

Dr. Zirui Zhuang

## CONTACT INFORMATION

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Beijing, China, 100876      zhuangzirui@bupt.edu.cn

## EDUCATION

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**Beijing University of Posts and Telecommunications**, Beijing, China  
Ph.D. in Information and Communication Engineering,      November, 2020  
B.S. in Electronic Information Engineering,      July, 2015

## ACADEMIA EXPERIENCE

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**Beijing University of Posts and Telecommunications**, Beijing, China  
State Key Laboratory of Networking and Switching Technology  
School of Computer Science  
*Associate Researcher*      **January, 2023 - Present**  
*Postdoctoral Research Fellow*      **January, 2021 - January, 2023**  
**University of Houston**, Texas, United States  
Wireless Networking, Signal Processing and Security Lab  
ECE Department  
*Visiting Scholar*      **May, 2019 - November, 2019**

## INDUSTRY EXPERIENCE

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**E-Byte Co., Ltd.**, (formerly known as EBupt Co., Ltd.), Beijing, China  
*Technical Expert*      **February, 2022 - Present**  
*Senior Research and Development*      **November, 2020 - February, 2022**  
*Research and Development*      **July, 2015 - November, 2020**  
*Internship*      **September, 2014 - July, 2015**

## GRANT

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### Academia Projects

1. **Principal Investigator** of general project: "Knowledge-Driven Intelligent Decision Theory for Edge Networks Routing," China Postdoc Science Foundation, CNY 80,000, 2022M710468, 2022-2024.
2. **Principal Investigator** of young scientists project: "Case-Based Learning for Intelligent Routing in Edge Networks: Mechanism, Theory, and Stability Analysis," National Natural Science Foundation of China, CNY 300,000, 62101064, 2021-2024.
3. **Participant** of general project: "A Research on Transient Edge Resource Collaboration Theory for Autonomous Driving Networks," National Natural Science Foundation of China, CNY 640,000, 62071067, 2021-2024.

4. **Participant** of a subproject of "Broadband Communications and New Networks," National Key Research and Development Program of China, CNY 6,740,000, 2020-2023.
5. **Participant** of general project: "A research on Machine Learning-Based Resource Management Optimization for Software-Defined Networks," Natural Science Foundation of Beijing, CNY 180,000, 4182041, 2018-2020.
6. **Participant** of general project: "A Research on Multi-Path Transmission Mechanism and Joint Optimization Theory for Software-Defined Data Centers," National Natural Science Foundation of China, CNY 580,000, 61671079, 2017-2020.

### **Industry Projects**

1. **Participant** of collaboration project "A Research on the Theory and Technologies of Knowledge-Defined Networking," BUPT-CM Innovation Center, CNY 2,450,000, 2020-2023.

## **PROFESSIONAL ACTIVITIES**

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### **Editor**

- Guest Editor, Electronics, special issue on "Advances in Information Retrieval and Natural Language Processing", 2023.

### **Technical Program Committee**

- Member of Technical Program Committee of IEEE Global Communications Conference (GLOBECOM), 2023
- Member of Technical Program Committee of European Conference on Machine Learning and Principles and Practice of Knowledge Discovery in Databases (ECMLPKDD), 2023
- Member of Technical Program Committee of ACM International Conference on Multimedia Retrieval (ICMR), 2023

### **Invited Talk**

- Invited Talk, "Knowledge-Defined Edge Network Routing," 2022 Cross Strait Radio Science and Wireless Technology Conference (CSRSWTC), December, 2022

### **Reviewer**

- IEEE Journal on Selected Areas in Communications
- IEEE Internet of Things Journal
- IEEE Systems Journal
- IEEE Transactions on Mobile Computing
- IEEE Communications Letters

- Future Generation Computer Systems
- Ad Hoc & Sensor Wireless Networks
- Journal of Communications and Networks
- Springer Journal of Cloud Computing: Advances, Systems and Applications
- Scientific Reports
- SN Applied Sciences
- Artificial Intelligence in Medicine
- Results in Control and Optimization
- ACM ICMR 2023
- IEEE WCNC 2022
- IEEE WCNC 2021 Workshops
- IEEE ICC 2020
- MobiQuitous 2019

