Qihao Li

College of Communication Engineering
Jilin University
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RESEARCH INTERESTS

- Industrial IoT: Industrial WSNs, MAC Protocol Design and Optimization, Localization, Sybil Attack Indication, Detection and Classification.
- Wireless Networking: RAN Slicing, Transport Protocol Design, Virtualization, Mobility Management.
- Intelligent Agent Communication and Networking: Digital Twin, Federated Learning.

EMPLOYMENT

- **Associate Professor** **Arp. 2023– Now**
  College of Communication Engineering
  Jilin University, Changchun, Jilin, China

- **Lecturer** **Dec. 2021– Mar. 2023**
  School of Electrical Engineering and Intelligentization
  Dongguan University of Technology, Dongguan, Guangdong, China

- **Postdoctoral Research Fellow** **Dec. 2019–June. 2021**
  Department of Electrical and Computer Engineering
  University of Waterloo, Waterloo, Ontario, Canada
  Supervisor: Prof. Xuemin (Sherman) Shen

EDUCATION

- **Doctor of Philosophy, Informatics** **Jan. 2014–Mar. 2019**
  University of Oslo, Oslo, Norway (**ARWU**: 61)
  Supervisors: Prof. Micheal Cheffena and Prof. Josef Noll
  Thesis: Channel-Awareness and Dependability in Industrial Wireless Sensor Networks
- **Visiting Scholarship, Electrical and Computer Engineering** **Feb. 2016–Aug. 2016**
  University of Waterloo, Waterloo, Ontario, Canada
  Supervisor: Prof. Xuemin (Sherman) Shen
- **Master of Information and Communication Technology** **Sept. 2011–Jun. 2013**
  University of Agder, Grimstad, Norway
  Supervisor: Prof. Yong (Frank) Li
  Thesis: Performance Evaluation of the Block ACK Mechanism in IEEE 802.11aa. (**Grade**: A)

AWARDS

- **"Best Paper Award" IEEE/CIC ICCC**, 2024
- **"Tang Aoqing" Distinguished Young Scholar Award**, 2023
- **"NetInfo Communication for Future Forum" Best Candidate in Open Competition**, 2023
- **"Dongguan Strategic Scientists" Team Member**, 2023

PUBLICATIONS

Refereed Journal Papers

[J1] **Q. Li**, Q. Ye, N. Zhang, W. Zhang, F. Hu, "Digital-Twin-Enabled Industrial IoT: Vision, Framework, and Future Directions," **IEEE Wireless Communications Magazine**, Early Access, DOI: 10.1109/MCOM.003.2400515, 2024.

[J2] **Q. Li**, J. Chen, M. Cheffena, X. Shen, "Channel-Aware Latency Tail Taming in Industrial IoT," **IEEE Trans. on Wireless Commun.**, vol.22, no. 9, page 6107-6123, 2023.

[J3] **Q. Li**, N. Zhang, M. Cheffena, X. Shen, "Channel-based Optimal Back-off Delay Control in Delay-Constrained Industrial WSNs," **IEEE Trans. on Wireless Commun.**, vol. 19, no. 1, page 696-711, 2020.

[J4] **Q. Li**, M. Cheffena, "Exploiting Dispersive Power Gain and Delay Spread for Sybil Detection in Industrial WSNs: A Multi-Kernel Approach," **IEEE Trans. on Wireless Commun.**, vol. 18, no. 3, page 1805-1818, 2019.

[J5] Z. Li, F. Hu, Z. Ling, S. Song, Q. Li, "Joint NLoS Predictive Beamforming and Power Allocation for SS-OTFS-Enabled ISAC in Vehicular Networks," IEEE Trans. on Intell. Transp. Syst., accepted, to be appeared.

[J6] W. Yao, H. Peng, Q. Li, Xuemin Shen"Modeling Realistic Adversarial Traffic Against Deep Learning-Based Intrusion Detection System in Industrial IoT," IEEE Internet of Things Journal, accepted, to be appeared.

