Hao **Luo**

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Research Interest

Wireless Communication, Wireless Sensing, Machine Learning (ML), Edge Computing

Education

Arizona State University — *Tempe, Arizona, United States*

Ph.D. in Electrical Engineering — *Aug. 2022 - Present*

- Wireless Intelligence Lab. Advised by Prof. Ahmed Alkhateeb

National Taiwan University — *Taipei, Taiwan*

M.S. in Electrical Engineering — *Feb. 2020 - Jan. 2022*

- Wireless Mobile Network Lab. Advised by Prof. Hung-Yu Wei

National Taiwan University — *Taipei, Taiwan*

B.S. in Electrical Engineering — *Sep. 2015 - Jan. 2020*

Publications

Journals

1. Yao Chiang, Yi Zhang, Hao Luo, Tse-Yu Chen, Guan-Hao Chen, Huan-Ting Chen, Yan-Jhu Wang, Hung-Yu Wei, and Chun-Ting Chou, "Management and Orchestration of Edge Computing for IoT: A Comprehensive Survey," *IEEE Internet of Things Journal*, Volume 10, Issue 16, Page 14307 - 14331, Aug. 2023
2. Hao Luo and Hung-Yu Wei, "Resource Orchestration at the Edge: Intelligent Management of mmWave RAN and Gaming Application QoE Enhancement," *IEEE Transactions on Network and Service Management*, Volume 20, Issue 1, Page 385-399, Mar. 2023
3. Po-Yuan Su, Yi-Chia Wei, Hao Luo, Chi-Hung Liu, Wen-Yi Huang, Kuan-Fu Chen, Ching-Po Lin, Hung-Yu Wei, and Tsong-Hai Lee, "Machine Learning Models for Predicting Influential Factors of Early Outcomes in Acute Ischemic Stroke," *JMIR Medical Informatics*, Volume 10, Issue 3, Mar. 2022
4. Wen-Chin Huang, Hao Luo, Hsin-Te Hwang, Chen-Chou Lo, Yu-Huai Peng, Yu Tsao, and Hsin-Min Wang, "Unsupervised Representation Disentanglement using Cross Domain Features and Adversarial Learning in Variational Autoencoder based Voice Conversion," *IEEE Transactions on Emerging Topics in Computational Intelligence*, Volume 4, Issue 4, Page 468–479, Apr. 2020

Peer-reviewed Conferences and Workshops

1. Hao Luo and Ahmed Alkhateeb, "Digital Twin Aided Compressive Sensing: Enabling Site-Specific MIMO Hybrid Precoding," *Asilomar*, 2024
2. Hao Luo, Umut Demirhan and Ahmed Alkhateeb, "ISAC with Backscattering RFID Tags: Joint Beamforming Design," *IEEE ICC*, 2024
3. Hao Luo and Ahmed Alkhateeb, "Integrated Imaging and Communication with Reconfigurable Intelligent Surfaces," *Asilomar*, 2023
4. Hao Luo, Umut Demirhan and Ahmed Alkhateeb, "Millimeter Wave V2V Beam Tracking using Radar: Algorithms and Real-World Demonstration," *EUSIPCO*, 2023
5. Abdelrahman Taha, Hao Luo, and Ahmed Alkhateeb, "Reconfigurable Intelligent Surface Aided Wireless Sensing for Scene Depth Estimation," *IEEE ICC*, 2023
6. Hao Luo and Hung-Yu Wei, "Machine Learning Based mmWave Orchestration for Edge Gaming QoE Enhancement," *IEEE VTC-Fall*, 2021

Research Experience

Nokia Bell Labs — *New Jersey, United States*

Research Intern, Reported to Dr. Saeed Khosravirad — *Jun. 2024 - Aug. 2024*

Project: Digital Twin Aided CSI Compression and Feedback

(The duties of this project can not be shared before its prospective conference paper is submitted)

Wireless Intelligence Lab, Arizona State University — *Tempe, Arizona, United States*

Graduate Research Associate, Advised by Prof. Ahmed Alkhateeb — *Aug. 2022 - Present*

Project 1: Digital Twin Aided Wireless Systems (Active)

Project 2: Integrated Sensing and Communication with Backscattering RFID Tags

- Formulated the ISAC-backscattering beamforming design problem to meet the requirements of tag interrogation and communication SINR.
- Proposed to leverage zero-forcing to design the beamforming vectors, and solve a convex optimization problem to determine the transmit power allocation between sensing and communication beams.
- Developed a joint design of sensing and communication beams while minimizing the transmit power.
- Publications: One accepted conference paper.