## PUBLICATIONS

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### Edited Books

1. Qi Qi, Xiaoyuan Fu, Zirui Zhuang, Jingyu Wang, and Jianxin Liao. *Deep Reinforcement Learning for Network Intelligence*. Posts & Telecom Press Co., Ltd., 2021.
2. Jingyu Wang, Haifeng Sun, Jianxin Liao, Jing Wang, Qi Qi, and Zirui Zhuang. *Smart Service Cloud Networks (Edition 2)*. Posts & Telecom Press Co., Ltd., 2019.
3. Jingyu Wang, Jianxin Liao, Jing Wang, Qi Qi, and Zirui Zhuang. *Smart Service Cloud Networks*. Posts & Telecom Press Co., Ltd., 2017.

### Journal Publications

*Published or Accepted*

1. Tianjian Dong, Qi Qi, Jingyu Wang, Zirui Zhuang, Haifeng Sun, Jianxin Liao, and Zhu Han. "Standing on the Shoulders of Giants: Cross-Slice Federated Meta Learning for Resource Orchestration to Cold-Start Slice." *IEEE/ACM Transactions on Networking*, vol. 31, num. 2, (April 2023): 1–18. *Early access*.
2. Long Zhang, Xiaozheng Ma, Zirui Zhuang, Haitao Xu, Vishal Sharma, and Zhu Han. "Q-Learning Aided Intelligent Routing with Maximum Utility in Cognitive UAV Swarm for Emergency Communications." *IEEE Transactions on Vehicular Technology*, November 2022, 1–16. *Early access*.
3. Tianjian Dong, Zirui Zhuang, Qi Qi, Jingyu Wang, Haifeng Sun, F. Richard Yu, Tao Sun, Cheng Zhou, and Jianxin Liao. "Intelligent Joint Network Slicing and Routing via GCN-Powered Multi-Task Deep Reinforcement Learn-

- ing." *IEEE Transactions on Cognitive Communications and Networking* vol. 8, num. 2, (June 2022): 1269–1286.
4. Jingyu Wang, and Zirui Zhuang. "Research on a Knowledge-Defined Polymorphic Network Attainable Service Architecture." *Journal on Communications* vol. 43, num. 4, (April 2022): 71–82.
  5. Jingyu Wang, Cheng Zhou, Lei Zhang, Cong Liu, Zirui Zhuang, Hongwei Yang, Danyang Chen, Yanhong Zhu, Lu Lu, and Jianxin Liao. "Knowledge-Defined Intent-Based Network Autonomy." *Telecommunications Science* vol. 37, num. 9, (September 2021): 1–13.
  6. Tianjian Dong, Qi Qi, Jingyu Wang, Alex X. Liu, Haifeng Sun, Zirui Zhuang, and Jianxin Liao. "Generative Adversarial Network-Based Transfer Reinforcement Learning for Routing with Prior Knowledge." *IEEE Transactions on Network and Service Management* vol. 18, num. 2, (May 2021): 1673–1689.
  7. Zirui Zhuang, Jingyu Wang, Qi Qi, Jianxin Liao, and Zhu Han. "Adaptive and Robust Routing with Lyapunov-Based Deep RL in MEC Networks Enabled by Blockchains." *IEEE Internet of Things Journal* vol. 8, num. 4, (February 2021): 2208–2225.
  8. Kai-Chu Tsai, Zirui Zhuang, Ricardo Lent, Jingyu Wang, Qi Qi, Lichun Wang, and Zhu Han. "Tensor-Based Reinforcement Learning for Network Routing." *IEEE Journal of Selected Topics in Signal Processing* vol. 15, num. 3, (February 2021): 617–629.
  9. Dezhi Chen, Qi Qi, Zirui Zhuang, Jingyu Wang, Jianxin Liao, and Zhu Han. "Mean Field Deep Reinforcement Learning for Fair and Efficient UAV Control." *IEEE Internet of Things Journal* vol. 8, num. 2, (January 2021): 813–828.
  10. Qi Qi, Lingxin Zhang, Jingyu Wang, Haifeng Sun, Zirui Zhuang, Jianxin Liao, and F Richard Yu. "Scalable Parallel Task Scheduling for Autonomous Driving Using Multi-Task Deep Reinforcement Learning." *IEEE Transactions on Vehicular Technology* vol. 69, num. 11, (November 2020): 13861–13874.
  11. Zirui Zhuang, Jingyu Wang, Qi Qi, Haifeng Sun, and Jianxin Liao. "Toward Greater Intelligence in Route Planning: A Graph-Aware Deep Learning Approach." *IEEE Systems Journal* vol. 14, num. 2, (June 2020): 1658–1669.
  12. Jingyu Wang, Zirui Zhuang, Qi Qi, Tonghong Li, and Jianxin Liao. "Deep Reinforcement Learning-Based Cooperative Interactions Among Heterogeneous Vehicular Networks." *Applied Soft Computing* vol. 82, (September 2019): 105557.
  13. Zirui Zhuang, Wang Jingyu, and Tong Xu. "Tenant-Oriented Customized Vm Networking Technology." *Telecommunications Science* vol. 31, num. 10, (October 2015): 144–150.

