplexing signals. Starting from the perspective of correcting the signal parameter structure, an algorithm based on each column rotation parameter backtracking the symbol position and fixing the parameter structure is proposed. The residual delay of the current symbol is derived by using the frequency offset contained in all estimated modulation index symbols. Then, the symbol starting position is corrected by interpolation, and the signal parameter structure is corrected based on the distance between adjacent symbol starting points. The simulation results show that the algorithm can control the demodulation bit error rate below 1% under the condition of a signal-to-noise ratio of not less than 5dB, and the results can continue to improve with changes in data volume and modulation method. Compared with existing frequency offset correction algorithms, the algorithm solves the essential problem of signal structure analysis and achieves a lower

demodulation bit error rate and faster convergence in performance. The algorithm is highly robust and less affected by frequency offset, making it better suited for non-cooperative communication scenarios.

14:35-14:50
KT3455

Title: Communication Signal Modulation Recognition Algorithm Based on Soft Threshold and Hole Convolution
Author(s): Minghui Gao, Yanjie Ren, Binquan Zhang, Lu Wang, Yuepeng Li and Xiaogang Tang
Presenter: Minghui Gao, Space Engineering University, China

The current communication signal modulation recognition based on end-to-end deep learning methods is susceptible to signal noise, resulting in poor recognition performance under low signal-to-noise ratio(SNR) conditions. To address this issue, this paper presents a modulation recognition convolutional neural network that combines soft threshold and hole convolution (STCNN). Firstly, adaptive filtering of useless features such as noise is achieved through a soft threshold layer and attention mechanism. Secondly, by using dilated convolutional networks to extract multi-scale time-frequency domain features of signals, the number of model parameters is reduced while the accuracy of signal classification is improved. Finally, simulation analysis was conducted based on the RML2016.10a dataset, and the highest recognition rate of 62.7% was achieved for 11 modulation signals under different SNR conditions, which is 10.9%, 4.5%, and 1.6% higher than that of CNN, LSTM, and SCRNN algorithms, respectively. Furthermore, the number of parameters is reduced by 98.8%, 82.5%, and 91.2%, respectively, which is simulated to verify the effectiveness and recognition performance of the proposed method.

14:50-15:05
KT4468

Title: Dimensional Spatial Upgrading with Variance Attention Mechanism and Its Application in the Field of Interleaved Signal Recognition
Author(s): Hao Meng, Yingke Lei, Hui Feng, Changming Liu, Fei Teng and Jin Wang
Presenter: Hao Meng, National University of Defence and Technology, China

This paper proposes a new attention mechanism DS-SE (Dimensional Spatial Upgrading Transformation Squeeze and Extraction Blocks) module to solve the problem of interleaved signal recognition. The DS-SE module addresses the challenge of how to introduce attention into one-dimensional data sets by means of dimensional spatial transformation. The experimental results show that the DS-SE module performs better than the traditional residual convolutional neural network and SENeT in a series of interleaved signal data sets. The introduction of the DS-SE module enables the network to better extract fine-grained features, thereby enhancing its representational capacity.

15:05-15:20
KT2118

Title: Detection of DSSS Signals Based on Autocorrelation Compressed Sampling and Deep Learning
Author(s): Fengyang Gu, Shilian Zheng, Keqiang Yue, Zhijin Zhao, Xiaoniu Yang
Presenter: Fengyang Gu, Hangzhou Dianzi University, China

This paper proposes a method that combines compressed sampling and deep learning to reduce computational complexity while ensuring the performance of

detecting direct sequence spread spectrum (DSSS) signals. We consider two scenarios: one where the prior condition of the spreading code sequence period is known, and the other where this prior condition is unknown. By exploiting signal sparsity in the correlation domain, we use random measurements to reduce dimensionality before feeding data into a convolutional neural network (CNN) for detection. Extensive simulation experiments validate the feasibility of this method for direct detection of DSSS signals under low signal-to-noise ratio (SNR) conditions. The approach accomplishes signal detection tasks without signal reconstruction.

TECHNICAL SESSION

T25: Edge Computing and Network Optimization

Chair: **Haide Wang**, Guangdong Polytechnic Normal University, China

15:50-17:40 | Oct. 20, 2024 | Meeting Room 1 - Qin Tai

Invited Speaker

Haide Wang | 15:50-16:10
Guangdong Polytechnic Normal University, China

Speech Title: Preamble Design and Burst-Mode DSP for Upstream Reception of 200G Coherent TDM-PON

Abstract: Based on the evolution rules of ITU-T standards, it can be expected that the line rate of Beyond 50G passive optical network (PON) may reach 200Gbit/s. Burst-mode digital signal processing (DSP) based on 10ns preamble is proposed for upstream reception of 200G coherent time division multiplexing-PON. The 128-symbol tone preamble is used for the state of polarization, frequency offset, and sampling phase estimation, while the 192-symbol constant amplitude zero auto-correlation preamble is used for frame synchronization and channel estimation. In conclusion, the proposed burst-mode DSP with a compact preamble makes it more possible to be applied in the future coherent TDM-PON.

TAIK DETAILS

Time	Presentation
16:10-16:25 KT1094	Title: Accelerating Federated Learning with Adaptive Test-driven Quantization at Edge Network Author(s): Yutao Liu, Chenyu Fan, Xiaoning Zhang Presenter: Yutao Liu, University of Electronic Science and Technology of China, China With the rapid development of 6G wireless communication and edge computing in recent years, mobile devices and terminals have collected vast amounts of data to train Machine Learning (ML) models. Since communication and computing resource constraints and data privacy exist for ML training at edge networks, the concept of Federated Learning (FL) is proposed to solve the above problems as a promising distributed ML paradigm. In FL, each participating client trains the local model and sends the local model upgrade to the central parameter server until the training process is completed. However, FL encounters a low bandwidth problem for parameter aggregation at network edges. To this end, in this paper, we propose the Test-driven Adaptive Quantization (TAQ) method for FL. In TAQ, each client dynamically adopts a quantization level according to the training accuracy on a public

testing dataset for the purpose of balancing communication overhead and training accuracy. In addition, we conduct a theoretical analysis of the convergence of TAQ. Detailed experimental results indicate that TAQ outperforms the state-of-the-art techniques, achieving a significant improvement in convergence speed ranging from 21% to 53%.

16:25-16:40
KT3337

Title: Edge-Cloud Collaborative Motion Planning for Autonomous Driving with Large Language Models
Author(s): Jiao Chen, Suyan Dai, Fangfang Chen, Zuohong Lv, Jianhua Tang, and Laiquan Han
Presenter: Jiao Chen, South China University of Technology, China

Integrating large language models (LLMs) into autonomous driving enhances personalization and adaptability in open-world scenarios. However, traditional edge computing models still face significant challenges in processing complex driving data, particularly regarding real-time performance and system efficiency. To address these challenges, this study introduces EC-Drive, a novel edge-cloud collaborative autonomous driving system with data drift detection capabilities. EC-Drive utilizes drift detection algorithms to selectively upload critical data, including new obstacles and traffic pattern changes, to the cloud for processing by GPT-4, while routine data is efficiently managed by smaller LLMs on edge devices. This approach not only reduces inference latency but also improves system efficiency by optimizing communication resource use. Experimental validation confirms the system's robust processing capabilities and practical applicability in real-world driving conditions, demonstrating the effectiveness of this edge-cloud collaboration framework.

16:40-16:55
KT3358

Title: Reliable Federated Learning-Based Wireless Computing Power Scheduling for Efficient Edge Computing Networks
Author(s): Hongtao Shen, Yunlong Lu, Hefu Li, Wei Zhao, Yuan Feng and Yongzheng Yuan
Presenter: Yuan Feng, Beijing Jiaotong University, China

With the advent of the 6G and the rapid development of various AI technologies, the demand for computing power has increased significantly in edge computing networks. The wireless computing power network (WCPN), as an emerging technology, can connect various ubiquitous and heterogeneous devices and computing resources, to enable flexible and unified management and scheduling of computing power. However, the openness of WCPN makes it vulnerable to being attacked by malicious nodes, leading to severe consequences. Additionally, data islands and the strong demand for data privacy protection make traditional centralized machine learning methods difficult to implement. To address these issues, this paper proposes a trusted wireless computing power network scheduling scheme using federated learning. A reputation evaluation mechanism is proposed to assess the reputation of each computing node, ensuring the security and trustworthiness of the participating nodes. A computation resource optimization problem is formulated to minimize the system delay by comprehensively considering energy consumption, reputation, and computing power constraints. We further propose a reputation-based deep reinforcement learning (RDRL) method to solve the optimization problem.

Experimental results show that our scheduling mechanism significantly reduces the total delay of WCPN system and enhances the accuracy of task execution.

16:55-17:10
KT3312

Title: Energy Efficient Computation Offloading for DNN Tasks in Semantic-Assisted Mobile Edge Computing Systems
Author(s): Guangyuan Zheng, Miaowen Wen, Yiwei Tao, Qiang Li, and Zhiguo Ding
Presenter: Guangyuan Zheng, South China University of Technology, China

In this paper, we focus on semantic-aware computation offloading for executing the deep neural network (DNN) inference tasks in a mobile edge computing (MEC) system. To cope with the challenges of insufficient wireless resources during task offloading, we propose a compress-then-offload mode, in which each user first compresses its raw large-size task data into a small-size semantic feature and then uploads it to the edge server for remote execution. Specifically, we establish the relationship between the compression ratio and computation ratio for different DNN tasks. To achieve energy-efficient offloading, we formulate an optimization problem to minimize the energy consumption of all users by jointly optimizing the compression ratio, computation allocation, uploading time, and DNN layer selection. We propose a low-complexity iterative algorithm to solve the original non-convex problem. Simulation results demonstrate that our proposed semantic-aware computation offloading scheme can substantially reduce users' energy consumption compared to the conventional offloading, especially with scarce wireless resources.

17:10-17:25
KT3435

Title: MAPPO-based Predictive Auto-Scaling Algorithm in Edge Cloud Clusters
Author(s): Wenling Tian, Tianyi Shi, Wen Zhao, Rong Huang, Tiankui Zhang
Presenter: Wenling Tian, Beijing University of Posts and Telecommunications, China

In edge cloud clusters, application instances are often deployed on edge nodes close to users, thereby reducing response time. However, the computing capacity of edge nodes is limited, necessitating the use of auto-scaling technology to dynamically adjust the number of application instances on the nodes based on the load. In this paper, we propose a predictive auto-scaling algorithm to improve the cluster resource utilization efficiency. Specifically, the service workload of each edge node is predicted by a time series parallel prediction model. Then, based on these prediction results of service workload, the auto-scaling decisions of edge nodes for resource adjustment in each cycle scale are obtained by the multi-agent proximal policy optimization algorithm. Experimental results show that the proposed algorithm can improve the degree of service level agreement of service applications and the cluster resource utilization efficiency.

17:25-17:40
KT7001

Title: Hybrid Priority-Based Latency Optimization for Massive Dependent Tasks
Author(s): XiaoMin He, Bo Li , JiaHao He, Tao Wang , Ye Yuan, GuoYong Dong
Presenter: Xiaomin He, NingXia University, China

Mobility in edge computing is claimed to be one of the solutions to meet the requirements of massive applications. Nevertheless, the current computational communication schemes are unable to adapt to massive applications. How to define the hybrid priority order for dependent tasks of the applications and optimize the

communication and computing latency for massive tasks to enhance the quality of service (QoS) for latencysensitive network is a great challenge. This article presents a hybrid priority-based latency optimization scheme for massive dependent tasks to address this issue. Firstly, the air-ground integrated mobile edge computing framework is established. The hybrid priority (HP) by taking the six characteristics of the task into account is devised to construct the communication and computing latency model. Then, the Q-learning algorithm is utilized to optimize the latency model. The simulation results showcase that efficiency of the proposed scheme outperforms over other benchmark algorithms in latency optimization.

TECHNICAL SESSION

T26: UAV Path Planning and Calculation

Chair: **Tao Zhang**, National University of Defense Technology

15:50-17:40 | Oct. 20, 2024 | Meeting Room 2 - Gu Li

Invited Speaker

Tao Yang | 15:50-16:10
Beijing University of Posts and Telecommunications, China

Speech Title: Key Technologies for Large-Scale WDM Optical Networks Monitoring

Abstract: Optical performance monitoring (OPM) technology, especially the optical power and OSNR of each WDM channel, are of great importance and significance that need to be performed to ensure stable and efficient operation and maintenance of network itself. In this presentation, we present our recent research activities and progresses on optical-label enabled OPM. Simulation results of WDM system show that the maximum error of channel power monitoring and OSNR estimation are less than 1dB after 20-span transmission. It confirms that the optical-label enabled OPM has lower cost and higher efficiency for mass deployment in practical WDM networks.

Invited Speaker

Tao Zhang | 16:10-16:30
National University of Defense Technology

Speech Title: Time-Varying Compressed Spectrum Mapping Using Dictionary-Weighted Smoothing

Abstract: In response to the problem of how to achieve accurate spectrum mapping in three-dimensional dynamic scenes, this work provides a time-varying spectrum mapping method. This method can dynamically adjust the measurement matrix and sparse basis according to the changes in spectrum data, and restore the spatial structure of the spectrum map through weighted smooth regularization.

TAIK DETAILS

Time	Presentation
16:30-16:45 KT1092	Title: Partial Task Offloading and UAV Trajectory Design in Air-Ground Integrated Mobile Edge Computing Network Author(s): Shichao Li, Bingji Lu, Hongbin Chen, Fangqing Tan, Mianxiong Dong, Kaoru Ota Presenter: Bingji Lu, Guilin University of Electronic Technology, China

The integration of mobile edge computing (MEC) with the air-ground integrated network is viewed as a crucial technology for Internet of remote things (IoRT) devices, where the tasks of IoRT devices can be executed by the unmanned aerial vehicle (UAV) and the high altitude platform. In this paper, we study a partial task offloading and UAV trajectory design problem to minimize the total task offloading delay in the air-ground integrated MEC network. Since the problem is nonconvex, we transform it into a Markov decision process (MDP). Considering the complexity of the MDP increases with the number of the IoRT devices and the UAVs, we divide the problem into two subproblems: the UAV trajectory design subproblem, and the partial task offloading and resource allocation subproblem. For these two subproblems, we utilize deep deterministic policy gradient and proximal policy optimization to solve them, respectively. Based on the two methods, a partial task offloading and UAV trajectory design (PTOUTD) algorithm is proposed. Simulation results show the proposed PTOUTD algorithm can achieve a reduction in total offloading delay.

