Zhenlin An | CV

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Education

The Hong Kong Polytechnic University — **Hong Kong SAR**
Ph.D. in Computer Science, — *2017.8–2021.10*

Dalian University of Technology — **Dalian, China**
B.E. degree in Electronic Information Engineering, — *2013.9–2017.7*

Experience

University of Pittsburgh — **Pittsburgh, PA**
Postdoctoral Associate at Department of Computer Science — *2024.7–present*
Advised by Longfei Shangguan, Kyle Jamieson (InterDigtial: John Kaewell, Philip Pietraski, NIST: Camillo Gentile)
***Note**: (1) Differentiable ray tracing system with neural networks for radio environment modeling, with a focus on FR3/mmwave. (2) Zero-shot vision guided (CLIP/NERF) radio/acoustic material learning for radio/sound propagation modeling.*

Princeton University — **Princeton, NJ**
Postdoctoral Research Associate at Department of Computer Science — *2023.12–2024.7*
Advised by Prof. Kyle Jamieson, Dr. Longfei Shangguan (InterDigtial: **John Kaewell** and **Philip Pietraski**)
***Note**: Develop a differentiable ray tracing system with neural networks for radio environment modeling, channel prediction, and wireless digital twin using TensorFlow and Nvidia Sionna. Modeling the moving human impact.*

The Hong Kong Polytechnic University — **Hong Kong SAR**
Postdoctoral Fellow, funded by PolyU Postdoc Matching Fund — *2021.11-2023.11*
Advised by Dr. Lei Yang
***Note**: (1) Design a NeRF-like neural ray tracing system (NeRF^2) for enhancing 5G FDD channel prediction and BLE/RFID localization: Best paper runner-up in MobiCom 2023. (2) Developed acoustic backscatter sensor networks for in-concrete health monitoring, including acoustic energy harvesting and communication hardware/software, presented at SIGCOMM 2022.*

Alolo Technology Limited (start-up) — **Hong Kong SAR**
Co-founder and Engineering Consultants for BLE-Vision localization System — *2022.12–2023.8*
***Note**: System design for BLE 5.1 Array and Vision co-localization platform for BLE tags. Focusing on developing low-level array signal processing algorithm and self-supervised deep learning based dual modality localization model.*

Huawei Technolgoies — **Shenzhen, China**
Research Intern in 2012 Lab on deep learning based RFID localization/beamforming. — *2020.6-2020.12*
***Note**: 1. Develop CNN-based RFID localization algotirhm for distributed antenna array. 2. Develop reinforcement learning based beamforming algorithms to improve the reading rates of RFID systems in complex warehouses. (two patents)*

Summary

- **(I) Summary of Research:** My research interests focus on AI-driven NextG wireless systems, particularly in the PHY/MAC layer design, wireless sensing and localization, passive IoT/backscatter communication, and wireless security. I specialize in developing and applying machine learning models for wireless channel prediction, indoor localization, and RF-Vision multi-modality sensing and have deep research on backscatter/RFID PHY and MAC layer optimization. I am the recipient of the ACM China SIGBED Doctoral Dissertation Award, ACM MobiCom Best Paper Runner-up, and two IEEE SECON Best papers, ACM MobiCom Graduate Award.
- **(II) Summary of Publications:** A total of over 30 publications on top conferences/journals range from: MobiCom (9), INFOCOM (3), MobiSys(1), SIGCOMM (1), Sensys (1), S&P (1), UbiComp (1), TMC (6), TNET (4), TOSN (1). These works have garnered over 440 citations, with an h-index of 12.
- **(III) Keywords:** NextG Wireless, AI4Wireless, Sensing/localization, acoustic, Backscatter, Wireless Security
- **(IV) Selected Publications**:
  - Xiaopeng Zhao, **Zhenlin An(corresponding author)**, Qingrui Pan, Lei Yang, "NeRF2: Neural Radio-Frequency Radiance Fields", In *Proc. of ACM MobiCom*, 2023. Best Paper Award Runner-up.
    ***Note:** First introduce NeRF-like neural rendering into the RF domain and demos SOTA performance in 5G channel prediction, BLE and RFID localization.*