*In Revision or Submitted*

14. Yu Liu, Zirui Zhuang, Qi Qi, Jingyu Wang, Dezhi Chen, Lu Lu, Hongwei Yang, Jianxin Liao, and Zhu Han. "Slice Sandwich: Jagged Slicing Multi-

tier Dynamic Resources for Diversified V2X Services." Submitted to *IEEE Transactions on Mobile Computing*.

15. Yu Liu, Jingyu Wang, Qi Qi, Zirui Zhuang, Jianxin Liao, and Zhu Han. "Towards High-Powered Connected Autonomous Vehicles: A Cooperative Solution via Transient Edge Intelligence Provision." Submitted to *IEEE Communications Magazine*.
16. Haifeng Sun, Jingyu Wang, Huazheng Wang, Zirui Zhuang, Qi Qi, Lu Lu, and Jianxin Liao. "Intent-based Edge Device Cooperation: Resource Knowledge Graph for Incomplete Semantic Reasoning." Submitted to *IEEE Communications Magazine*.

### **Conference Publications**

*Published or Accepted*

1. Jinming Wu, Qi Qi, Jingyu Wang, Haifeng Sun, Zhikang Wu, Zirui Zhuang, and Jianxin Liao. "Not Only Pairwise Relationships: Fine-Grained Relational Modeling for Multivariate Time Series Forecasting." In The 32nd International Joint Conference on Artificial Intelligence (IJCAI'23). Macao, S.A.R, China, August 2023. *Accepted*.
2. Jinyu Zhao, Haifeng Sun, Jingyu Wang, Qi Qi, Zirui Zhuang, Shimin Tao and Jianxin Liao. "CONFPLOT: A Pilot for Faster Configuration by Learning from Device Manuals." In 2023 *IEEE International Conference on Distributed Computing Systems (ICDCS'23)*. Hongkong, China, July 2023. *Accepted*.
3. Menghao Zhang, Jingyu Wang, Jing Wang, Qi Qi, Zirui Zhuang, Haifeng Sun, and Ning Xiao. "Robust Video Anomaly Detection Framework via Prior Knowledge and Multi-Path Frame Prediction." In 2023 *IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP'23)*. Rhodes Island, Greece, June 2023. *Accepted*.
4. Zhixian Chu, Lingqi Guo, Jingyu Wang, Qi Qi, Zirui Zhuang, Haifeng Sun, Cheng Zhou. "HIRN: A Hierarchical Intent Refinement Approach for Dependable Network Slicing with Multi-path Resource Allocation," in The 53rd Annual IEEE/IFIP International Conference on Dependable Systems and Networks (DSN'23), Porto, Portugal, June 2023. *Accepted*.
5. Peng Zhan, Guangyi Qin, Xingxin Qian, Xiong Wang, Jing Ren, Zirui Zhuang, and Shizhong Xu. "Deep Reinforcement Learning Based Fast Anomaly Detection and Localization for Programmable Networks." In 2023 *IEEE International Conference on Communications (ICC'23)*. Rome, Italy, May 2023. *Accepted*.
6. Chen Hu, Lei Zhang, Dezhi Chen, Zirui Zhuang, Qi Qi, Cong Liu, Jianxin Liao, and Jingyu Wang. "Digital Twins-Based Multi-Agent Deep Reinforcement Learning for UAV-Assisted Vehicle Edge Computing." In The 2022 *IEEE International Conference on Ubiquitous Intelligence and Computing (UIC'22)*. Haikou, China, December 2022.