16:45-17:00
KT3270

Title: Trajectory Optimization for Multi-UAV Covert Communication Assisted by Non-Gaussian Noise
Author(s): Jilei Yan, Mingqian Liu and Jiawei Jiang
Presenter: Jiawei Jiang, Xidian University, China

With the widespread application of unmanned aerial vehicles (UAVs) in areas such as cellular networks and disaster response, preventing their communication links from being externally detected and eavesdropped has become a challenge. In the context of covert secure transmission in a collaborative scenario of UAV nodes under non-Gaussian noise interference, we introduces a secure and efficient transmission design scheme based on Multi-Agent (MA) deep reinforcement learning. Initially, an optimization problem aiming to maximize secure covert transmission throughput is formulated and transformed into a MA Markov Decision Process (MDP). Subsequently, an Attention Mechanism (AM) combined with MA Twin Delayed Deep Deterministic Policy Gradient (MATD3) is employed to solve the problem using a MA deep reinforcement learning algorithm, optimizing the trajectories and power of UAV transmitters and jammers. Simulation results demonstrate that the proposed algorithm exhibits smoother convergence and achieves superior secure transmission performance in a multi-UAV network scenario assisted by non-Gaussian noise at UAV nodes.

17:00-17:15
KT3353

Title: Low-cost Absolute Altitude Measurement for UAV Based on Geospatial and Meteorological Data
Author(s): Zhicheng Zeng, Lei Zhang, Ziye Jia, Chao Dong, and Yiyang Liao
Presenter: Lei Zhang, Nanjing University of Aeronautics and Astronautics, China

According to the regulation of unmanned aerial vehicles (UAVs), the flight control requirements of absolute altitude for UAVs under the height of 120m are proposed. However, the current UAV flight altitude measurement is mainly for the pressure altitude of standard atmospheric pressure. The absolute altitude indicates the actual height between the UAV and the ground, which is a direct altitude indicator. In this work, relying on geographic and meteorological data, we propose a UAV absolute

altitude measurement scheme with a barometer. Besides, comparing sliding window, Kalman and improved Kalman filter, we finally choose Kalman filter for correction. The simulation results show that the variance using Kalman filter can be reduced by 96.75%. Further, through the design of UAV supervision network node and the application of flight experiments, the proposed mechanism is compared with the non-differential GNSS and real-time kinematic measurement schemes, showing the advantages of high accuracy and low cost of price.

17:15-17:30
KT9241

Title: Joint Optimization of Age of Information and Energy Consumption in UAV Trajectory Planning
Author(s): Jiao Yang, Wu Muqing

Presenter: Yang Jiao, Beijing University of Posts and Telecommunications, China

With the advancement of technology, the application of unmanned aerial vehicles (UAVs) in emergency communications and disaster response have received widespread attention, especially in emergency situations such as natural disasters where traditional communication cannot transmit information in a timely and effective manner. This paper investigates the auxiliary communication of UAVs to ground equipment in disaster response scenarios, focusing particularly on the problem of optimizing UAV trajectories to minimize the Age of Information (AoI). We propose a multi-agent control trajectory and communication algorithm (MACTC) to improve learning efficiency and performance, addressing the dual challenges of information timeliness and energy consumption in drone networks. The study demonstrates that optimizing UAV service allocation and trajectory design can significantly reduce the AoI and save energy. Simulation results show that, compared to existing algorithms, MACTC offers significant advantages in reducing AoI and energy consumption, providing an effective solution for UAV network performance optimization.

17:30-17:45
KT3464

Title: Multi-Stage Data Collection and Path Planning for Multiple UAV-Enabled Aerial REM Construction
Author(s): Junyi Lin, Hongjun Wang, Tao Wu, Zhexian Shen, Ruhao Jiang
Presenter: Junyi Lin, National University of Defense Technology, China

An aerial Radio Environment Map (REM) characterizes the spatial distribution of Received Signal Strength (RSS) across a geographic space of interest, which is crucial for optimizing wireless communication network in the air. To address this issue, this paper proposes a multi-stage data collection and path planning algorithm with multiple Unmanned Aerial Vehicles (UAVs). Specifically, the UAV's data collection task over the target area is divided into multiple stages. In each stage, collaboration among multiple UAVs is achieved by Voronoi diagram partitioning. Each UAV decides whether to adopt a more granular collecting strategy based on based on the degree of variation in the current RSS values. A Deep Reinforcement Learning (DRL) approach is proposed to design the shortest flight path for selected collecting points. Experimental results demonstrate that the proposed algorithm improves the accuracy of aerial REM construction, while efficiently planning the shortest paths for UAVs between collecting locations.

Title: Secrecy and Covertness for UAV-Assisted Wireless Transmission With Non-Gaussian Noise
Author(s): Jilei Yan, Mingqian Liu and Jiawei Jiang
Presenter: Jiawei Jiang, Xidian University, China

17:45-18:00
KT3271

With the development of communication technology and the wide application of unmanned aerial vehicles (UAVs), the problem of covert and secure transmission in UAVS communication with ground is becoming more and more important. Aiming at the covert secure transmission problem of non-Gaussian noise-assisted UAVs networks under the ground node interference collaboration scenario, a joint trajectory and power optimisation scheme based on the dual-delay depth deterministic policy gradient technique is proposed to improve the throughput of covert secure transmission. Firstly, based on the system model of UAV line-of-sight (LoS) link, an objective function to maximise the average secure covert communication throughput from the start point to the end point is constructed under the constraints of covertness and security. Then, this optimisation problem is transformed into a single-intelligence Markov Decision Process (MDP), and a deep reinforcement learning algorithm is constructed to achieve the optimal decision, which leads to the optimal solution of the objective function. In this method, the problem of insufficient policy updates during training is effectively solved by incorporating a unique reward shaping mechanism into the MDP, which in turn effectively reduces the local convergence of the algorithm and achieves fast convergence of the training network. Simulation results show that the proposed method has faster convergence and higher rewards than the baseline scheme based on average power and without reward shaping, and achieves a higher average security concealment throughput in the UAV network scenario assisted by non-Gaussian noise at ground nodes.

TECHNICAL SESSION

T27: UAV Path Planning and Calculation

Chair: **Bo Li**, Ningxia University, China

15:50-17:40 | Oct. 20, 2024 | Meeting Room 3 - Gu Lou

Invited Speaker

Jian Zhao | 15:50-16:10
South China University of Technology, China

Speech Title: Residual-field based Physical-Layer Network Coding in OFDM-VLC Two-way Relay Networks

Abstract: We review our recent works on residual-field based physical-layer network coding (PNC) scheme for OFDM-VLC two-way relay networks. The proposed scheme employs operations in the residual field and many-to-one mapping to reduce the constellation size at the relay. Experiments with up to 1.47-Gbit/s throughput show that the proposed scheme enables PNC of high-order QAMs and outperforms conventional amplify-and-forward scheme. We further show that in the asymmetric uplink condition, adjusting transmitted power at users can improve the performance while reducing the power consumption.

TAIK DETAILS

Time	Presentation
16:10-16:25 KT3442	Title: Resource Allocation for RSMA-aided URLLC in NAFD Cell-Free mMIMO Systems Author(s): Wei Jia, Jincheng Zhong, Yunzhen Yu, Yiting Chen, Jilong Wu, Pengcheng Zhu Presenter: Yunzhen Yu, Southeast University, China This paper investigates the application of rate-splitting multiple access (RSMA) within the framework of network-assisted full-duplex (NAFD) in cell-free massive multiple-input multiple-output (mMIMO) systems to achieve ultra-reliable and low-latency communication (URLLC). We derive the lower-bound expressions for both downlink and uplink ergodic data rates, which are pertinent to scenarios involving short-packet communication. In light of the challenges posed by imperfect channel state information (CSI) and pilot contamination, a graph-coloring based approach is implemented for the remote antenna unit (RAU) selection and pilot assignment. Subsequently, the focus shifts to the design of power allocation for full-duplex data transmission, which is formulated as an optimization problem with the objective of maximizing the sum of the lower bound of ergodic data rates (SER). To address the non-convex nature of this problem, a successive convex approximation

(SCA) based algorithm is proposed. The article concludes with an extensive performance analysis that substantiates the effectiveness of the proposed framework and algorithm.

16:25-16:40
KT1080

Title: Joint Optimization of Distance and Stability Link Assignment Strategy in Cislunar Space Networks
Author(s): Qianyi Tan, Yiming Xu, Lei Yan, Suzhi Cao
Presenter: Qianyi Tan, University of Chinese Academy of Sciences, China

The cislunar space network is attracting increasing international attention due to the rapid advancements in launch technology and the growing demand for deep space exploration. This network promises to facilitate lunar exploration and ensure robust communication links between the Moon and Earth. In designing a reliable topology for dynamically changing networks, such as the cislunar space network, considerations must include distance, link stability, and antenna limitations. However, existing link assignment strategies primarily focus on Low Earth Orbit (LEO) satellite networks. This paper proposes a collaborative scheme for link assignment named the Joint Optimization of Distance and Stability (JODS) Link Assignment Strategy. This method utilizes static snapshots derived from network status data exported from the Satellite Tool Kit (STK) and divides the constellation period into unequal time slots to address the comprehensive demands of distance and stability. The cislunar space network is modeled as a graph, with links assigned using the JODS strategy. Simulation results indicate that JODS reduces link changes by 28.68%, decreases the average distance by 15.82%, and significantly increases the fully-connected time compared to the simulated annealing algorithm and the LDL algorithm.

16:40-16:55
KT2158

Title: Transmit Power Minimization for IRS-Assisted Full-Duplex Cooperative NOMA Networks
Author(s): Siyi Duan, Shidang Li, Mingsheng Wei, Lijuan Zhong, Qiyu Jia and Chunguo Li
Presenter: Siyi Duan，Jiangsu Normal University，China

Aiming at the shortcomings of traditional network framework, such as limited coverage and small system capacity, this paper considers the combination of Non-Orthogonal Multiple Access (NOMA) technology and Intelligent Reflective Surface (IRS) technology, and constructs a Full-Duplex (FD) cooperative NOMA network based on Simultaneous Wireless Information and Power Transfer (SWIPT). To meet user needs and achieve Successive Interference Cancelation (SIC), transmit power is minimized. Because of variable coupling and nonlinear constraints, this problem cannot be solved directly. To solve the problem, the transmission power of base station beamforming, transmitting information, Power Splitting (PS) of SWIPT and IRS reflection coefficient matrix are jointly optimized. The problem is decomposed into two subproblems, and the convex problem caused by coupling optimization variables is solved by Successive Convex Approximation (SCA) and first order Taylor approximation. Alternate iterations are used to optimize the variables. Simulation results show that the proposed NOMA scheme with IRS and SWIPT cooperation requires lower transmit power than other baseline schemes.

16:55-17:10
KT3295

Title: Spatial-Temporal Traffic Prediction Based Load Balancing in Cellular Networks
Author(s): Yu Zou, Yufei Song, Hong Shen, Tianyi Shi and Tiankui Zhang
Presenter: Yu Zou, Beijing University of Posts and Telecommunications, China

The rapid growth of cellular network traffic reveals the need for real-time load balancing strategies to improve network performance and resource utilization. To address this issue, a load balancing algorithm based on traffic prediction is proposed. First, a traffic prediction model based on an adaptive hybrid spatial-temporal graph neural network is designed for cellular network traffic prediction. Second, using the predicted traffic data, an ant colony optimization-based load balancing algorithm is proposed, which can dynamically adjust network resource allocation to cope with future traffic peaks and load imbalances. Simulation results show that the load balancing algorithm based on traffic prediction can more intelligently schedule network resources compared to traditional methods, improving the utilization rate of cellular network resources and providing a solution for the sustainable development of mobile communications.

17:10-17:25
KT3320

Title: Cross-Period Joint Scheduling of Task and Network in IEEE 802.1Qbv Time-Sensitive Networks
Author(s): Pengyu Wang, Hailong Zhu, Huayu Zhang and Tao Huang
Presenter: Pengyu Wang, Beijing University of Posts and Telecommunications, China

Time-sensitive networking introduces deterministic latency and low jitter to Ethernet through traffic shaping mechanisms. The IEEE 802.1Qbv standard ensures deterministic transmission of critical flows via the time-aware shaper, where synthesizing the Gate Control List (GCL) schedule is a core challenge. Most SMT-based schedule synthesis algorithms consider only single-period scheduling under a unified timeline, leading to low schedulability. In this paper, we propose a cross-period scheduling algorithm that jointly schedules task and network, ensuring the correctness of cross-period scheduling constraints under a unified timeline through reasonable period mapping. In our defined task tree model, we introduce an optimization objective to minimize the end-to-end latency of task trees. Finally, we evaluate the performance of our algorithm. The results demonstrate that our algorithm significantly improves schedulability and achieves lower end-to-end latency compared to existing algorithms. Moreover, our algorithm can complete the computation within a reasonable time, even in large-scale networks.

TECHNICAL SESSION

T28: Deep Learning Theory and Model in Communication System

Chair: **Xinwei Du**, BNU-HKBU United International College, China

15:50-17:40 | Oct. 20, 2024 | Meeting Room 5 - Nan Jie

Invited Speaker

Xinwei Du | 15:50-16:10
BNU-HKBU United International College, China

Speech Title: Maximum Likelihood Estimation of Wiener Phase Noise Variance in Coherent Optical Systems

Abstract: The estimation of laser linewidth or phase noise variance is of great significance for the applications including coherent optical communications, optical fiber sensing, quantum optics, etc., to ensure the detection sensitivity and accuracy. In coherent optical communications, the Wiener phase noise introduced by the non-zero laser linewidth can lead to the rotation of constellations of the transmitted signal, which results in severe signal detection performance degradation. Many algorithms require the prior information of phase noise variance to achieve accurate phase recovery. In this article, we propose a maximum likelihood (ML) algorithm for the estimation of Wiener phase noise variance or laser linewidth, which is based on the amplitude and phase-form of the noisy received signal model together with the use of the best, linearized, additive observation phase noise (AOPN) model due to additive white Gaussian noise (AWGN). The closed-form expression of ML estimates of carrier phase offset and Wiener phase noise variance is derived. We also verified theoretically that the obtained ML estimate of Wiener phase noise variance is unbiased and close to the actual variance with probability arbitrarily close to 1, as the sample size N tends to infinity. The proposed ML estimator is shown to have accurate estimation performance with low computational complexity.