- **Zhenlin An**, Qiongzheng Lin, Lei Yang, Yi Guo, and Ping Li, "Localizing RFIDs in Pixel Dimensions" in *ACM Transactions on Sensor Network*, 2022. Best Paper Award in IEEE SECON.
  Note: *First design a radio-vision co-localization platform for RFID tag tracking in robots.*
- **Zhenlin An**, Qiongzheng Lin, Ping Li, Lei Yang, "General-Purpose Deep Tracking Platform across Protocols for the Internet of Things", In *Proc. of ACM MobiSys*, 2020.
  Note: *First to propose an extra-large array with a deep learning localization algorithm for UHF IoT devices.*
- **Zhenlin An**, Qiongzheng Lin, Lei Yang, Yi Guo, "Revitalizing Ultrasonic Positioning Systems for Ultrasound-Incapable Smart Devices", in *IEEE Trans on Mobile Computing*, 2020. (Also in ACM MobiCom)
  Note: *First to propose an ultrasound positioning system for normal microphones using intermodulation.*

Skills

- **Programming**: Python; Matlab; C/C++
- **Platform**: Tensorflow, Pytorch; Nvidia Sionna; Bluetooth (Silicon Lab EFR32); Microcontroller (MSP430, ESP32, Arduino); PCB design (Altium Designer); Antenna Simulation and Design (CST); Android Studio;
- **Tool**: VNA, Spectrum Analyzer, USRP and GNU Radio, WARP (WiFi), RFID (Impinj)
- **Domain Knowledge**: RFID, WiFi PHY, BLE, array signal processing, wireless networking, communication theory, ray tracing, machine learning, embedded system

Awards and Honors

- **Best Paper Award Runner-up, ACM MobiCom** 2023
- Graduate Award, ACM MobiCom 2023
- **Best Paper Award, IEEE SECON** 2023
- **ACM SIGBED China Doctoral Dissertation Award** 2022
- Best Demo Award Runner-up (2/20), ACM MobiCom 2022
- **Best Paper Award (1/129), IEEE SECON** 2020
- Best-In-Session Presentation Award, IEEE INFOCOM 2019
- Student Travel Grant, IEEE INFOCOM 2019
- Best Demo Award Runner-up (2/27), ACM MobiCom 2018
- Outstanding Graduate, Dalian University of Technology 2017
- Meritorious Winner, Interdisciplinary Contest in Modeling (ICM) 2016
- Gold Award, International Visual Designer for Arduino Competition, Labcenter Electronics 2016

Publications

* indicates students I mentored, Google Scholar Page

Conference Papers

[C1] **Zhenlin An**, Shangguan Longfei, Kaewell John, Pietraski Philip, and Kyle Jamieson. "RadioTwin: A Digital Building Material Twin for Wideband, Cross-link, Cross-band Wireless Channel Prediction". In: *Submission*.

[C2] Donghui Dai*, **Zhenlin An (Co-first Author)**, and Lei Yang. "Inducing wireless chargers to voice out for inaudible command attacks". In: *IEEE Symposium on Security and Privacy (SP)*. 2023.

[C3] Zheng Gong*, **Zhenlin An (corresponding author)**, Donghui Dai, Jingyu Tong, Shuijie Long, and Lei Yang. "Enabling cross-medium wireless networks with miniature mechanical antennas". In: *Proc. of ACM MobiCom*. 2024.

[C4] Jingyu Tong*, **Zhenlin An**, Xiaopeng Zhao, Sicong Liao, and Lei Yang. "In-Sensor Machine Learning: Radio Frequency Neural Networks for Wireless Sensing". In: *Proc. of ACM MobiHoc*. 2024.