7. Shaoxiong Zhu, Qi Qi, Zirui Zhuang, Jingyu Wang, Haifeng Sun, and Jianxin Liao. "FedNKD: A Dependable Federated Learning Using Fine-Tuned Random Noise and Knowledge Distillation." In *2022 ACM International Conference on Multimedia Retrieval (ICMR'22)*, 185–193. Newark, NJ, USA, June 2022.
8. Yixiao Li, Lixiang Li, Zirui Zhuang, Yuan Fang, and Yixian Yang. "ResNet Approach for Coding Unit Fast Splitting Decision of HEVC Intra Coding." In *2021 IEEE Sixth International Conference on Data Science in Cyberspace (DSC'21)*, 130–135. IEEE, October 2021.
9. Bo He, Jingyu Wang, Qi Qi, Haifeng Sun, Zirui Zhuang, Cong Liu, and Jianxin Liao. "DeepHop on Edge: Hop-by-Hop Routing by Distributed Learning with Semantic Attention." In *International Conference on Parallel Processing (ICPP'20)*, 1–11, August 2020.
10. Zirui Zhuang, Jingyu Wang, Qi Qi, Jianxin Liao, and Zhu Han. "Adaptive and Robust Network Routing Based on Deep Reinforcement Learning with Lyapunov Optimization." In *IEEE/ACM International Symposium on Quality of Service (IWQoS'20)*, 1–10. IEEE, June 2020.
11. Yu Zhang, Zirui Zhuang, Feifei Gao, Jingyu Wang, and Zhu Han. "Multi-Agent Deep Reinforcement Learning for Secure UAV Communications." In *IEEE Wireless Communications and Networking Conference (WCNC'20)*, 1–5. IEEE, May 2020.
12. Zirui Zhuang, Jingyu Wang, Qi Qi, Haifeng Sun, and Jianxin Liao. "A Case-Based Decision System for Routing in Packet-Switched Networks." In *IEEE International Performance Computing and Communications Conference (IPCCC'18)*, 1–2. IEEE, November 2018.
13. Zirui Zhuang, Jingyu Wang, Qi Qi, Haifeng Sun, and Jianxin Liao. "Graph-Aware Deep Learning Based Intelligent Routing Strategy." In *IEEE Conference on Local Computer Networks (LCN'18)*, 441–444. IEEE, October 2018.
14. Yunming Xiao, Haifeng Sun, Zirui Zhuang, Jingyu Wang, and Qi Qi. "Common Knowledge Based Transfer Learning for Traffic Classification." In *IEEE Conference on Local Computer Networks (LCN'18)*, 311–314. IEEE, October 2018.

## TEACHING EXPERIENCE

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### Beijing University of Posts and Telecommunications, Beijing, China

- *Guest Lecturer, Undergraduate*
  - *The Introduction of Software-Defined Networking*
  - **Spring, 2023**
  - *Principles of Computer Organization*
  - **Spring, 2023**
- *Guest Lecturer, Undergraduate*

- *The Evolution of Information Technology*
- **Fall, 2021, 2022**

## **HOBBY**

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Swimming, cycling, and weight-lifting.