TAIK DETAILS

Time	Presentation
16:10-16:25 **KT2222**	Title: Iterative SINR Precoding with Deep Learning Design for Network Massive MIMO Systems Author(s): Wen-Jie Zhu, Ziyu Xiang, Xiao Fu, Xinrui Gong and Xiqi Gao Presenter: Wen-Jie Zhu, Southeast University, Purple Mountain Laboratories, China In this paper, we investigate the sum-rate maximization problem for network massive MIMO systems in which all base stations (BSs) transmit data cooperatively. We introduce the iterative signal-to-interference-plus-noise ratio (ISINR) precoder by alternately iterating the SINR and precoding vectors. By exploring the ISINR precoder

structure, we represent the precoder using some low-dimensional parameters, which can be generated with deep learning networks to improve real-time computation. Thus, the precoding vectors can be directly computed without iterations. Simulation results show that the ISINR precoding algorithm can reduce computational complexity while increasing sum-rate, and that deep learning design can achieve similar performance while further reducing complexity.

16:25-16:40
KT2132

Title: Distributed Partial Collaborative Deep Learning for Spectrum Sensing
Author(s): Wang Yingshu, Ma Binyao, Wei Shuo, Zhang Juanjuan, Ren Unknown, Wang Bin
Presenter: Shuo Wei, University of Electronic Science and Technology of China, China

With the rapid development of wireless communications, the number of mobile devices is increasing at an unprecedent speed, leading to a shortage of spectrum resources. Dynamic spectrum allocation (DSA) is an effective way to alleviate the scarcity of spectrum resources. DSA relies on spectrum sensing, which aims to detect unoccupied frequency bands. Traditional spectrum sensing methods only consider the scenario of a single sensing node, which can only monitor a limited geographical scope. In order to monitor a large geographical range, it is necessary to consider the distributed sensing architecture. Due to the varying hardware accuracy and sensing environment, there exists a heterogeneity among devices in a distributed system. To address this issue, this paper proposes a new distributed spectrum sensing architecture. The proposed architecture consists of several sensing nodes, each of which is equipped with a convolutional neural network (CNN) in order to identify whether the monitored spectrum is occupied. The shallow layers of these CNNs are demanded to be the same, while the deep layer of each CNN is independently trained using each node's local training data. The proposed method can significantly enhance the sample efficiency while enabling each CNN to be well-adapted to the local SNR (signal-to-noise ratio). Simulation results demonstrates the efficiency of the proposed method.

16:40-16:55
KT2143

Title: Energy-efficient Task Offloading for D2D-MEC via Multi-agent Deep Reinforcement Learning
Author(s): Zhiliang Pan, Jun Xu
Presenter: Zhiliang Pan, Nanjing Normal University, China

The D2D-MEC technology enables the offloading of computation tasks to the edge server and nearby mobile devices, which has advantage in reducing the traffic burden of resource-constrained devices and improve the system’ s energy efficiency. We study the task offloading problem for multiple user equipments (UEs) to minimize the energy consumption. We model the task offloading problem as a multi-agent deep reinforcement learning problem. To solve this problem, we propose a D3QN based task offloading algorithm. Simulation results show that our proposed task offloading algorithm consumes lower energy compared with the baseline algorithms.

16:55-17:10
KT2195

Title: LDTA-Pose: Advancing 2D Human Pose Estimation with Lightweight Dynamic Task Alignment based on modified YOLOv8
Author(s): Jingzhe Ge and Hongmei Zhang
Presenter: Jingzhe Ge, Guilin University of Electronic Technology, China

2D Human Pose Estimation plays a crucial role in analyzing performance in fitness activities. Current single-stage methods suffer from the lack of interaction between classification and regression branches, large network parameter sizes, and poor detection accuracy due to strong short-distance dependencies between keypoints. To address these issues in fitness, a lightweight dynamic task alignment framework based on Yolov8-pose is proposed. In order to enhance classification and regression alignment in single-stage networks, a dynamic task alignment detection head is proposed by leveraging label assignment strategies and learning task interaction features. To mitigate the issue of information loss caused by the unidirectional propagation in Yolov8-pose, the backbone is replaced with RevCol to enhance feature retention. Additionally, efficient self-adjusting weighted downsampling module is designed to retain more useful information. Furthermore, the C2f module in downsampling is enhanced with Context-Guided Blocks, integrating local and global feature fusion. Experimental results on a self-created fitness action dataset show that, compared to Yolov8n-pose, our proposed algorithm reduces parameters by 60.8%, decreases computational cost by 33.7%, and improves average detection accuracy by 1.89%.

17:10-17:25
KT1284

Title: Radio Environment Map Construction Based on Graph Convolutional Network
Author(s): Shoubin Zhang, Zhimeng Li, Hongjun Wang, Zhexian Shen, Chao Chang
Presenter: Shoubin Zhang, National University of Defense Technology, China

Constructing radio environment maps(REMs) from spatial sparse measurements finds many applications in the field of wireless communication, including network planning, power control, dynamic spectrum access and emitter localization to name a few. However, it is still a challenging task to construct a high-precision radio environment map, especially in urban environments or scenarios with multiple emitters under few sampling nodes conditions. In this paper, a method for constructing high-precision REMs based on graph convolutional network regressor is proposed, which can extract patterns between electromagnetic data while considering spatial correlation. The comparative simulation experiments with benchmark methods in both urban and open areas show the effectiveness of the method proposed in this paper.

17:25-17:40
KT3266

Title: Power Allocation Strategies of Non-Orthogonal HARQ: From Deep Learning Perspective
Author(s): Yi Chen, Jintao Wang, Zheng Shi, Guanghua Yang, Yaru Fu, Hong Wang and Shaodan Ma
Presenter: Zheng Shi, Jinan University, China

This paper introduces a power-constrained NonOrthogonal Hybrid Automatic Repeat Request (N-HARQ) scheme to enhance communications in edge networks, aiming to

improve the transmission reliability and reduce the latency between edge servers and devices. To address the challenge of deriving a closed-form expression for the outage probability of N-HARQ, we propose a twin evaluation network which leverages the concept of the digital twin (DT) to provide an accurate outage approximation. We then formulate a long-term average throughput (LTAT) maximization problem to ensure constrained power consumption and high reliability over fading channels. Considering the non-convex and intractable nature of the LTAT maximization problem, we propose three distinct deep learning approaches to design the optimal power allocation strategies, including Graph Convolutional Network (GCN), Long ShortTerm Memory (LSTM), and Multi-Layer Perceptron (MLP). The trainable weights of these neural networks are adjusted by using the primal-dual learning method. Numerical results demonstrate the effectiveness of the proposed twin evaluation network and the three deep learning approaches in enhancing throughput and reliability. The GCN shows superior performance in both metrics, then followed by the LSTM-based method, whereas the MLP-based method exhibits the worst performance.

TECHNICAL SESSION

T29: Data Network and Network Service Strategy

Chair: **Lin Jiang**, Southwest Jiaotong University, China

15:50-17:40 | Oct. 20, 2024 | Meeting Room 6 - Kuan Xiang

Invited Speaker

Lin Jiang | 15:50-16:10
Southwest Jiaotong University, China

Speech Title: Chaotic Optical Communications Over Long-Distance Optical Fiber Driven by An Ai Chaos Generation Model

Abstract: We have proposed a model construction scheme of chaotic optoelectronic oscillator (OEO) based on Fourier neural operator (FNO). The proposed scheme can obtain a multi-parameter chaotic OEO model without any prior knowledge in advance, which is trained from chaotic time series generated by the chaotic OEO (actual components) with different feedback gains and time delays. We introduce the maximal Lyapunov exponent λmax and the Pearson correlation coefficient (PCC) to evaluate the chaotic state of time series and the nonlinear mapping ability of FNO, respectively. Both numerical and experimental results show that the PCC can be greater than 0.99 in the case of low feedback gain, and the λmax of time series generated by chaotic OEO (actual components) and FNO are both positive. Meanwhile, the generalization ability of FNO is analyzed, and the results show that FNO is more robust than LSTM. Besides, the generalization ability of FNO is analyzed, and the results show that FNO is more robust than LSTM. Finally, the proposed scheme has been experimentally verified in chaotic-encrypted 200-Gbit/s 16QAM systems over 1000-km.

Invited Speaker

Yuming Xiao | 16:10-16:30
Purple Mountain Laboratory, China

Speech Title: Design and Implementation on Service Customized Network (SCN)

Abstract: Over the past decades, Internet has flourished into various aspects of human life built on the TCP/IP network architecture. TCP/IP serves applications with a "best-effort" capability without QoS commitment. The "best-effort" design greatly simplifies networks but forces applications to passively adapt to dynamic network conditions or even compensate for QoS degradation themselves. Traditional human-oriented applications were somewhat tolerant of QoS fluctuations, thus the lack of QoS assurance was not highlighted. Looking ahead, Internet is transforming

to support digital manufacturing, which are productivity-oriented with zero tolerance for "best-effort". Actually, strengthening QoS had already attracted attentions with various proposed technologies - yet only incremental, rather than changing TCP/IP's "best-effort" essence. Thus, to accommodate future requirements are aggressively steering Internet architecture evolution, necessitating fundamental changes grounded in rethinking its top-level design philosophy. SCN is dedicated to exploring a novel application-centric architecture that enables applications to proactively declare QoS requirements and customize substrate networks in terms of bandwidth, latency, reliability, and sequentiality etc. This exemplifies a pioneering Network-as-a-Service (NaaS) paradigm serving diverse application's requirements. To achieve this vision, this presentation will propose core connotations and theories like networking models, layering mechanisms, encapsulation formats of SCN, as well as its system implementation.

TAIK DETAILS	
Time	**Presentation**
16:30-16:45 **KT1087**	Title: Accelerating Communication for Distributed Training with Collaborative In-network Aggregation Author(s): Long Luo, Xixi Chen, Shulin Yang, Wenqi Fan and Hongfang Yu Presenter: Xixi Chen, University of Electronic Science And Technology of China, China Distributed training (DT) has emerged as a crucial and popular practice for training high-quality machine learning (ML) models. However, the communication efficiency of gradient aggregation during the training process has become the primary performance bottleneck. Advanced programmable switches with in-network computing capabilities offer a promising solution to improve the communication efficiency of DT by offloading partial gradient aggregation tasks from servers to switches within the network. In this paper, we propose CINA (Collaborative In-network Aggregation), a novel approach that harnesses the in-network computing capabilities of programmable switches and allows multiple switches and servers to collaboratively perform gradient aggregation tasks, thereby improving the communication efficiency of distributed machine learning training. CINA aims to minimize the aggregation completion time by jointly optimizing the aggregation task assignment among switches and the gradient routing of aggregation requests. We formulate this joint optimization problem as an integer nonlinear programming problem under multi-dimensional resource constraints and design an efficient two-stage random rounding algorithm to compute satisfactory solutions rapidly. Extensive experimental results demonstrate that CINA significantly outperforms other state-of-the-art in-network gradient aggregation solutions, reducing the aggregation completion time by up to 75%.

Title: Research on Resource Management for High-Speed Train in Vacuum Tube
Author(s): Meilu Liu, Liu Liu, Kai Wang, Zhaoyang Su and Yuchen Cai,
Presenter: Yuchen Cai, Beijing Jiaotong University, China

16:45-17:00
KT2099

This paper studies the resource management of secure and non-secure communication services in vacuum tube high-speed trains. By optimizing the resource reuse scheme, secure service delay and bit error rate requirements are ensured, while non-secure service throughput is ensured. The simulation results show that the optimized scheme can meet the demand better than random allocation and improve the quality of passenger communication service.

Title: Research on Measurement Relaxation and Predictive Handover Based on LSTM Networks
Author(s): Ziqi Dai, Gengshuo Liu, Weidong Gao, Xu Zhao, Kaisa Zhang and Yuchen Guo
Presenter: Ziqi Dai, Beijing University of Posts and Telecommunications, China

17:00-17:15
KT2173

In this study, we explore the application of 5G RedCap technology in smart factory scenarios, focusing on how inspection vehicles with fixed trajectories can maintain low power consumption while ensuring service reliability. The development of 5G technology, along with denser base station deployments and more frequent handovers, increases the likelihood of handover failures, making it challenging to achieve low power consumption while ensuring system reliability for RedCap. This paper investigates the use of Long Short-Term Memory (LSTM) networks to predict Reference Signal Received Power (RSRP) and optimize measurement relaxation algorithms and handover decisions based on these predictions. Specifically, we consider scenarios where low-speed or stationary user equipment start moving upon receiving service requests and need to exit the measurement relaxation state in a timely manner before handover. By predicting future RSRP values, we propose an algorithm to precisely control the timing of exiting the measurement relaxation state and make effective handover decisions based on the predicted data. The results show that this method significantly improves network performance and reliability while reducing energy consumption, providing substantial practical value for the management and optimization of 5G RedCap networks.

Title: Spectrum Sharing Algorithm Based on Game Theory for Operators
Author(s): Shuhao Zhang, Qi Zhu
Presenter: Shuhao Zhang, Nanjing University of Posts and Telecommunications, China

17:15-17:30
KT3293

In recent years, the varying spectrum demands of operators, imbalances and challenges in reconciliation pose a significant concern. In this paper, a spectrum sharing strategy based on game theory for multiple operators is proposed. A multioperator spectrum sharing model is established, incorporating a spectrum leasing service platform, multiple operators, and users. Each type of operator possesses a fixed number of users and spectrum resources. A Stackelberg game model is constructed for spectrum leasing, with sellers as leaders and buyers as

followers.
The pricing and purchasing strategies of the two types of operators are optimized using gradient descent and Lagrange multiplier methods. Simulation results demonstrate that the proposed method achieves a game equilibrium while ensuring QoS (Quality of Service) for users. Compared to fixed pricing strategies, it significantly enhances the benefits obtained by both types of operators.