[C5] Donghui Dai*, **Zhenlin An**, Zheng Gong, Qingrui Pan, and Lei Yang. "{RFID+}: Spatially Controllable Identification of {UHF}{RFIDs} via Controlled Magnetic Fields". In: *Proc. of USENIX NSDI*. 2024.

[C6] Xueyuan Yang*, **Zhenlin An**, Qingrui Pan, Lei Yang, Dangyuan Lei, and Yulong Fan. "Binary Optical Machine Learning: Million-Scale Physical Neural Networks with Nano Neurons". In: *Proc. of ACM MobiCom*. 2024.

[C7] Xiaopeng Zhao*, **Zhenlin An (corresponding author)**, Qingrui Pan, and Lei Yang. "NeRF2: Neural Radio-Frequency Radiance Fields". In: *Proc. of ACM MobiCom*. (Best Paper Runner-up). 2023.

[C8] Donghui Dai*, **Zhenlin An**, Qingrui Pan, and Lei Yang. "Magcode: Nfc-enabled barcodes for nfc-disabled smartphones". In: *Proc. of ACM MobiCom*. 2023.

[C9] **Zhenlin An**, Qiongzheng Lin, Xiaopeng Zhao, Lei Yang, Dongliang Zheng, Guiqing Wu, and Shan Chang. "One tag, two codes: Identifying optical barcodes with NFC". In: *Proc. of ACM MobiCom*. 2021.

[C10] Qingrui Pan*, **Zhenlin An (Co-first author)**, Xueyuan Yang, Xiaopeng Zhao, and Lei Yang. "RF-DNA: Large-scale physical-layer identifications of RFIDs via dual natural attributes". In: *Proc. of ACM MobiCom*. 2022.

[C11] Zheng Gong*, Lubing Han, **Zhenlin An (corresponding author)**, Lei Yang, Siqi Ding, and Yu Xiang. "Empowering smart buildings with self-sensing concrete for structural health monitoring". In: *Proc. ACM SIGCOMM 2022*. (Best Demo Runner-up). 2022.

[C12] **Zhenlin An**, Qiongzheng Lin, Qingrui Pan, and Lei Yang. "Turbocharging deep backscatter through constructive power surges with a single RF source". In: *Proc. of IEEE INFOCOM*. IEEE. 2021.

[C13] **Zhenlin An**, Qiongzheng Lin, Ping Li, and Lei Yang. "General-purpose deep tracking platform across protocols for the internet of things". In: *Proc. of ACM MobiSys*. 2020.

[C14] **Zhenlin An**, Qiongzheng Lin, Lei Yang, and Xie Lei. "Activating wireless voice for e-toll collection systems with zero start-up cost". In: *Proc. of IEEE INFOCOM*. 2020.

[C15] **Zhenlin An**, Qiongzheng Lin, Lei Yang, and Wei Lou. "Embracing tag collisions: Acquiring Bloom filters across RFIDs in physical layer". In: *Proc. of IEEE INFOCOM*. 2019.

[C16] Qiongzheng Lin (Co-first Author), **Zhenlin An (Co-first Author)**, and Lei Yang. "Rebooting ultrasonic positioning systems for ultrasound-incapable smart devices". In: *Proc. of ACM MobiCom*. 2019.

[C17] **Zhenlin An**, Qiongzheng Lin, and Lei Yang. "Cross-Frequency Communication: Near-Field Identification of UHF RFIDs with WiFi!" In: *Proc. of ACM MobiCom*. (Best Demo Runner-up). 2018.

[C18] Xiaopeng Zhao*, Shen Wang, **Zhenlin An**, and Lei Yang. "Crowdsourced Geospatial Intelligence: Constructing 3D Urban Maps with Satellitic Radiance Fields". In: *Proc. of ACM UbiComp* 8.3 (2024).

[C19] Qingrui Pan*, **Zhenlin An**, Xiaopeng Zhao, and Lei Yang. "Revisiting Backscatter Frequency Drifts for Fingerprinting RFIDs: A Perspective of Frequency Resolution". In: *Proc. of IEEE SECON*. (Best Paper Award). 2023.

