# 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
- Thesis: "Orchestration of Machine Learning Aided mmWave System for Mobile Edge Gaming QoE Enhancement"
- GPA: 4.17/4.3 (4.0/4.0)

### 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, Umut Demirhan and Ahmed Alkhateeb, "Millimeter Wave V2V Beam Tracking using Radar: Algorithms and Real-World Demonstration," *EUSIPCO*, 2023
2. Abdelrahman Taha, Hao Luo, and Ahmed Alkhateeb, "Reconfigurable Intelligent Surface Aided Wireless Sensing for Scene Depth Estimation," *IEEE ICC*, 2023
3. Hao Luo and Hung-Yu Wei, "Machine Learning Based mmWave Orchestration for Edge Gaming QoE Enhancement," *IEEE VTC-Fall*, 2021

## Research Experience

### Wireless Intelligence Lab, Arizona State University *(Prof. Ahmed Alkhateeb)*
*Tempe, Arizona, United States*

GRADUATE RESEARCH ASSOCIATE — *Aug. 2022 - Present*

**Project 1: 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 2: 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 3: 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 *(Prof. Hung-Yu Wei)*** *Taipei, Taiwan*

Master Student *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 *(Prof. Hsin-Min Wang)*** *Taipei, Taiwan*

Research Intern *Jul. 2018 - Feb. 2020*

**Project 1: 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.

**Project 2: Speech Enhancement for Electrolarynx Speech**

- Studied speech enhancement for electrolarynx speech using voice conversion and speech synthesis techniques.

## 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

## Teaching Experience

**National Taiwan University** *Taipei, Taiwan*

Computer Programming Laboratory, Teaching Assistant *2020, Fall*

- Designed C++ practice problems for students every week.
- Provided homework consultancy for students 3 hours per week.

## Selected Courses

**Arizona State University** Digital & Wireless Communication, Advanced Probability Theory
**National Taiwan University** Introduction to Wireless and Mobile Networking, Personal Communications Services, Machine Learning, Convex Optimization, Algorithms, Data Structure and Programming, Information Theory

## Skills

**Programming Languages** Python, Matlab, Javascript, HTML/CSS, C/C++
**Software Knowledge** Pytorch, Tensorflow, Blender, Wireless Insite

## Professional Activities

**Technical Reviewer** IEEE TCOM, IEEE TCCN, IEEE JSTSP