[J7] N. Cheng, L. Ma, Y. Dai, X. Wang, Q. Li, W. Quan, H. Liang, X. (Sherman) Shen, "Mixture of Gradient: A Unified Enhancing Approach for Deep Learning-based Wireless Network Optimization," IEEE Internet of Things Journal, accepted, to be appeared.

[J8] D. Wang, L. Cao, W. Shen, Z. Li, Q. Li, "Age of Information Minimization in Aerial IRS Assisted Covert Communication for Internet of Things Networks, " IEEE Internet of Things, vol. 12, no. 18, 2025.

[J9] Y. Bi, R. Fu, C. Jiang, G. Han, Z. Yin, L. Zhao, Q. Li, "Single Source Cross-Domain Bearing Fault Diagnosis via Multi-Pseudo Domain Augmented Adversarial Domain-Invariant Learning," IEEE Internet of Things, vol. 11, no. 19, 2024.

[J10] Z. Li, F. Hu, Q. Li, Z. Ling, Z. Chang, and Timo Hamalainen, "AoI-Aware Waveform Design for Cooperative Joint Radar-Communications Systems with Online Prediction of Radar Target Property," IEEE Trans. on Commun., vol. 72, no 10, 2024.

[J11] M. Gao, B. Ai, Y. Niu, Q. Li, Z. Han, Z, Zhong, X. Shen and N. Wang"IRS-Assisted High-Speed Train Communications: Performance Analysis and Optimal Configuration," IEEE Internet of Things, vol. 10, no. 21, 2023.

[J12] B. He, J. Wang, Q. Qi, Q. Ye, Q. Li, J. Liao, X. Shen, "ShuttleBus: Dense Packet Assembling with QUIC Multi-Stream Independent Transfer for Massive IoT," IEEE Trans. on Mobile Comput., Early Access, DOI: 10.1109/TMC.2023.3345898, 2023.

[J13] J. Chen, H. Wu, P. Yang, F. Lyu, Q. Li, and X. Shen, "Adaptive Resource Allocation for Diverse Safety Message Transmissions in Vehicular Networks," IEEE Trans. on Intell. Transp. Syst., vol. 23, no. 8, page 13482 - 13497, 2021.

[J14] L. Song, A Hjorungnes, MR Bhatnagar, Q. Li, "Approximate maximum likelihood serial decision-feedback equaliser and Tomlinson–Harashima pre-equalisation," IET Communications, vol. 3, no. 2, page 223-231, 2009.

[J15] M. Sun, X. Xu, H. Peng, Q. Li, P. Zhang and X. Shen, "Multi-Tier Multi-Resource Allocation for Latency-Aware Applications in Mobile Edge Networks: A DRL-Based Approach," prepared to submit to IEEE Trans. on Vel. Tech.

[J16] Q. Li, W. Zhuang, M. Li, C. Zhou, X. Shen, "Group Transmission: A Protocol for Mobile VR Video Transmission," prepared to submit to IEEE Trans. on Mobile Comput.

Refereed Conference Papers

[C1] **Q. Li**, F. Hu, "Digital Twin-enabled Channel Access Control in Industrial IoT" in Proc. IEEE/CIC ICCC 2024.

[C2] **Q. Li**, M. Li, N. Zhang, F. Hu, "Digital twin-enabled Channel Access and Power Control Optimization in Industrial IoT" in Proc. IEEE Globecom 2024.

[C3] **Q. Li**, M. Li, J. Kang, F. Hu, "Digital twin-based Intrusion Detection in Smart Grid: A Multi-kernel Knowledge Replay Approach" in Proc. IEEE Globecom 2024.

[C4] H. Liu, M. Li, F. Gu, Q. Li, W. Zhang, S. Guo, "End-to-end Flow Scheduling Optimization for Industrial 5G and TSN Integrated Networks", in Proc. IEEE Globecom 2024.

[C5] Z, Li, F. Hu, Z. Ling, S. Song, Q. Li, "Sensing-Communication Trade-off in Vehicular Network with Spatially-Spread OTFS Modulation: An AoI-and-CRB-based Power Allocation Scheme", in Proc. IEEE Globecom 2024.