17:30-17:45
KT3348

Title: The Internet Exchange and .ID Domain Name Service as a National Critical Information Infrastructure
Author(s): Dudi Gurnadi Kartasasmita, F.G Cempaka Timur, Agus H.S Reksoprodjo
Presenter: F.G Cempaka Timur, Indonesia Defence University, Indonesia

Internet exchange and .ID domain name services are vital parts of the national digital ecosystem that are vulnerable to attacks and result in system failures and even hamper transactions in cyberspace. This descriptive qualitative research seeks to explain the functions, roles, threats, and impacts of the internet exchange and .ID domain name services. The results show the vulnerability of these two services to attacks that can cause system failures and disrupt transactions in cyberspace, due to the dominant control of non-state actors. The lack of formal recognition that these two services are national vital objects is one of the obstacles to their control. Presidential Regulations No. 62/2004 and 82/2022 provide a legal basis for the state to take over control of these services for the sake of national security. Control by the state does not aim to replace the role of non-state actors, but rather to minimize the potential for disruption and prevent the paralysis of economic activity in cyberspace due to attacks on internet network interconnection centres or domain ID naming services.

17:45-18:00
KT3460

Title: Computing Services Oriented Evolutionary Architecture and Key Technologies of Electric Power Communication Network
Author(s): Xiangyi Zhang, Xing Zhao, Xiaofang Gao, Hanyu Zhao, Jia Tang, Xiaoxi Guo, Yanyu Chen and Junfeng Zhao
Presenter: Xing Zhao, China Academy of Information Communications Technology(CAICT), China

With the deepening of the digital transformation of power systems, new service scenarios such as computing power access and interconnection are continuously developing. The electric power communication network urgently needs to evolve to comprehensively carry the existing services and new computing services. This paper analyzes the typical service scenarios and performance characteristics of new power systems against the development of computing services, summarizes the evolution demands faced by the electric power communication network. In response to the demand for comprehensive carrying of multiple services, the paper proposes a computing application oriented overall evolutionary architecture for the power communication network and proposes key technologies such as all-optical interconnection based on OTN/OSU, multi-dimensional perception of computing and network, deterministic bearing, and intelligent collaborative operation and maintenance of computing and network. This paper can provide solid strategic suggestions for the future design and technological evolution of the electric power communication network oriented to computing services.

TECHNICAL SESSION

T30: Artificial Intelligence in Communication System

Chair: **Dongdong Wang**, Academy for Network & Communication of CETC, China

15:50-17:40 | Oct. 20, 2024 | Meeting Room 7 - Zhai Xiang

Invited Speaker

Wenyi Zhang | 15:50-16:10
University of Science and Technology of China, China

Speech Title: Information Rates of Channels with Additive White Cauchy Noise

Abstract: Information transmission over discrete-time channels with memoryless additive noise obeying a Cauchy, rather than Gaussian, distribution, are studied. The channel input satisfies an average power constraint. Upper and lower bounds to such additive white Cauchy noise (AWCN) channel capacity are established. In the high input power regime, the gap between upper and lower bounds is within 0.5 nats per channel use, and the lower bound can be achieved with Gaussian input. In the lower input power regime, the capacity can be asymptotically approached by employing antipodal input. It is shown that the AWCN decoder can be applied to additive white Gaussian noise (AWGN) channels with negligible rate loss, while the AWGN decoder when applied to AWCN channels cannot ensure reliable decoding. The analysis is further extended to the vector receiver case. It is shown there that in the high input power regime the capacity acts like that of an AWGN channel with maximum ratio combining, but a straightforward linear combining receiver front end incurs a substantial rate loss.

Invited Speaker

Hongmei Zhang | 16:10-16:30
Guilin University of Electronic Technology, China

Speech Title: A Text-to-Speech Synthesis Method Based on Speaker Transfer

Abstract: In the context of limited sample sizes for speaker voice data, end-to-end Text-to-Speech (TTS) synthesis models often face challenges related to synthesis quality, training speed, and inference time. To address these challenges, this study proposes an advanced speaker-adaptive TTS synthesis framework. The approach involves pre-training in a high-resource single-speaker monolingual domain, followed by fine-tuning in a low-resource single-speaker monolingual target domain. By masking the high-resource single-speaker embedding layer in the model, we achieve speaker timbre adaptation for the low-resource speaker through transfer learning. To enhance prosody in the generated speech, we incorporate prosodic features

extracted and integrated from text using RoBERTa. Additionally, to improve synthesis efficiency, we introduce inverse short-time Fourier transform (ISTFT) into the upsampling part of the decoder, significantly accelerating the synthesis process. The proposed model achieves a real-time factor (RTF) of 0.017, a Mel cepstral distortion (MCD) of 4.76, a speaker embedding cosine similarity (SECS) of 0.70, and a mean opinion score (MOS) of 3.34, demonstrating advancements in both synthesis speed and quality.

TAIK DETAILS	
Time	**Presentation**
16:30-16:45 KT1059	Title: Large Language Models Based Communication Simulation Platform Author(s): Yizhuo Wang, Shiqi Cui, Rongxin Wan, Jingyi Wang, and Fanggang Wang Presenter: Yizhuo Wang, Beijing Jiaotong University, China In recent years, Large Language Models (LLMs) have been widely used in various fields, including personalized education, data analysis, disease diagnosis, and engineering design. These advancements have opened new possibilities for wireless communication engineering. In this paper, we propose an LLM-based human-machine collaborative framework to generate a simulation platform for the communication system. The proposed framework effectively combines human experience with the powerful generative capabilities of LLMs through well- designed prompt engineering techniques, enhancing the design of wireless communication systems. Specifically, the proposed prompt engineering framework directs the LLM in tasks such as requirement elicitation, system modeling, and code generation for different modules of wireless communication systems. Parallel tests on the commercially mature LLMs like GPT-3.5 and Claude 3 further demonstrate that our approach can improve the efficiency, quality, and reliability of the design process.
16:45-17:00 KT2128	Title: Bandwidth Reduction and Object Detection Model in Close-circuit Camera Systems Author(s): Pichet Chonpattanapaisan and Ratsameetip Wita Presenter: Pichet Chonpattanapaisan, Chiang Mai University, Thailand Abstract—The use of video streaming is a prevalent platform nowadays, such as providing online movie services, online learning services, and CCTV systems. Video streaming requires substantial bandwidth to maintain data clarity, leading to exponential bandwidth usage within internal networks. CCTV systems also use video streaming to transmit data within the network between the cameras and the server. The data transmission between these two devices leads to exponentially increased bandwidth usage compared to other devices. We proposed a method to reduce the bandwidth of video streaming between CCTV cameras and the server. Starting with a video compression model using YOLO for image detection to classify the video into subframes, combined with reducing the frame rate and constant rate factor when there is no target object, and increasing the frame rate and constant rate factor when there are target object, result in a bit rate reduction of up to 95.797%.

During decompression, YOLO is used to divide the video into subframes, with the frame rate and constant rate factor adjusted uniformly across all frames. The Real-ESRGAN method is then applied to restore the quality of each subframe to match the original video. The Model performance is evaluated using YOLO, a state-of-art object detection algorithm. By comparing the video quality and traffic in different settings including, no compression, during compression, and after decompression.

17:00-17:15
KT2198

Title: Attribute Encryption Based Multi-Party Cooperative Key Distribution Method for Unmanned Equipment
Author(s): Peng Zeng, Xingyu E, Tianyou Zhang, Xi Wang, Aodi Liu
Presenter: Peng Zeng, Information Engineering University, China

With the development of information technologies such as artificial intelligence, cloud computing, and the Internet of Things, Iot devices play an important role in people's lives. As a hardware carrier for carrying devices and transmitting sensitive information, Internet of Things devices may be out of control and leak sensitive information if they are attacked by networks. Therefore, they have urgent security needs in terms of confidential transmission of device data, dynamic command control, real-time picture sharing, and data collaborative analysis. In recent years, the frequent security incidents of Internet of Things devices have made people realize the importance of data security of Internet of Things devices. Aiming at the problems such as low key distribution efficiency and difficulty in distributed multi-party collaborative key distribution in cloud-edge collaborative scenario of existing key distribution methods used by Iot devices, this paper proposes a multi-party collaborative key distribution method based on attribute encryption. The method uses attribute encryption algorithm and national secret SM4 algorithm to achieve secure and efficient distribution of session keys in the environment of multi-user request data, ensure the data security of Iot devices, and achieve fine-grained control of user key distribution. Compared with the existing key distribution methods based on asymmetric cryptographic algorithms, this paper verifies that this method has certain advantages in the efficiency of key distribution, and verifies the effectiveness of this method through simulation experiments, and evaluates the performance.

17:15-17:30
KT3297

Title: A Knowledge-Driven Graph Convolutional Network for Spectrum Prediction
Author(s): Yibo Guo, Yang Huang, Qiuming Zhu
Presenter: Yibo Guo, Nanjing University of Aeronautics and Astronautics, China

In the 6G mobile communication systems, the integration of sensing, communication, and array signal processing technologies heralds a new era of advanced situational awareness. However, this advancement raises critical concerns about privacy and security, especially with the widespread deployment of devices equipped with radar-like sensing capability, including malicious ones. Moreover, suffering from rapidly changing spectrum environments and the restricted capability of spectrum prediction, jamming effectiveness evaluation values may not be fully obtained. Therefore, in order to effectively jam the malicious sensing device and improve the spectrum utilization, spectrum prediction is expected to be a key enabler, which features predicting the jamming effectiveness evaluation values and recommending

frequency-domain subbands for utilization. In order to characterize the relation between jamming devices and malicious sensing devices when predicting spectrum, we construct a spectrum knowledge graph (SKG). In order to encode the KGE vectors from the triplets composed of entities and relations, we develop the CNN-based KGE model, where the CNN can be exploited to derive embedding encoded with knowledge of relations. In order to address the problem of predicting spectrum, we convert this issue into a node regression problem based graph model and graph convolution network (GCN). In order to address the problem of sparse feature vectors related to entities and relationships within the SKG, we exploit KGE vectors generated by a CNN-based KGE algorithm to replace the one-hot encoding method, which can be used to formulate the feature matrix in the graph model. Simulation results indicate that the spectrum prediction algorithm based on a knowledge-driven graph convolutional network (KGCN) can significantly improve the accuracy of spectrum prediction.

17:30-17:45
KT3386

Title: Throughput for WPT-UAV Assisted Network Exploring TD3PG Algorithm
Author(s): Tao Wang, Bo Li, Xiaomin He, Jiahao He, Xurong Jin, Run Ma
Presenter: Tao Wang, Ning Xia University, China

The unmanned aerial vehicle (UAV) acts as an airborne mobile base station to provide reliable and low-cost communication services to ground users in a fast and timely
manner. It is a challenge to optimize UAVs resource allocation and coordinates to maximize throughput when wireless power transfer (WPT) technology is utilized to power UAVs. In this article, a multi-UAV assisted downlink network is investigated.
To keep the UAVs running to guarantee the quality of service (QoS), a renewable energy powered wireless charging station is proposed to charge the UAVs with WPT. To improve the total throughput performance, the joint optimization of the UAVs position coordinates and the power control under the dynamic energy flow is research target. First, dynamic energy flow model from the ground to the air is mathematically constructed. Next, twin delayed deep deterministic policy gradient (TD3PG) algorithm is designed to jointly optimize the power control and position coordinates of the UAVs considering future channel gain and energy harvesting. Simulation results demonstrate that the proposed algorithm can improve the system throughput
under dynamic energy flow compared to traditional optimization algorithms.

17:45-18:00
KT3443

Title: A Novel Joint AI and Communication Framework with CSI Enhancement
Author(s): Xiaohang Zhang, Yuehong Gao, Jinfei Zhou, Shuangfeng Han, Gang Li, Yupeng Li
Presenter: Xiaohang Zhang, Beijing University of Posts and Telecommunications, China

With the development of 6G and Massive Multiple-Input Multiple-Output (Massive MIMO), Artificial Intelligence (AI) and communication has become a significant research focus. This paper designs a novel joint AI and communication framework that integrates dataset generation, deep learning model training/ inference, and communication performance evaluation. The simulation platform has been validated to align with the IMT-2020 calibration results submitted by multiple companies,

demonstrating its accuracy in representing real-world scenarios and the credibility of its outcomes. The effectiveness of framework in Channel State Information (CSI) enhancement is assessed through System-Level Simulation (SLS), the results show that while model accuracy decreases with lower compression ratios, the communication performance remains stable within certain limits. This demonstrates the importance of evaluating AI models within the context of communication systems, providing a foundation for future 6G and native AI integration.

TECHNICAL SESSION

T31: New Generation IoTs and Key Technologies

Chair: **Haiquan Zhao**, Southwest Jiaotong University, China

15:50-17:40 | Oct. 20, 2024 | Meeting Room 9 - Jin Sha

Invited Speaker

Zuqing Zhu | 15:50-16:10

University of Science and Technology of China, China

Speech Title: Overview of ML-aided QoT Estimation in Optical Networks: A Perspective of Model Generalization

Abstract: The past decade has witnessed a tremendous stride toward automated and intelligent optical networking thanks to the revolutionary development in machine learning (ML). Among the various ML applications for optical networks, quality-oftransmission (QoT) estimation outstands as a fundamental yet challenging task, and therefore, has grabbed intensive research interests. This paper provides an overview of ML-aided QoT estimation. We first describe several representative QoT estimation models. Then, we elicit challenges related to model generalization ability and review the state of the art in this perspective.

Invited Speaker

Mengyuan Ye | 16:10-16:30

China University of Geosciences, China

Speech Title: Silicon Integrated Optical Phase Array with Non-uniform Antenna

Abstract: With the developments of autonomous driving, remote sensing and 3D imaging, light detection and ranging (Lidar) has been investigated extensively Among all kinds of Lidar technologies, silicon integrated optical phased array (OPA) is commonly regarded as the most prominent candidate by taking advantages of low-cost, high reliability and small-footprint. Here we demonstrate our resent progress on OPAs with non-uniform antenna design, in which both steering range and detection resolution could be improved significantly.