Project 3: Integrated Imaging and Communication with Reconfigurable Intelligent Surfaces (RIS)

- Proposed a novel RIS-aided integrated imaging and communication system that utilizes the high spatial dimensions of the RIS for depth estimation of the surrounding environment.
- Developed a user detection algorithm to extract user positions from the depth map, enabling the design of an RIS interaction vector for communication.
- Designed an efficient beam selection strategy, incorporating a pre-defined RIS interaction codebook, to optimize communication with minimal overhead
- Publications: One accepted conference paper.

Project 4: Radar-aided mmWave Beam Tracking for V2V Communication

- Formalized the radar-aided beam tracking problem by considering practical communication and radar models.
- Developed two LSTM-based approaches with the combination of various degrees of radar signal processing and machine learning.
- Evaluated the performance of the proposed solutions on real-world data collected with the V2V testbed of the DeepSense 6G dataset.
- Publications: One published conference paper.

Project 5: Reconfigurable Intelligent Surfaces Aided Wireless Sensing for Depth Estimation

- Proposed a general RIS-aided wireless sensing framework.
- Designed a specific RIS interaction codebook for depth estimation.
- Developed a signal processing approach for building high-resolution depth map.
- Publications: One published conference paper.

Wireless Mobile Network Lab, National Taiwan University

Taipei, Taiwan

Master Student, Advised by Prof. Hung-Yu Wei

Feb. 2020 - Jan. 2022

Project 1: Edge Orchestration for Intelligent mmWave Management and Gaming Application QoE Enhancement

- Proposed a sequence-to-sequence learning (Seq2Seq) based mmWave beam tracking model for codebook-based beamforming design.
- Researched on resource management strategies for ML-aided wireless communication systems supported by edge computing techniques.
- Studied the scenario of ML-based network management algorithms and user applications operating on a shared edge computing platform.
- Publications: One published conference paper, one accepted journal article, and the M.S. thesis.

Project 2: Edge Computing Platform Prototyping

- Implemented an edge computing system aligned with the IEEE P1935 Standard using Python scripts, Kubernetes, and Openstack.
- Designed UI for P1935-compliant edge computing system to support the management and orchestration of applications and resources.

Project 3: Machine Learning Based Prediction of Early Outcomes in Stroke Patients

- Studied ML development, validation and model analysis for predicting Discharge-mRS and deterioration of stroke patients.
- Publication: One published journal article.

Speech, Language and Music Processing Lab, Academia Sinica

Taipei, Taiwan

Research Intern, Advised by Prof. Hsin-Min Wang

Jul. 2018 - Feb. 2020

Project: Variational Autoencoder Based Voice Conversion with Adversarial Learning

- Improved the cross-domain variational autoencoder (VAE) voice conversion model by introducing generative adversarial networks (GANs) and domain adversarial training.
- Analyzed the degree of disentanglement of the voice conversion model to achieve enhanced latent representation.
- Publication: one published journal article.

Honors & Awards

2023 **Winner**, Qualcomm Innovation Fellowship (North America)

2023 **Finalist**, Meta PhD Research Fellowship for AR/VR Wireless

2020 **Second Place**, ViWi Vision-Aided Millimeter Wave Beam Tracking Competition (ViWi-BT) at ICC 2020

Skills

Programming Languages Python, Matlab

Software Knowledge Pytorch, Tensorflow, Blender, Wireless Insite

Professional Activities

Technical Reviewer IEEE TCOM, IEEE TCCN, IEEE JSTSP