[C6] X. Su, M. Li, Q. Li, C. Chen, S. Guo, X. Wang, "Energy Consumption Prediction for Manufacturing in Industrial IoT Based on Heterogeneous GNN", in Proc. IEEE/CIC ICCC 2024.

[C7] T. Yang, Q. Li, F. Hu, "Intelligent Congestion Control in QUIC for Reliable E2E Communication Network: A Digital Twin-based Approach," in Proc. IEEE/CIC ICCC Workshop 2024.

[C8] Y. Zhang, J. He, N. Cheng, R. Sun, Q. Li, W. Quan, "ISL-based Multi-Satellite Collaborative Computation Offloading and Resource Allocation in ISTN," in Proc. IEEE Globecom Workshop 2024.

[C9] J. Liao, J. Wen, J. Kang, Y. Zhang, J. Du, Q. Li, W. Zhang, D. Yang "Optimizing Information Propagation for Blockchain-empowered Mobile AIGC: A Graph Attention Network Approach", in Proc. IWCMC 2024.

[C10] T. Yang, Q. Li, N, Zhang, L. Zhao, F. Hu "Reliable Federated Learning in Vehicular Communication Networks: An Intelligent Vehicle Selection and Resource Optimization Scheme", in Proc. IEEE VTC 2024 Spring.

[C11] **Q. Li**, W. Wen, W. Zhang, X. Shen, "Online Traffic Prediction in Multi-RAT Heterogeneous Network: A User-Cybertwin Asynchronous Learning Approach", in Proc. IEEE PIMRC 2023

[C12] Z. Li, F. Hu, Q. Li, Z. Chang, T. Hamalainen, "Optimizing Waveform Power Allocation in Cognitive DFRC Systems: An Individual User AoI Preference-Based Approach", submitted to Proc. IEEE Globecom 2023.

[C13] L. Hui, W. Yang, Q. Li, W. Zhang, "Poisson Game with Population Uncertainty for Mobile Edge Computing Networks", in Proc. IEEE/CIC ICCC 2022.

[C14] Z. Huang, P. Yang, N. Zhang, F. Lyu, **Q. Li**, W. Wen, X. Shen, "QoE-driven Mobile 360 Video Streaming: Predictive View Generation and Dynamic Tile Selection", in Proc. IEEE/CIC ICCC 2021.

[C15] C. Li, Z. Li, H. Wu, **Q. Li**, L. Guan, X. Shen, "Covert communication via dynamic spectrum control-assisted transmission scheme", in Proc. IEEE Globecom 2021.

[C16] Z. Mao, F. Hu, **Q. Li**, W. Wen, X. Shen, "Joint Distributed Beamforming and Backscatter Cooperation for UAV-Assisted WPSNs", in Proc. IEEE Globecom 2021.

[C17] **Q. Li**, K. Zhang, M. Cheffena, X. Shen, "Channel-based Sybil Detection in Industrial WSNs: A Multi-kernel Approach", in Proc. IEEE Globecom, 2017.

[C18] **Q. Li**, K. Zhang, M.Cheffena, X. Shen,"Channel-based Sampling Rate and Queuing State Control in Delay-Constraint Industrial WSNs", in Proc. IEEE Globecom, 2017.

[C19] **Q. Li**, K. Zhang, M. Cheffena, X. Shen, "A Measurement-based Boundary Estimation Approach for Localization in Industrial WSNs", in Proc. IEEE ICC, 2017.

[C20] **Q. Li**, K. Zhang, M. Cheffena, X. Shen, "Exploiting Dispersive Power Gain and Delay Spread for Sybil Detection in Industrial WSNs", in Proc. IEEE/CIC ICCC, 2016.

[C21] Y. Ai, M. Cheffena, **Q. Li**, "Power Delay Profile Analysis and Modelling for Industrial Indoor Channel", in Proc. EuCAP, 2015.

[C22] Y. Ai, M. Cheffena, **Q. Li**, "Radio Frequency Measurements and Capacity Analysis for Industrial Indoor Environments", in Proc. EuCAP, 2015.