TAIK DETAILS

Time	Presentation
16:30-16:45 KT2104	Title: Network Situation Assessment Method for Industrial Internet of Things Author(s): Chenpeng Lu, Hao Wu Presenter: Chenpeng Lu, Beijing Jiaotong University, China

Industrial internet of things is facing the increasingly serious threat of network attacks, but the traditional situation assessment methods are not suitable for industrial internet of things, and the existing network attack classification methods cannot accurately evaluate with a small number of sample data. In view of the above problems, this paper proposes a network situation assessment method based on attack classification according to the characteristics of industrial internet of things. This method utilizes the One-Sided Selection algorithm (OSS) and Generative Adversarial Networks (GAN) to handle imbalanced datasets and employs the MultiAttention-BiLSTM-DNN (MABD) model to achieve network attack classification, ultimately obtaining the situation value. With the traditional situation assessment method based on attack classification, the experiment results show that the proposed assessment method has better evaluation effect.

16:45-17:00
KT2152

Title: Minimizing Delay in 5G Cellular IoT with Bursty Traffic in Uplink and Downlink Directions
Author(s): Eduard Sopin, Anastasia Daraseliya, Vyacheslav Begishev, Yevgeni Koucheryavy, Konstantin Samoylov
Presenter: Anastasia Daraseliya, RUDN University, Russia

Future 5G/6G cellular Internet of Things (CIoT) technologies need to be able to multiplex a number of traffic types having different arrival patterns, resource requirements, and directions. To this aim, the random access (RA) and data transmission (DT) phases in such technologies should be appropriately optimized. In this paper, we develop a service model accounting for successive service and both random access and data transmission phases and the different nature of traffic types in uplink and downlink directions multiplexed over the data transmission phase. The uplink traffic requires both phases to get service while the downlink one shall pass the data transmission phase only. We establish the stability criterion for the considered system and then utilize this model to investigate the performance of the system serving asynchronous arrivals in the uplink direction and software updates in the downlink one. Our results show that modern CIoT systems such as NB-IoT are not optimized for wide ranges of load conditions. Specifically, even in the presence of software updates constituting 3\% or less of the overall load, RA phase may bottleneck the whole system. The optimal division of resources may drastically vary depending on the uplnk and downlink traffic load. The model developed in this paper allows optimal tuning RA and DT phases for any offered load conditions in the uplink and downlink directions.

17:00-17:15
KT2206

Title: Utility-Efficient Edge-Cloud Collaborative Space-Air-Ground Integrated Internet of Things
Author(s): Tiexin Zhang, Yinyu Wu, Wenchao Liu, Chunjie Wang, Zhenzhen Jin, Xuhui Zhang and Yanyan Shen
Presenter: Yanyan Shen, Chinese Academy of Sciences, China

As the demand for tasks requiring low latency and high computational intensity increases, interest in the study of integrated space-air-ground networks (SAGINs) is

growing. Meanwhile, the multi-layer task data processing for Internet of thing (IoT) devices continues to be a topic worthy of investigation. In this paper, we propose a multi-layer data processing method in edge-cloud collaborative SAGINs for IoT systems. The IoT devices may select the most suitable unmanned aerial vehicle, and low earth orbit satellite with the optimized data splitting portion to assist data processing based on their residual energy, task latency requirements, communication conditions, and multi-layer computing capabilities. Based on the system model, we formulate an utility efficiency maximization problem. Due to the non-convex
nature of this problem and the coupling between variables, we introduce a deep reinforcement learning-based method to acquire multi-layer data processing decisions. Simulation results validate that our proposed method exhibits effectiveness and superiority compared to other benchmarks.

17:15-17:30
KT2215

Title: Coexistence Analysis Between 5G NR and Ambient IoT Systems in the Downlink
Author(s): Sumin Yuan, Xia Chen, Rongtao Xu, Zhaojian Liu, Gongpu Wang
Presenter: Sumin Yuan, Beijing Jiaotong University, China

Ambient Internet of Things (A-IoT) represents an innovative advancement in IoT technology, utilizing devices with ultra-low complexity and ultra-low power consumption to facilitate extensive connectivity in IoT applications. The A-IoT system can be deployed in three operation modes with current 5G system, that is, in-band within the new radio (NR) carrier, in the guard-band of the NR carrier, and stand-alone. As in-band deployment has the greatest inter system interference, this paper focuses on studying the downlink (DL) coexistence performance of both systems through theoretical analysis and simulation. The results illustrate that the NR system has a marginal impact on the A-IoT system, and the A-IoT system has a minor impact on the NR system with a single guard resource block configuration. The analysis in this paper has shown that in-band deployment of A-IoT with 5G NR is feasible in the downlink.

17:30-17:45
KT3379

Title: Performance Analysis of Ambient IoT with Sampling Frequency Offset
Author(s): Zhaojian Liu, Rongtao Xu, Sumin Yuan and Gongpu Wang
Presenter: Yuan Sumin, Beijing Jiaotong University, China

In 3GPP Release 18, the ambient Internet of Things (A-IoT) has been introduced to provide ultra-low complexity and ultra-low power consumption, facilitating extensive connectivity in Internet of Things applications. Considering cost constraints, the performance of oscillators in A-IoT communication systems is limited. Oscillators cause frequency deviation that increases over time and leads to a significant challenge in the decoding design of the A-IoT system. In this paper, we investigate an approach to mitigate the effects of sampling frequency offset (SFO) on the performance of A-IoT systems. The method involves Manchester decoding and is supported by both link analysis of A-IoT signals alone and the evaluation of their coexistence with fifth generation (5G) New Radio (NR) signals. The results illustrate that even though frequency offsets up to 20%, this Manchester decoding approach is also used to mitigate the impact of frequency deviation. The study presented in this paper demonstrates that the Manchester decoding method can withstand sampling

frequency offsets caused by misalignment between the transmitter ′ s Digital-to-Analog Converter and the receiver's Analog-to-Digital Converter.

17:45-18:00
KT2207

Title: Performance Analysis of Integrated Active-RIS and STAR-RIS enhanced RSMA-IOT Systems
Author(s): Yake Hu, Xingwang Li, Junyao Zhang, Gaojian Huang, Weidong Wang, Zhengyu Zhu
Presenter: Xingwang Li, Henan Polytechnic University, China

This paper investigates a communication system where an active reconfigurable intelligent surface (RIS) cascades with a simultaneously reflecting and transmitting RIS (STAR-RIS) to assist rate-splitting multiple access (RSMA). The approximate expression of the cascade channel distribution is obtained by the central limit theorem (CLT) and momentmatching (MM) technique. The study focuses on studies the impact of transmitting power and the number of RIS element on the physical layer security performance of the system. We deduce the closed expression of outage probability (OP) and intercept probability (IP). The numerical findings support the validity of the theoretical analysis and highlight the impacts of various key factors, including transmission power, the number of elements, road loss index on the performance of the proposed system.

TECHNICAL SESSION

T32: Modern Electronic Equipment Design and Development

Chair: **Long Luo,** University of Electronic Science and Technology, China

15:50-17:40 | Oct. 20, 2024 | Meeting Room 10 - Wen Weng

Invited Speaker

Lu Zhang (Presenter: Wenbo Zhao) | 15:50-16:10
Zhejiang University, China

Speech Title: Enhancing Simulation Efficiency in Semiconductor Optical Amplifier (SOA) Models: A Comparative Study of First and Second Order Approaches (Invited)

Abstract: This study evaluates the numerical performance of first and second-order nonlinear dynamic semiconductor optical amplifier (SOA) models, including the distributed traveling-wave (TW) and lumped models. We find that while the first-order method is sufficient for the lumped SOA model, the second-order method significantly improves simulation efficiency for the TW-SOA model. These insights enhance the optimization of SOA applications in various advanced optical systems.

TAIK DETAILS

Time	Presentation
16:10-16:25 KT2146	Title: A Channel Sensing Method with Partial Hologram for Holographic Interference Surfaces Author(s): Yuyao Wu, Haifan Yin and Jindiao Huang Presenter: Yuyao Wu, Huazhong University of Science and Technology, China In this paper, we propose a new communication architecture named Holographic Interference Surface (HIS), which has the advantages of reduced hardware cost and simplified architecture compared with traditional multiple input multiple output (MIMO). We elaborately clarify the working mechanism of the holographic interference principle in wireless communications. We analyze the special noise of channel estimation by holograms and prove its distributions. The Truncated Singular Value Decomposition (Truncated SVD) is exploited to suppress the hologram noise. We analyze the performance of this denoising method and prove that it asymptotically achieves error-free estimation. In order to further reduce the hardware cost, we proposed the Dynamic Adjusted Optimization Objective-Alternating Direction Method of Multipliers (DAO-ADMM) to realize channel estimation under partial hologram sampling. We prove the convergence of the proposed method. Simulation results demonstrate the performance gain over existing methods.
16:25-16:40 KT2153	Title: Digital Linearizer Based on 1-Bit Quantizations Author(s): Deijany Rodriguez Linares and Håkan Johansson Presenter: Deijany Rodriguez Linares, Linköping University, Sweden

This paper introduces a novel low-complexity memoryless linearizer for suppression of distortion in analog frontends. It is based on our recently introduced linearizer which is inspired by neural networks, but with orders-of-magnitude lower complexity than conventional neural-networks considered in this context, and it can also outperform the conventional parallel memoryless Hammerstein linearizer. Further, it can be designed through matrix inversion and thereby the costly and time-consuming numerical optimization traditionally used when training neural networks is avoided. The linearizer proposed in this paper is different in that it uses 1-bit quantizations as nonlinear activation functions and different bias values. These features enable a look-up table implementation which eliminates all but one of the multiplications and additions required for the linearization. Extensive simulations and comparisons are included in the paper, for distorted multi-tone signals and bandpass filtered white noise, which demonstrate the efficacy of the proposed linearizer.

16:40-16:55
KT1083

Title: Low Complexity Convolutional Neural Network Digital Predistortion for Radio Frequency Power Amplifiers
Author(s): Qian Xie, Yong Wang, Jianyang Ding, Zihan Guo, and Jiajun Niu
Presenter: Qian Xie, Xidian University, China

The predistortion models for radio frequency (RF) power amplifiers (PAs), such as convolutional neural networks (CNNs) and deep neural networks (DNNs), has shown a significant improvement in predistortion performance. However, digital predistortion (DPD) models with neural network structures encounter challenges related to high computational complexity and prolonged training duration. In this study, we propose a DPD model utilizing a low complexity convolutional neural network (LCCNN). The proposed model simplifies the traditional CNN structure, employing an augmented real-valued cross-memorized terms (ARCT) matrix as input layer, and configuring convolutional layer to extract nonlinear features through macro convolutional kernels. Furthermore, migration learning and pruning operations are implemented to expedite model training and parameter reduction, thereby decreasing training duration and floating-point operations (FLOPs). The experiment results based on a 160\,MHz Doherty PA indicate that the proposed model effectively reduces computational complexity while maintaining required predistortion performance.

16:55-17:10
KT2139

Title: A Novel Intelligent Method for CFR Implemention in Transceivers for Multiple Scenarios
Author(s): Zhuangzhuang Li, Peng Jin, Dapeng Wang, Nan Li, Min Zhang, Jiayao Wang and Zhenping Hu
Presenter: Zhuangzhuang Li, China Mobile Research Institute, China

Transceiver is the core chip of 5G base station, among which Crest Factor Reduction (CFR) module is the mostimportant digital function. In the design, it is compatible with performance and flexibility, adopts the way of Hardware- Software Co-Design, supports zero IF and low IF scenarios, supports peak search dynamic adjustment, develops parameter configuration platform to improve the efficiency of firmware configuration. The simulation and post-silicon test verify that the system has good

	performance and flexibility.
17:10-17:25 KT2200	Title: SigRNet: A Deep Intelligent Speech Receiver Based on Regression Model Author(s): Ziliang Zhou, Shilian Zheng, Zhijin Zhao, Xiaoniu Yang Presenter: Ziliang Zhou. Hangzhou Dianzi University, China In the realm of wireless digital communication, the reception of signals has always been a crucial component. Traditional receivers typically comprise multiple modules to decode signals that have been impaired by the physical channel. However, with the evolution of artificial intelligence and deep learning technologies, intelligent receivers based on neural networks have increasingly become a focal point of research. In this paper, we introduce a novel intelligent receiver based on a deep learning regression model, termed SigRNet, designed to replace all modules in the traditional signal reception process and directly output the restored analog voice signals. SigRNet is primarily divided into two parts: Backbone and Reconstruction. In the Backbone, deep separable convolutions are employed, integrated with three distinct attention mechanisms to extract features highly correlated with the input signal. In the Reconstruction part, these features are restructured using residual convolutions. Simulation results indicate that SigRNet, with less data transmission, outperforms traditional hard decision-making across various channel environments. Concurrently, in additive noise scenarios, SigRNet further reduces the quantization error inherent in digital signals.
17:25-17:40 KT2218-A	Title: Optimal Prototype Filter Design for UFMC System Author(s): Le Yang, Jiangang Wen, Yuanping Zou, Jingyu Hua, Bin Sheng Presenter: Le Yang, Zhejiang Gongshang University, China In next generation mobile communications, Universal Filtered Multi-Carrier (UFMC), as a novel multi-carrier modulation technique, has received considerable attention due to its applicability to various communication scenarios. However, like other multi-carrier techniques, the UFMC system is susceptible to carrier frequency offset (CFO) during transmission. Therefore, in this paper, the signal and interference analysis of UFMC system in the presence of CFO is first investigated theoretically, and then the system signal to interference plus noise ratio (SINR) expression is derived. Subsequently, an optimisation filter design model aimed at minimizing the averaged symbol error rate (SER) of all subcarriers is constructed and solved by the Sequential Convex Approximation (SCA) algorithm. Finally, the performance of UFMC system with a DC filter and the optimal prototype filter is compared through simulation. Simulation results demonstrate that the optimal prototype filter achieves superior SER performance and exhibits enhanced resilience to hybrid interference.