[C23] **Q. Li**, L. Jiao and F. Y. Li, "Performance Evaluation of the GCR Block ACK Mechanism in IEEE 802.11aa Networks," European Wireless, 2013.

[C24] L. Song, Z. Han, Q. Li, B. Jiao, "Feedback Control Game for Channel State Information in Wireless Networks", in Proc. IEEE ICC, 2011.

Work in progress

[J1] **Q. Li**, W. Zhuang, F. Hu, N. Zhang, X. Shen, "GACK: Tuning Retransmission resilience with a time threshold"

[J2] **Q. Li**, F. Hu, N. Zhang, X. Shen, "Resource Sharing for Joint Sensing and Communication in Mobile-edge Computing Networks"

[J3] **Q. Li**, F. Hu, N. Zhang, M. Gao, X. Shen, "Groupcast-based Joint Task Offloading and Resource Allocation for Multi-Server in Vehicle Networks"

[J4] C. Li, L. Guan, H. Wu, **Q. Li**, Z. Li, and X. Shen, "A Family of Dynamic Spectrum Control Sequence for Cognitive Satellite Communications"

[J5] M. Gao, B. Ai, Y. Niu, **Q. Li** and X. Shen, "Edge Coordinated Caching and Scheduling for Adaptive Video Streaming in High-speed Railways"

[J6] **Q. Li**, F. Hu, N. Zhang, X. Shen, "Transmission Delay Optimization with Hidden Channel State in Industrial WSNs: A Hidden Semi-Markov Dynamic Programming Approach"

[J7] **Q. Li**, C. Li, F. Hu, N. Zhang, X. Shen, "Covert communication detection in D2D underlaying cellular network: A Multi-kernel Approach"

FUNDING EXPERIENCES

Funding Application and Administration

[F1] **Digital Twin-Driven Machine-type E2E Transmission Reliability and Network Resource Optimization in Industrial Internet** **Jan. 2023–Dec. 2025**
Funded by National Natural Science Foundation of China at CN¥300,000
PI: Qihao Li

[F2] **Research on ultra-High Reliable Transmission Technology in Industrial Internet Empowered by Smart Twins** **Jan. 2023–Dec. 2025**
Funded by National Natural Science Foundation of China at CN¥30,000
PI: Qihao Li

[F3] **Ubiquitous Intelligent Human-Vehicle-Road-City Panoramic Virtual-Reality Collaboration System and Application** **Jul. 2024–Jul. 2028**
Funded by Science and Technology Agency of Dongguan at CN¥50,000,000
sub-Topic Manager: Qihao Li

Funding Assistance and Participation

[FA1] **Cybertwin-enabled Novel Intelligent Network Architecture Technology and Experimental Platform** **Jan. 2021–Dec. 2025**
Funded by Key Area Research and Development Program of Guangdong Province
PI: Professor Quan Yu

[FA2] **Proactive User-centric Networking and Management Technology for Next Generation Wireless Communications** **Jan. 2019–Dec. 2022**
Funded by Canada NSERC Collaborative Research and Development Grant and Huawei Canada Research Center
PI: Professor Xuemin (Sherman) Shen

[FA3] **Channel Modelling and Prediction, Routing and Adaptive Data Rate for Industrial Wireless Sensor Networks** **Jan. 2012–Dec. 2013**
Funded by Regional Research Fund of Norway
PI: Professor Michael Cheffena

[FA4] **Wireless Sensor Network for Industrial Process Automation and Smart Grid: Technology, Application and Experimental Platform** **Jan. 2013–Dec. 2016**
Funded by Regional Research Fund of Norway
PI: Professor Michael Cheffena

SELECTED SEMINARS AND PRESENTATIONS

[S1] A Measurement-based Boundary Estimation Approach for Localization in Industrial WSNs
BBCR seminar – Broadband Communications Research Group, University of Waterloo, Aug. 2020.

[S2] Channel-based Sybil Detection in Industrial WSNs: a Multi-kernel Approach
BBCR seminar – Broadband Communications Research Group, University of Waterloo, Feb. 2020.

[S3] Channel-Awareness and Dependability in Industrial Wireless Sensor Networks
Informatics PhD Seminar – Department of Informatics, University of Oslo, Mar. 2019.

[S4] 5G communication system, and its applicability to process automation
Informatics Trial Lecture – Department of Informatics, University of Oslo, Mar. 2019.

[S5] Industrial Communication Networks - Enabling Technologies in wired and wireless communication system
Informatics Trial Lecture – Department of Informatics, University of Oslo, Feb. 2019.

[S6] Sybil Detection in Industrial WSNs: A Multi-kernel Approach
IEEE Globecom 2017 – IEEE Global Communications Conference, Singapore, Dec. 2017.

[S7] Channel-based Sampling Rate and Queuing State Control in Delay-Constraint Industrial WSNs
IEEE Globecom 2017 – IEEE Global Communications Conference, Singapore, Dec. 2017.

[S8] A Measurement-based Boundary Estimation Approach for Localization in Industrial WSNs
IEEE ICC 2017 – IEEE International Conference on Communications, France, May. 2017.

[S9] Exploiting Dispersive Power Gain and Delay Spread for Sybil Detection in Industrial WSNs
IEEE/CIC ICCC 2016 – IEEE/CIC International Conference on Communications in China, China, Jul. 2016.

[S10] Channel-based Sybil Detection in Industrial WSNs
BBCR seminar – Broadband Communications Research Group, University of Waterloo, Jun. 2016.

[S11] Advance Routing and Adaptive Data Rate for Industrial WSNs
BBCR seminar – Broadband Communications Research Group, University of Waterloo, Apr. 2016.

[S12] Channel Modelling and Advanced Routing in Industrial WSNs
Research seminar – Norwegian University of Science and Technology, Gjovik, Norway, Aug. 2015.

[S13] Fuzzy Triangle Forward Routing Protocol in Industrial WSNs
Research seminar – Norwegian University of Science and Technology, Gjovik, Norway, Feb. 2015.

[S14] Performance Evaluation of the GCR Block ACK Mechanism in IEEE 802.11aa Networks
Research seminar – Norwegian University of Science and Technology, Gjovik, Norway, Oct. 2014.

RESEARCH EXPERIENCES

Department of Electrical and Computer Engineering, University of Waterloo, Canada
Postdoctoral Research Fellow, Broadband Communications Research (BBCR) Laboratory
Supervised by: Prof. Xuemin (Sherman) Shen, Prof. Weihua Zhuang

◇ **Proactive User-Centric Networking for Next Generation Wireless** **Dec. 2019–Dec. 2022**

- ***Customized Transport Protocol Design for NGWN***
  - Conducting background research in the field of 6G, the next generation wireless network.
  - Investigate E2E transport protocol automation for virtual networks in the radio access network domain

- Develop machine learning algorithms to generate customized protocol operations for different service slices and orchestrate protocol parameters upon the dynamics of complex network features.
- Mentoring the research and paper writing of Ph.D. students.

University of Oslo & Norwegian University of Science and Technology, Norway
Full-time Researcher, Department of Informatics
Supervised by: Prof. Michael Cheffena, Prof. Josef Noll

◇ **Channel-Awareness and Dependability in Industrial WSNs** **Jan. 2014 – May. 2018**

- ***Channel-based low-latency packet transmission in industrial WSNs***
  - Three different packet optimal control schemes are proposed to improve the packet transmission dependability in IWSNs
  - The packet back-off latency can be maintained stability and be kept within 0.1ms when the interference rate of the propagation channel is increased.
- ***Channel modelling and analysis in industrial environment***
  - Model the industrial wireless propagation channel with a taped delay line-based channel simulator.
  - Propose a forward learning method to detect the hidden channel status and the channel fading duration according to a designed hidden semi-Markov model.
- ***Advanced routing protocol in industrial WSNs***
  - Analyze and debug numerous routing protocols of mobile ad-hoc network on NS2 simulation platform.
  - Design and produce a routing protocol, called Fuzzy Triangle Forward Protocol, for industrial WSNs.
- ***Localization in industrial WSNs***
  - An appropriate statistical path-loss model is proposed based on real-life measurements to reduce the influence of inconsistent channel features in different manufacturing environments.
  - A noise-reduction scheme, called support vector semidefinite scheme, is proposed to achieve high precision in localization.