POSTER SESSIONS

PS01: System Modeling, Resource Allocation and Network Performance Optimization on Digital Communications

Chair: **Yijing Liu,** University of Electronic Science and Technology, China

13:30-15:20 | Oct. 19, 2024 | Poster Exhibition Area

PAPER DETAILS		
No.	**Paper ID**	**Presentation**
1	KT1045	Title: Energy-Efficient Cooperative MIMO Generalized Spatial Modulation Transmission in Wireless Sensor Networks Author(s): Zhang Jiayao, Cai Caixia, Gan Wenyang, Hai Han, Zhang Fuli, and Fan Jinlong Presenter: Zhang Jiayao, Shanghai Maritime University, China
2	KT1060	Title: Deeper and Wider Networks for Performance Prediction in Communication Networks Author(s): Aijia Liu, Shiqing Liu and Xiaobing Pei Presenter: Aijia Liu, Huazhong University of Science and Technology, China
3	KT1073	Title: Joint User Selection and Resource Allocation for Efficient Federated Learning in UAV-Assisted Wireless Networks Author(s): Xiaoxuan Dong, Enchang Sun, Mengsi Li, Dongying Zhang Presenter: Xiaoxuan Dong, Beijing University of Technology, China
4	KT1074	Title: Latency Minimization of Multi-Layer Aerial Networks for Maritime Collaborative Mobile Edge Computing Author(s): Shiyu Li，Zhenyu Na，Yue Zhang，Jinyu Zhang Presenter: Shiyu Li, Dalian Maritime University, China
5	KT1085	Title: Performance Analysis of Reliable Transport Protocols in Mobile Ad Hoc Networks Author(s): Yizhen Pan, Xin Xu, Liangdong Wei, Hengqiang Shi Presenter: Yizhen Pan, Army Engineering University of PLA, China
6	KT1093	Title: Wideband Beamspace Channel Estimation Based on OAMP Approach Author(s): Yang Nie and Lili Jing Presenter: Lili Jing, Jining Normal University, China
7	KT2107	Title: Deep Reinforcement Learning based Task Offloading for MEC with User Mobility Author(s): Jiayi Huang, Zipeng Lu, Xiajun Huang, Jun Xu Presenter: Jiayi Huang, Nanjing Normal University, China
8	KT2119	Title: Performance Evaluation of Integrated Sensing and Communication System Based on Sensing Efficiency and Communication Capacity in Vehicle Communication Network Author(s): Wei Li, Jing Lei Presenter: Wei Li, National University of Defense Technology, China

9	KT2124	Title: Cost-Aware Deterministic Latency-Bounded Network Slicing Deployment Author(s): Kaili Qian, Yiqin Lu, Xiaohuan Zhang, Wenqi Zhou Presenter: Kaili Qian, South China University of Technology, China
10	KT2131	Title: Graph Coding Aided Deep Reinforcement Learning for Fault-tolerant Workflow Scheduling Author(s): Jiangming Li, Sen Li, Jian Tan, Siyu Cheng, Dong Jin, Shuangwu Chen and Jian Yang Presenter: Dong Jin, University of Science and Technology of China, China
11	KT2151	Title: Resource Allocation and Task Offloading for Mobile Edge Computing System Based on UAV-EC Collaboration Author(s): Jingyi Ma, Siyang Xu and Sin Song Presenter: Siyang Xu, Northeastern University at Qinhuangdao, China
12	KT2157	Title: Generalized Random OFDM-IM Backscatter Communication: Verification and Implementation Author(s): Dongdong Mou, Xiaodan Zhai, Chao Ding and Lixia Xiao Presenter: Dongdong Mou, Huazhong University of Science and Technology, China
13	KT2159	Title: Power Allocation for STAR-RIS-Assisted C-V2X System with Discrete Phase Shifts Author(s): Fang Han, Zaixue Wei, Yaolan Huang Presenter: Fang Han, Beijing University of Posts and Telecommunications, China
14	KT2177	Title: Uncertainty-aware Sensor Deployment Optimization for Radio Map Construction Author(s): Tianhao Zhang, Zhiyong Du, Jiaqi Chen and Ximing Wang Presenter: Tianhao Zhang, National University of Defense Technology, China
15	KT2190	Title: Joint Precoding for Hybrid RIS-assisted V2X Systems Author(s): Ziting Yu, Youyun Xu Presenter: Dicheng Zhang, Nanjing University of Posts and Telecommunications, China
16	KT2194	Title: Stochastic Gradient Descent Based MIMO Detection with Interference Rejection Combining Author(s): Yubin Zhu, Ruobing Yang, Ya Gao, Kaining Han, Jianhao Hu Presenter: Yubin Zhu, University of Electronic Science and Technology of China, China
17	KT2197	Title: Resource Optimization for NOMA-Based Secure MEC Networks with Unknown Eavesdroppers Author(s): Xinyue Pei, Xingwei Wang, Jihao Liu, Miaowen Wen Presenter: Xinyue Pei, Northeastern University, China
18	KT2211	Title: Reinforcement Learning-based Scheduling for UAV-assisted Ad-hoc Computing-aware Network Author(s): Manyao Fu, Zhenyu Wu, Banghao Xu, Yang Ji Presenter: Manyao Fu, Beijing University of Posts and Telecommunications, China

19	KT2224	Title: A Bi-objective Optimization Algorithm to extend the Clean Bandwidth of All Digital Transmitters Author(s): Lei Zhu, Zhihu Wei, Zhang Chen, Qiang Zhou, Haitao Zhao, Jibo Wei Presenter: Lei Zhu, The Sixty-Third Research Institute, National University of Defense Technology, China
20	KT2228	Title: FedMABA: Towards Fair Federated Learning through Multi-Armed Bandits Allocation Author(s): Zhichao Wang, Lin Wang, Yongxin Guo, Ying-Jun Angela Zhang and Xiaoying Tang Presenter: Zhichao Wang, The Chinese University of Hong Kong, China
21	KT2241	Title: Recent Advancements and Challenges in Integrated Sensing and Communication in Optical Fiber Author(s): Ying Wu, Chao Xu, Fang Chen, Ying Wang, Guangzhe Wu, Peizhe Xin, Zhiyi Chen, Peng Zhan, Zhirui Zhou, Zuoxing Zhang, Weizhe Ma, Meng Li, Jing Yan, Mengwen Pan, Yajie Li, Yongli Zhao, Jie Zhang Presenter: Ying Wu，Beijing University of Posts and Telecommunications, China
22	KT2253	Title: Physical Layer Security in Bistatic Backscatter Communications for Passive Internet of Things Author(s): Sihao Li, Huang-Jie Zhou, Gang Yang, Ning Jin, Ying-Chang Liang Presenter: Huang-Jie Zhou, University of Electronic Science and Technology of China (UESTC) Shenzhen, China
23	KT3268	Title: A Multi-UAV Relay Network Supporting Mobile Ground Nodes Communication Author(s): Cancan Tao, Rui Zhou, Bowen Liu, Tao Che, Shizhao She, Li Zha Presenter: Cancan Tao, Beihang University, China
24	KT3275	Title: Research on Collaborative Spectrum Sensing Algorithm Based on Energy Detection Author(s): Liuwen Li, Yaoyao Liu, Wei Xie, Xin Zhou, Han Zhou and Jiajun Wang Presenter: Liuwen Li, National University of Defense Technology School of Information and Communication, China
25	KT3277	Title: Implementation of Converged Gateway for Airport Heterogeneous Networks Based on Edge Cache Author(s): Hao Su, Qiang Gao, XinYing Li, Shijie Zhang. Presenter: Hao Su, Beihang University, China
26	KT3298	Title: Joint Optimization of Serial Task Offloading Decision and UAV Position in Cache-Based Mobile Edge Computing Networks Author(s): Mengyuan Tao, Qi Zhu Presenter: Mengyuan Tao, Nanjing University of Posts and Telecommunications, China
27	KT3315	Title: Joint Beamforming and Trajectory Design for UAV-aided Integrated Sensing and Communication Author(s): Yu Fu, Shuyan Hu, Ziwen Qian and Xin Wang Presenter: Yu Fu, Fudan University, China

28	KT3326	Title: Configuration of Multicast Routing and IEEE 802.1CB in Time-Sensitive Networking for Software-Defined Vehicles Author(s): Xu Zhong, Yuan Zhu Presenter: Xu Zhong, Tongji University, China
29	KT3329	Title: Toward Integrated Sensing and Communication Network: The Evolutionary Architecture for 5G-Advanced and Beyond Author(s): Yuhan Zhang, Yilin Lin, Qingyu Bie, Ruiqi Zhang and Yufeng He Presenter: Yuhan Zhang, China Telecom Research Institute, Guangzhou, China
30	KT3334	Title: Joint Optimization of Channel Allocation and Power Control Algorithm for AoI-Aware Industrial IoT with Deep Reinforcement Learning Author(s): Lin Tang, Shaohong Zhong, Hongzhi Li, Shenwei Chen, Libin Zheng Presenter: Lin Tang, Central South University of Forestry and Technology, China
31	KT3342	Title: A Dynamic Resource Scheduling Algorithm based on Traffic Prediction for Coexistence of eMBB and Random Arrival URLLC Author(s): Yizhou Jiang, Xiujun Zhang, Xiaofeng Zhong, Shidong Zhou Presenter: Yizhou Jiang, Tsinghua University, China
32	KT3371	Title: Model-driven Time-varying Channel Estimation Method for OFDM System Based on Neural Network Author(s): Yue Zhu, Dian Fan, Yunping Mu and Gongpu Wang Presenter: Yue Zhu, China Academy of Information and Communications Technology, P. R. China
33	KT3407	Title: Low-Complexity Transmission for STAR-RIS-Assisted Symbiotic Radio Using OOK Author(s): Mingjiang Wu, Xianfu Lei, Ibrahim Al-Nahhal, Octavia A. Dobre, Luyao Sun Presenter: Mingjiang Wu, Southwest Jiaotong University, China
34	KT3417	Title: Research on Fog Computing Task Scheduling Based on Improved Gray Wolf Optimization Algorithm Author(s): Xinyi Shi and Xiangli Zhang Presenter: Shi Xinyi,Guilin University of Electronic Technology, China
35	KT3424	Title: Multi-AP-Aided Joint Localization Enabled by Near-Far-Field Codebook Design Author(s): Wei Lin, Mengjun Yin, Shupei Zhang, Xian Gao, and Daqing Zhang Presenter: Shupei Zhang, Peking University, China
36	KT3430	Title: Pulse Sub-sequence Design for Integrated Sensing and Communication Author(s): Wenbin Yang，Yuehe Qiu，Lei Zhang，Yufei Zhang，Xi Liu Presenter: Wenbin Yang，China Mobile (Chengdu) R&D Institute, China
37	KT3459	Title: Implementation of SLB for Public Cloud Author(s): Zhangfeng Hu, Siqing Sun, Yao Chen, Mufei Zhang, Yanjun Li, Qiuzheng Ren Presenter: Zhangfeng Hu, Inspur Cloud, China
38	KT5164	Title: Group Selection Beamforming for RIS-Aided V2X Communication Systems Author(s): Chenxu Wang, Youyun Xu Presenter: Dicheng Zhang, Nanjing University of Posts and Telecommunications,

		China
39	KT1046	Title: Sum-rate Maximization in RIS-aided MU-MIMO System with Movable Antenna Author(s): Dicheng Zhang and Youyun Xu Presenter: Dicheng Zhang, Nanjing University of Posts and Telecommunications, China
40	KT1063	Title: A Network Security Convergence Orchestration Framework for 6G Network Author(s): Jia Chen, Can-Can Chen, Wei Wang, Li Su, Hui-Juan Zhang, Zhe-Yuan Sun, Kai Yang, Peng Ran Presenter: Jia Chen, Research Institute of China Mobile Communications Corporation, China

POSTER SESSION

PS02: Satellite Communication and Space-Air-Ground Integrated Network

Chair: **Long Luo**, University of Electronic Science and Technology, China

15:50-17:40 | Oct. 19, 2024 | Poster Exhibition Area

PAPER DETAILS		
No.	**Paper ID**	**Presentation**
1	KT1035	Title: Joint Design of Waveform and Filter for OFDM MIMO Dual-Function Radar-Communication Systems under Satellite-UAV Framework Author(s): Ye Lai, Keqing Duan, Xingjia Yang, Zizhou Qiu, Weiwei Wang Presenter: Ye Lai, Sun Yat-sen University, China
2	KT2142	Title: Simultaneous Localization for Multi-GNSS Interference Source Based on a Single LEO Satellite Author(s): Zhichao Cui, Jian Zhang, Weiheng Dai, Jian Cheng, and Guangxia Li Presenter: Zhichao Cui, Army Engineering University of PLA, China
3	KT2149	Title: QFAF: Enable QUIC with Feedback-Based Adaptive FEC in LEO Satellite Networks Author(s): An Liu, Rong Fan, Lin Xu and Tao Han Presenter: An Liu，Huazhong University of Science and Technology, China
4	KT2150	Title: History and Trends in The Development of Low-Orbit Satellite Communication Systems Author(s): Caiyu Liu, Yao Wu Presenter: Caiyu Liu, National University of Defense Technology, China
5	KT2220	Title: Dynamic Service Migration Mechanism in Satellite Edge Computing with Location Privacy Protection Author(s): Houpeng Wang, Yu'e Gao, Zhonglin Guo, Lei Yan, Suzhi Cao Presenter: Houpeng Wang, University of Chinese Academy of Sciences, China
6	KT2221	Title: Performance Evaluation of LEO Satellite-assisted Caching: A Stochastic Geometry Approach Author(s): Chunyi Ma, Jiajie Xu, Jianhua Yang, Mustafa A. Kishk. Presenter: Chunyi Ma, Northwestern Polytechnical University, China
7	KT2240	Title: Adaptive Congestion Control Strategies for LEO Satellite Networks Author(s): Jialing Fang and Jingjing Zhang Presenter: Jialing Fang, Fudan University, China
8	KT3299	Title: A Method for Integrated Target Positioning and Recognition Based on Sensing for Millimeter Wave Satellites Author(s): Dongnuan Cui, Hongwei Li, Jingxuan Lv, Ruiliang Song Presenter: Jingxuan Lv, The 54th Research Institute of China Electronics Technology Group Corporation
9	KT3412	Title: Handover Scheme in LEO Satellite Networks Based on QoE for Streaming Services Author(s): Huazhi Feng, Lidong Zhu and Jianhong Zhou