University of Agder, Grimstad, Norway
Research Assistant
Supervised by: Prof. Yong (Frank) Li

◇ **Wi-Fi display and IEEE 802.11aa Networks** **Nov. 2012 – Jun. 2013**

- Investigate the properties of transmission service features in the new standard 802.11aa, and related standard 802.11ae, 802.11REVmb, 802.11n.
- Creatively design a Markov model to analyze the throughput of the GCR Block ACK multi-cast scheme, which is one of the most important features in the 802.11aa standard.
- Analyze the numerical result of the proposed model by Matlab and do the simulation using network simulator (NS2).
- Have gained the knowledge of wireless network architecture and concept in the IEEE 802.11 series standards.

Peking University, Beijing, China
Supervised by: Prof. Lingyang Song

◇ **Research and standardization on wireless networks of 3GLTE** **Aug. 2012**

- Research in heterogeneous network switching algorithm especially focused on IEEE 802.11f which supports fast hand-off between different vendors' APs.
- Have gained knowledge of operation principle of IEEE 802.11f.

TEACHING EXPERIENCES

Undergraduate Course

- **Sensors and Intelligent Sensing Technologies (200 students)** **May. 2025 – Jun. 2025**
  College of Communication Engineering, Jilin University
- **Communication and Networking (75 students)** **Mar. 2024–Jul. 2024, Sep. 2024–Jan.2025**
  College of Communication Engineering, Jilin University
- **MATLAB and Applications (65 Bachelor students)** **Mar. 2022–Jul. 2022**
  School of Electrical Engineering and Intelligentization, Dongguan University of Technology
- **Technical English for Communication Engineering (80 students)** **Aug. 2022–Dec. 2022**
  School of Electrical Engineering and Intelligentization, Dongguan University of Technology
- **5G Network Clouding Technology and Application (80 students)** **Mar. 2023–Jul. 2023**
  School of Electrical Engineering and Intelligentization, Dongguan University of Technology

Graduate Course

- **DSP Principles and Applications (40 students)** **May. 2025 – Jun. 2025**
  College of Communication Engineering, Jilin University
- **Fundamentals of Short-Range Wireless Communication Technology (20 students)** **May. 2025 – Jun. 2025**
  College of Communication Engineering, Jilin University

PROFESSIONAL ACADEMIC SERVICES

Journal Editor

– IEEE Internet of Thinigs, Associate Editor
– Future Internet Journal, Invited Editor

Technical Program Committee Chair

– IEEE MASS 2025 Workshop
– IEEE VTC 2025-Spring, -Fall Workshop
– IEEE Globecom 2025 Workshop
– IEEE Globecom Workshop on Ubiquitous Network Intelligence for NGWNs, 2024
– IEEE/CIC ICCC Workshop on DTs and PI Synergy in 6G Networks, 2024
– IEEE/CIC ICCC Workshop on Edge Intelligence for 6G Networks, 2023

Technical Program Committee

– IEEE Global Communications Conference (GLOBECOM), 17-24
– IEEE International Conference on Communications (ICC), 18-25
– IEEE International Conference on Communications in China (CIC/ICCC), 17-24
– BDEC-SmartCity' 18, 19
– IEEE Vehicular Technology Conference (VTC) 19-Fall, 24-Spring
– 3ICT' 20

Reviewer of Refereed Journals

– IEEE Transactions on Wireless Communication
– IEEE Transactions on Vehicular Technology
– IEEE Transactions on Industrial Informatics
– IEEE Internet of Things Journal
– IEEE Communication Letters
– IEEE Access
– Springer Peer-to-Peer Networking and Applications
– Springer Wireless Networks
– IET Communications