		Presenter: Huazhi Feng, University of Electronic Science and Technology of China, China
10	KT3439	Title: A QoS Guaranteed Routing Framework based on Software-Defined Satellite Networks Author(s): Yuanzhi He, Zhenyu Niu, Jinchao Liu Presenter: Zhenyu Niu, Institute of Systems Engineering, China
11	KT1032	Title: Payload-Adaptive Hybrid MAC Protocol for Sustainable Internet of Things Networks Author(s): Xinyu Fan, Jie Hu and Kun Yang Presenter: Xinyu Fan, University of Electronic Science and Technology of China, China
12	KT1056	Title: A Sojourn Time based Algorithm for Vehicular Edge Task Offloading Author(s): Jindie Zhang, Dongyang Yan, Xiaohong Jing and Rongrong Qian Presenter: Jindie Zhang, Yunnnan University, China
13	KT2120	Title: Single-layer Reflective Metasurface Design for Multi-Vortex Beams in the Terahertz Band Author(s): Haibo Yu, Xuehong Sun, Liping Liu and Tong Yu Presenter: Haibo Yu, Ningxia University, China
14	KT2154	Title: DLCAS: Distributed Large-scale Cyberspace Asynchronous Scanning Framework Author(s): Yu Cao, Fu Chen, Xiaowen Quan, Kai Zhou Presenter: Yu Cao, Central University of Finance and Economics, China
15	KT2161	Title: Unequal Error Protection Rateless Codes for Spatial Audio Transmission Author(s): Junpeng Yin, Yusun Fu, Haobo Huang and Jinhui Tang Presenter: Junpeng Yin, Shanghai Jiao Tong University, China
16	KT2170	Title: A Novel Approach to Continuous Security Authentication in the Internet of Things Based on RF Fingerprints Author(s): Ning Yang, Daoxing Guo, Bangning Zhang, Zhibo Chen Presenter: Ning Yang, Army Engineering University of PLA, China
17	KT2217	Title: WiFi and Passive IoT Symbiotic Communication System Architecture Author(s): Yinxiang Zheng, Yun Xu, Yao Fu Presenter: Yinxiang Zheng, China Mobile Research Institute, China
18	KT2230	Title: An Improved Combination Algorithm for Tone Reservation and Active Constellation Extension Based on Least Squares Approximation Author(s): Fengyuan Guo, Jiaying He, Yujie Zhou, Jianhua Ge Presenter: Fengyuan Guo, Xidian University, China
19	KT2231	Title: Radio Map Reconstruction Based on Transformer from Sparse Measurement Author(s): Zhibo Chen, Daoxing Guo, Ning Yang, Xiaoyu Wang, Heng Wang, Jiawei Xie Presenter: Ning Yang, Army Engineering University of PLA, China
20	KT2232	Title: Indoor U6G Channel Measurement and Small-Scale Fading Characterization Author(s): Xiayang Chen, Hongsheng Chang, Hui Zhang, Jiachen Tian, Yu Han and Shi Jin

		Presenter: Xiayang Chen, Southeast University, China
21	KT2258	Title: Zero Correlation Zone Codes Based Multiple Access for Ambient Backscatter Communications Author(s): Yunfei Long, Rongtao Xu, Jiancun Hu, Heng Liu, Gongpu Wang Presenter: Yunfei Long, Beijing Jiaotong University, China
22	KT2261	Title: A Lightweight Multi-Factor Continuous Authentication Method Based on IBE Author(s): Xiaopeng Yang, Qiang Wang, Hao Li, Ziyi Jia, Lizhe Liu, Xiaobo Guo Presenter: Qiang Wang, National Key Laboratory of Advanced Communication Networks, China
23	KT3287	Title: Characterization Method and Performance Verification of Space-Ground Integrated Networks Based on Graph Neural Networks Author(s): Lulu Feng, Jie Sheng, Cheng Wu and Bing Bu Presenter: Lulu Feng, Soochow University, China
24	KT3288	Title: The Radio Number of Cartesian Product for Stars and Square Mesh Networks Author(s): Linlin Cui, Feng Li Presenter: Linlin Cui, Qinghai Normal University, China
25	KT3289	Title: MADRL-based Intelligent Cooperative Formation Control Algorithm for UAV Swarms Author(s): Yufeng Chen, Gaoqing Shen, Lei Lei and Xueying Qian Presenter: Yufeng Chen, Nanjing University of Aeronautics and Astronautics, China
26	KT3323	Title: Quadratic Neural Network-Based Fault Diagnosis for UAV Author(s): Yicheng Wang, Daojie Yu, Yijie Bai, Tao Li, Liyue Liang, Jiale Zhou, Guoguo Wang, Zhenning Yao Presenter: Yicheng Wang, Information Engineering University, China
27	KT3347	Title: Temporal Cooperative Localization for RIS-Assisted mmWave Systems Author(s): Yulong Jiang, Ming-Min Zhao, Ming Lei, Liyan Li, Qingqing Wu and Minjian Zhao Presenter: Yulong Jiang, Zhejiang University, China
28	KT3351	Title: Heterogenous CSI based Coexistence of URLLC and eMBB in RIS-assisted mMIMO system Author(s): Hao Zeng, Yan Cai Presenter: Hao Zeng, Nanjing University Of Posts And Telecommunications, China
29	KT3367	Title: Game-Theoretic Incentive Mechanism for Spectrum Sharing in UAV Swarms: An Innovative Hybrid Access Model Author(s): Yi Shen, Qin Wang, Letao Peng, Jiaming Wang, Sogar Mia Presenter: Qin Wang, Nanjing University of Posts and Telecommunications, China
30	KT3375	Title: A Novel Multi-service QoS Routing Algorithm for Inclined Low-orbit Constellations Author(s): Jiaxue Wang, Kanglian Zhao and Wenfeng Li Presenter: Jiaxue Wang, Nanjing University, China

31	KT3385	Title: Application of TTE Bus Technology in Launch Vehicle Telemetry System Author(s): Ran Liu, Manhong Lu, Xianhui Zhang and Wentao Yang Presenter: Ran Liu, Beijing Research Institute of Telemetry, China
32	KT3388	Title: Learning to Design Constellation of MLC With Geometric Shaping Author(s): Fan Ding, Ming Jiang, Yi Wang, Qiushi Xu, and Qiang Wang Presenter: Fan Ding, National Mobile Communications Research Laboratory, Southeast University, China
33	KT3416	Title: Extend Kalman Filter Based Delay Compensation for High-Precision UAV Time Synchronization Author(s): Ning Meng, Weimiao Jing, Kaixuan Kang, Suzhi Cao and Peng Liu Presenter: Nine Meng, University of Chinese Academy of Sciences, China
34	KT3420	Title: Adaptive WKNN Algorithm Using Improved Distance and Extreme Learning Machine for Indoor Visible Light Positioning Author(s): Ren Liu, Zhonghua Liang, Mengan Song Presenter: Ren Liu, Chang'an University, China
35	KT3436	Title: Applications of Cooperative Vehicle-Infrastructure System Using HighPrecision Positioning Author(s): Bingyan Yu, Xianping Hua, Ning Xie Presenter: Bingyan Yu, Research Institute of Technology and Standards, China
36	KT7107	Title: Performance Simulation and Analysis of LEO Constellation Author(s): Mengyuan Duan, Danyang Geng, Dongye Sun, Yunfei Ai, Xiaoyong Kang, Fei Su, Pengzhi Zhao Presenter: Mengyuan Duan, China Transport Telecommunications& Information Center (CTTIC), China
37	KT2237	Title: Beamforming Optimization for UAV-Enable ISAC Systems under Malicious Jamming Attack Author(s): Yuan Liu, Bangning Zhang, Jingming Hu and Daoxing Guo Presenter: Bangning Zhang, Army Engineering University of PLA, China, China
38	KT1068	Title: Latency Minimization for C-NOMA Based Multi-UAV MEC Systems Author(s): Jinyu Zhang, Zhenyu Na, Yue Zhang, Shiyu Li Presenter: Jinyu Zhang, Dalian Maritime University, China
39	KT2098	Title: Wireless Traffic Prediction with L2 Paradigm Optimized Federated Learning Author(s): Fuwei Gao, Chuanting Zhang, Jingping Qiao, Anming Dong Presenter: Dongjiao Sun, Shandong Normal University, China
40	KT3354	Title: A Class of Low-Complexity Transmit Antenna Selection Schemes for Spatial Modulation Author(s): Hao Chen, Yanrui Wang, Juan Zhang, Yue Xiao and Vladimir Poulkov Presenter: Hao Chen, University of Electronic Science and Technology of China, China.
41	KT3355	Title: Amplitude Modulation for Constant Envelope OFDM Using Relay in Satellite Communications Author(s): Yanrui Wang, Hao Chen, Lilin Dan, Yue Xiao and Vladimir Poulkov Presenter: Yanrui Wang, University of Electronic Science and Technology of China, China

POSTER SESSION

PS03: Signal Detection, Analysis and Processing

Chair: **Jian Zhao**, South China University of Technology, China

13:30-15:20 | Oct. 20, 2024 | Poster Exhibition Area

PAPER DETAILS		
No.	**Paper ID**	**Presentation**
1	**KT0568**	Title: A Novel Blind CFO Estimator for RCP-OTFS Systems Author(s): Liangdong Wei, Aijun Liu, Xiaohu Liang, Siqi Xia, Yizhen Pan Presenter: Liangdong Wei, Army Engineering University of PLA, China
2	**KT1052**	Title: Deep Learning Empowered Spectrum Prediction with Wavelet Decomposition Author(s): Fumin Zhang, Yang Cao, Yanyan Wang, Xiaohu Tang Presenter: Zhang Fumin, Southwest Jiaotong University, Chengdu, China
3	**KT1067**	Title: Joint Sensing and Communications Using Bi-static Radar with Two Users Author(s): Enhao Wang; Yun Xiao; Yunfei Chen Presenter: Enhao Wang, Durham University, United Kingdom
4	**KT1075**	Title: End-to-End Light Field Image Compression with Sparse Reconstruction at Low Bit Rates Author(s): Xinbo Wang, Haiyong Xu, Yeyao Chen, Gangyi Jiang Presenter: Xinbo Wang, Ningbo University, China
5	**KT1077**	Title: Underdetermined Source Signal Reconstruction Based on Multi-modal Fusion Author(s): Hongyi Pan, Lichun Li, Hailong Zhang, Weinian Li and Siyao Tian Presenter: Hongyi Pan, School of Information Systems Engineering Information Engineering University Zhengzhou, China
6	**KT1089**	Title: An Anti-jamming Communication Method Based on Dual Channel Independent Component Extraction Author(s): Shilian Wang, Zhiyi Du, Yili Zhao Presenter: Yili Zhao, National University of Defense Technology, China
7	**KT11003**	Title: A Tighter Lower Bound on Aperiodic Hamming Correlation of Frequency Hopping Sequences Author(s): Shifu Yang, Kaichuang Jiang, Zhe Xu and Yebin Bai, Presenter: Shifu Yang, Shanghai Radio Equipment Research Institute (the 802-research institute), China
8	**KT2117**	Title: Enhanced Channel-Phase Based Physical-Layer Authentication for Multi-Carriers Transmission Author(s): Yuxin Shi, Xinjin Lu, Bingyin Ren, Yusheng Li and Kang An Presenter: Shi Yuxin, Sixty-third Research Institute, National University of Defense Technology, China

9	KT2169	Title: A Non-Line-of-Sight Target Detection System Based on Acoustic-Electromagnetic Intermodulation Author(s): Jiandi Tang, Yuchen Su, Shaohua Hong and Haixin Sun, Presenter: Jiandi Tang, Xiamen University, China
10	KT2205	Title: A High-precision Distance Measurement Method Based on OTFS Signal Author(s): Siqi Xia, Aijun Liu, Xiaohu Liang, Liangdong Wei. Presenter: Siqi Xia, Army Engineering University of PLA, China
11	KT2225	Title: An Orthogonal Time Frequency Space Covert Modulation Scheme Based on Modified Weighted Fractional Fourier Transform Author(s): Heyun Yan, Qiangjian Song, Feng Chen, Jialei Bai, Xiaoyan Kuai and Lidong Zhu Presenter: Heyun Yan, University of Electronic Science and Technology of China (UESTC), China
12	KT2254	Title: A Fast Demodulation Algorithm for Co-Frequency Mixed Signals Based on Pre-decision Author(s): Renpeng Zha, Hongyi Yu, Zhixiang Shen Presenter: Renpeng Zha, Information Engineering University, China
13	KT3269	Title: Riemannian Alternative Iteration Algorithm for NLFM Synthesis of Radar Signals Author(s): Haoyu Yi, Xinjin Lu, Weidong Jiang, Xinyu Zhang, Kai Huo Presenter: Xinjin Lu, National University of Defense Technology, China
14	KT3274	Title: Beacon Signal based Energy-saving Mechanism for 6G Networks Author(s): Ailin Deng, Xiaoqian Li, Gang Feng and Lu Guan Presenter: Xiaoqian Li, University of Electronic Science and Technology of China, Chengdu, China
15	KT3321	Title: AOA Based Localization and Orientation Estimation of UWB via Weighted Least Squares Author(s): Di Zhang, Ye Li and Guangqiang Yin Presenter: Di Zhang, University of Electronic Science and Technology of China, China
16	KT2236	Title: Multi-Level and Multi-Scale Representation Learning for Cross-Person Activity Recognition in Wireless Networks Author(s): Ziheng Zhang, Yutao Lu, Jie Yang, Fang Lu, Yu Wang Presenter: Ziheng Zhang, Nanjing University of Posts and Telecommunications, China
17	KT2257	Title: A Novel Low-Complexity Angle-Assisted Delay and Doppler Estimation for MIMO-OTFS Author(s): Weixin Deng, Hui Gao, Ruohan Cao, Xinzhou Cheng Presenter: Weixin Deng, Beijing University of Posts and Telecommunications, China
18	KT3305	Title: EMGL: Enhancing Mandarin-English Code-Switching Speech Recognition using Generative Labeling Technique Author(s): Zhentao Lin, Zihao Chen, Bi Zeng, Shengyu Wei, Jia Cai, Shang Xiao Presenter: Zihao Chen, Guangdong University of Technology, China

19	KT3391	Title: Non-contact Human Respiratory Monitoring Using FMCW Radar Author(s): Xuda Zhao, Qiang Chen, Xiangfei Nie, Wenliang Nie Presenter: Xuda Zhao, Chongqing Three Gorges University, China
20	KT3401	Title: Clutter Suppression based Sensing Algorithm in ISAC System Author(s): Songhui Shen, Rongyan Xi, Hanning Wang, Jing Dong, Jing Jin and Qixing Wang Presenter: Songhui Shen, China Mobile Research Institute Beijing, China
21	KT3410	Title: Small Sample Intelligence Text Classification Model Based on ChatGPT and Neighboring Prompt Author(s): Lai Qian, Weiwei Zhao, Liuwen Li, QianQian Chen, yaoyao Liu, yaoyao Liu Presenter: QianQian Chen, University of Shanghai for Science and Technology, China
22	KT7898	Title: A Method for Calibration of RIS Array Element Errors Based on Dynamic Reconstruction of Time-domain Electromagnetic Response Author(s): Wuding Liu, Ming Yi, Keming Ma, Lilong Hou Presenter: Wuding Liu, Information Engineering University, China
23	KT9117	Title: Long Baseline Acoustic Localization using Rapid Convergence Track-Before-Detect Method Over a Large Sea Area Author(s): Tao Jin, Bo Wang, Yi Lou, Chenxu Wang, Zhiquan Zhou Presenter: Bo Wang, Harbin Institute of Technology (Weihai), China
24	KT9559	Title: An Efficient and Robust Algorithm for Uniform Linear Array Adaptive Beamforming Author(s): Weinian Li, Lichun Li and Mingang Pu Presenter: Weinian Li, Information Engineering University, China
25	KT1031	Title: RCEFL: Reputation-based Communication-aware Optimization of Federated Learning Author(s): Xun Liu, Jian Yang, Wenke Yuan, Yunpeng Hou, Feng Yang and Xiaofeng Jiang Presenter: Wenke Yuan, University of Science and Technology of China, China
26	KT1034	Title: S-band Power Amplifier Design Based on Pseudo-Doherty Load Modulation Structure Author(s): Chen Wang, Ran Chu, Linlin Sun, Jia Liao Presenter: Chen Wang, Nanjing University of Science and Technology, China
27	KT1055	Title: Cross-plane Image Encryption Based on a New 2D Chaotic Map and DNA Cryptography Author(s): Yueyue Lin, Meng Tang, Guo Du, Yanru Yang, Yongtao Yu Presenter: Yueyue Lin, Yunnan University, Kunming, China
28	KT1071	Title: A Low Complexity Modified Decomposition Vector Rotation Model Author(s): Xu Lu, Chang, Feng Liang, Cheng Deng, YaQi Wu, XinYue Zhu, Han Xiong, Zhang Chen Presenter: Xu Lu, Nanjing University of Information Science and Technology Nanjing, China

29	KT2112	Title: FFT Algorithm Optimization and RD Imaging Algorithm Implementation Based on Heterogeneous Platform Author(s): Bingzhi Hou, Chengguang Ma, Junyu Li, Daiwei Li Presenter: Bingzhi Hou, Graduate School of the Second Research Institute of China Aerospace Science and Industry Corporation, China
30	KT2239	Title: Knowledge Distillation and Contrastive Learning for Robust Multimodal Sentiment Analysis with Missing Data Author(s): Yue Wang, Weiliang Zhang, Ning Sun Presenter: Yue Wang, Nanjing University of Posts and Telecommunications, China
31	KT3366	Title: A Deep Graph Reinforcement Learning Approach for Multi-Streaming Scheduling in Real-Time Communication Network Author(s): Hao Zhang, Ting Han, Cheng Gao, Chen Wang, Yue Song, Bo Hu, Bin Wei Presenter: Chen wang, Research Institute of China Mobile, China
32	KT3377	Title: AoI-Reliability Analysis with Block Length over Erasure Channels Using Rateless Codes Author(s): Haobo Huang, Yusun Fu, Yue Qiao, Junpeng Yin and Weiwu Yan Presenter: Haobo Huang, Shanghai Jiao Tong University, China
33	KT2179	Title: Design of Broadband High Efficiency Power Amplifier based on Harmonic Control and Filter Matching Author(s): Han Xiong, Zhihu Wei, Qiang Zhou, Haoyang Fu, Xu Lu and Yaqi Wu Presenter: Han Xiong, School of Electronics and Information Engineering Nanjing University of Information Science and Technology Nanjing, China
34	KT2242	Title: Boltzmann Robust Soliton Distribution for Rateless Codes Author(s): Jinhui Tang, Yusun Fu, Yue Qiao, Junpeng Yin, and Haobo Huang Presenter: Jinhui Tang, Shanghai Jiao Tong University, China
35	KT3294	Title: Combined-Step-Size Geometric-Algebra Affine Projection Versoria Algorithm Against Impulsive Noise Author(s): Zhao Zhang, Jiashu Zhang, Fuyi Huang Presenter: Zhao Zhang, The 10th Research Institute of China Electronics Technology Group Corporation Chengdu, China
36	KT2155	Title: Quasi-NN assisted Channel Estimation for MIMO-OFDM Author(s): Wanchen Hu, Xin Liang, Jie Yang, Rong Ran, Yi Jiang Presenter: Wanchen Hu, Fudan University, China
37	KT2176	Title: Feature Alignment Transformer for Cross-domain Radio Frequency Fingerprint Identification Author(s): Yatong Wang, Zhongyi Wen, Bin Cao, Mu Yan and Changqing Song Presenter: Yatong Wang, Beijing Institute of Technology, China

POSTER SESSION

PS04: Next Generation Mobile Communication Systems and Key Technologies

Chair: **Seon Phil Jeong**, BNU-HKBU United International College, China

15:50-17:40 | Oct. 20, 2024 | Poster Exhibition Area

PAPER DETAILS		
No.	**Paper ID**	**Presentation**
1	**KT1030**	Title: Research on Miniaturized E-band Integrated Transmitter Module Author(s): Shengsi Wang, Ran Chu, Linlin Sun, Jia Liao and Yanhong Wang Presenter: Shengsi Wang, Nanjing University of Science and Technology, China
2	**KT1082**	Title: A PFC-enhanced Flow Control Method for Lossless Long-Distance Data Transmission in WAN Author(s): Tian Yang, Xing Wang, Yaxin Yu, Zhibo Hu, Junda Yao, Ce Zhou, Jiashuo Yao, Binyi Bai Presenter: Tian Yang, Northeastern University Shenyang, China
3	**KT1036**	Title: E-band Waveguide Filter Based on TE301 High Sub-mode Author(s): Zhiwei Pan, Linlin Sun, Ran Chu, Jia Liao Presenter: Zhiwei Pan, Nanjing University of Science and Technology, China
4	**KT1047**	Title: A Security Authentication Scheme for Electric Vehicle Charging Reservation in Cross-Service Provider Domains Author(s): Lingyan Huang, Zhongwei Sun, Mingjian Wu and Xudong Zhang, Presenter: Lingyan Huang, School of Electrical and Electronic Engineering, North China Electric Power University, China
5	**KT1069**	Title: MTFALoc: A Novel CSI-based Multi-target Device-free Passive Fingerprinting Localization via Multi-Label Classification Author(s): Xinping Rao; Gang Lei; Yong Luo; Le Qin Presenter: Le Qin, Jiangxi Normal University, China
6	**KT1033**	Title: Study of Miniaturized Low Phase Noise E-Band Frequency Doubling Circuits Author(s): Xiao Wu, Ran chu, Linlin Sun, Jia Liao and ShengSi Wang Presenter: Xiao Wu, Nanjing University of Science and Technology, China
7	**KT1088**	Title: New Construction of QC-LDPC codes Based on Full-Length Row-Multiplier Author(s): Jia Ke, Qin Yu Presenter: Jia Ke, Xi'an University of Posts and Telecommunications, China
8	**KT1537**	Title: Real-Time DAG Task Allocation Strategy for Multiprocessor by Optimistic Parallelism Author(s): Yumeng Chen, Songlin Liu, Jianhong Zhou and Xiang Ling Presenter: Songlin Liu, University of Electronic Science and Technology of China, China

9	KT2115	Title: IGP Convergence Optimization with AI Author(s): Biswarup Das, Maxim Prihodko, Artem Krantsevich, Abdurasul Rakhimov, Jian Jin, Pingan Yang and Longfei Dai, Presenter: Biswarup Das, Principal Engineer, Network Algorithm Lab., Russia
10	KT2134	Title: Dual RCS-Based Path Loss Model for Active Transmissive RIS and Prototype Verifications Author(s): Rongguang Song, Haifan Yin, Zipeng Wang, Taorui Yang and Xue Ren Presenter: Rongguang Song, Huazhong University of Science and Technology, China
11	KT2138	Title: An AFDM off-grid Channel Estimation Based on Sparse Bayesian Learning Author(s): Fan Yang, Shan Luo, Lifan Wu, Dongxiao Song, Rongping Lin and Siyu Xie Presenter: Fan Yang, University of Electronic Science and Technology of China, China
12	KT2141	Title: MUSA Receiver Algorithm Based on Residual Network Denoising Author(s): Shufeng Li, Yujun Cai, Yubo Tan, Baoxin Su Presenter: Shufeng Li, Communication University of China, China
13	KT2175	Title: Reflective Analog Predistorter with Tunable AM/AM Compensation and Constant AM/PM Conversion Author(s): Hailin Deng, Benhua Ma, Liu XIAO, Dewei Zhang, Yi ZHANG, Dalong Lv Presenter: Hailin Deng, Aerospace Information Research Institute, Chinese Academy of Sciences, and also with the PLA Strategic Support Information Engineering University, China
14	KT2189	Title: On the Design of PolarSK-SCMA Codebooks Author(s): Tuofeng Lei, Shuyan Ni, Qu Luo, Weibai Sun and Shuhao Zhang Presenter: Tuofeng Lei, Space Engineering University, China
15	KT2192	Title: Design of 6-18 GHz Power Amplifier for Efficiency Enhancement Based on Reconfigurable Matching Networks Author(s): Chenlong Ma, Xiaojiang Yao, Xuming Yu, Runnan Guo, Junfeng Liu and Zheng Yin Presenter: Chenlong Ma, School of Intergrated Circuit Science and Engineering, Nanjing University of Posts and Telecommunications Nanjing, China
16	KT2229	Title: DNS Route Tampering Attack in 5G Application Layer Author(s): Zhiqian Xiao, Qian Sun, Lin Tian Presenter: Zhiqian Xiao, Zhengzhou University, China
17	KT2260	Title: A Resilient Packet Routing Approach Based on Deep Reinforcement Learning Author(s): Yongjie Pang, Fangying Dong, Ruolan Huang, Qi He, Zhiping Shi, Zhi Chen Presenter: Yongjie Pang, University of Electronic Science and Technology of China, China
18	KT2262	Title: First-Packet Matching-Based Strategy for Preventing 5G IPv6 Source Address Spoofing Author(s): Xinsheng Ji, Wenhao Wu, Jie Yang, Wei You, Mingyan Xu

		Presenter: Webhao Wu, Information Engineering University, China
19	KT2645	Title: The Diagnosability of the Lexicographic Product of Paths and Stars Under PMC Model Author(s): Bu Chen, Feng Li Presenter: Bu Chen, Qinghai Normal University, China
20	KT3278	Title: Off-grid Near-field Narrowband Channel Estimate with Grouping Strategy Author(s): Tianshun Cheng, Youyun Xu Presenter: Ke Xu, Nanjing University of Posts and Telecommunications, China
21	KT3290	Title: Packet Management of AoI in the Finite Block-Length Regime Author(s): Mingxiao Sun, Di Zhang, Shaobo Jia, Aimin Li Presenter: Mingxiao Sun, Zhengzhou University, China
22	KT3311	Title: Digital Twin Empowered Channel Prediction for Massive MIMO Communications Author(s): Zaichuan Zhang, Shuyan Hu, Sili Wu, and Xin Wang Presenter: Zaichuan Zhang, Fudan University, China
23	KT3324	Title: A Bi-static ISAC Channel Measurement and Its Digital Twin Author(s): Tao Jiang, Guangyi Liu, Liang Xia, Jing Jin, Qixing Wang, Jianhua Zhang Presenter: Tao Jiang, China Mobile Research Institute, China
24	KT3330	Title: Fast Implementation of RNC-based Authentication Codes Author(s): Weijia Li, Lei Cao, Jijian Cai, Yi Tang Presenter: Weijia Li, Guangzhou University, China
25	KT3338	Title: Kramers–Kronig Receiver Without DC Component Recovery Enabled by End-to-End Artificial Neural Network Modelling Author(s): Jiankang Li, Yuancheng Cai, Xiaoguang Yang, Bingchang Hua, Mingzheng Lei, Jiao Zhang, Junjie Ding, Xingyu Chen, Yucong Zou, Xiang Liu, Yunwu Wang and Min Zhu Presenter: Jiankang Li, National Key Laboratory of Mobile Communications Southeast University, Purple Mountain Laboratory, China
26	KT3387	Title: An Efficient PAPR Reduction Scheme Based on TKM-TR for OFDM Signals Author(s): Meng Li, Jingqi Wang, Tiantian Xiao, Wen Wu Presenter: Meng Li, Nanjing University of Science and Technology, China
27	KT3393	Title: Dimming Control Scheme for Multi-LED Visible Light Communication with Individual Power Constraints Author(s): Jia-Ning Guo, Jian Zhang, Qi Wu, Xin-Yu Zhang and Xing-Yu Xiao Presenter: Jia-Ning Guo, Information Engineering College, China
28	KT3395	Title: Secure Transmission Design for RSMA-ISAC Systems Author(s): Ziwei Wang, Xianfu Lei, Daniel Benevides da Costa, Kai Yu Presenter: Ziwei Wang, Southwest Jiaotong University, China
29	KT3415	Title: Cloud Data Deduplication Methods Supporting Popularity-Based Partitioning and Access Control Author(s): Minshi Chen, Jia Liu, Ningning Ni, Chen Zhang Presenter: Ningning Ni, China Mobile Group Design Institute Co. Ltd., China

30	KT3461	Title: A Peaceman-Rachford Splitting Approach with Deep Equilibrium Network for Channel Estimation Author(s): Dingli Yuan, Shitong Wu, Haoran Tang, Lu Yang, Chenghui Peng Presenter: Dingli Yuan, Tsinghua University, China
31	KT5276	Title: A Joint Encryptions System Based on McEliece and RLWE Author(s): Zixuan Yao, Deyuan Chen, Shaoshuai Gao, Can Zhang, Haokun Li Presenter: Zixuan Yao, University of Chinese Academy of Sciences, China
32	KT7853	Title: Generalized Channel Coding and Decoding with Natural Redundancy in Sources and Protocols Author(s): Yongbin Li, Hongyi Yu, Zhixiang Shen, Xia Zhang, Renpeng Zha and Bin Wang Presenter: Yongbin Li, Information Engineering University, China

MEMO