[C20] Sicong Liao*, **Zhenlin An**, Qingrui Pan, Xiaopeng Zhao, Jingyu Tong, and Lei Yang. "XiTuXi: Sealing the Gaps in Cross-Technology Communication by Neural Machine Translation". In: *Proc. of ACM Sensys*. 2023.

[C21] Qiongzheng Lin, Lei Yang, **Zhenlin An**, Yi Guo, and Ping Li. "RFCamera: Identifying RFIDs in Pixel Dimensions". In: *Proc. of IEEE SECON*. (Best Paper Award). 2020.

[C22] Lei Yang, Qiongzheng Lin, Chunhui Duan, and **Zhenlin An**. "Analog on-tag hashing: Towards selective reading as hash primitives in Gen2 RFID systems". In: *Proc. of ACM MobiCom*. 2017.

Journal Papers

[J1] Donghui Dai*, **Zhenlin An**, Qingrui Pan, and Lei Yang. "Harnessing NFC to Generate Standard Optical Barcodes for NFC-Missing Smartphones". In: *IEEE Transactions on Mobile Computing* (2024).

[J2] Yanni Yang, **Zhenlin An**, Jiannong Cao, Yanwen Wang, Pengfei Hu, Guoming Zhang, and Xiuzhen Cheng. "Jump out of Resonance: A Practical NFC Tag Fingerprinting Scheme". In: *IEEE Transactions on Mobile Computing* (2024).

[J3] Qingrui Pan*, **Zhenlin An**, Xiaopeng Zhao, and Lei Yang. "The Power of Precision: High-Resolution Backscatter Frequency Drift in RFID Identification". In: *IEEE Transactions on Mobile Computing* (2023).

[J4] Xueyuan Yang*, **Zhenlin An**, Xiaopeng Zhao, and Lei Yang. "Transfer Beamforming via Beamforming for Transfer". In: *IEEE Transactions on Mobile Computing* (2023).

[J5] **Zhenlin An**, Qiongzheng Lin, Lei Yang, and Lei Xie. "Tagcaster: Activating Wireless Voice of Electronic Toll Collection Systems With Zero Start-Up Cost". In: *IEEE/ACM Transactions on Networking* 30.5 (2022).

[J6] **Zhenlin An**, Qiongzheng Lin, Lei Yang, Yi Guo, and Ping Li. "Localizing RFIDs in pixel dimensions". In: *ACM Transactions on Sensor Networks* (2022).

[J7] **Zhenlin An**, Lei Yang, and Qiongzheng Lin. "Identifying UHF RFIDs in Range of Readers With WiFi". In: *IEEE/ACM Transactions on Networking* 01 (2021).

[J8] **Zhenlin An**, Qiongzheng Lin, Lei Yang, Wei Lou, and Lei Xie. "Acquiring bloom filters across commercial rfids in physical layer". In: *IEEE/ACM Transactions on Networking* 28.4 (2020).

[J9] **Zhenlin An**, Qiongzheng Lin, Lei Yang, and Yi Guo. "Revitalizing ultrasonic positioning systems for ultrasound-incapable smart devices". In: *IEEE Transactions on Mobile Computing* 20.5 (2020).

[J10] Ping Li, **Zhenlin An**, Lei Yang, Panlong Yang, and QiongZheng Lin. "RFID harmonic for vibration sensing". In: *IEEE Transactions on Mobile Computing* 20.4 (2019).

Patents

Patents

[P1] Donghui Dai, **Zhenlin An**, Qingrui Pan, and Lei Yang. "Near field communication method and system based on camera magnetic field interference". CN116132956B (China). 2023.

[P2] Yanni Yang, Sen Jia, Dongxiao Yu, Peng Wang, **Zhenlin An**, Huafeng Xu, Jiannong Cao, Entao Sun, and Chao Du. "Passive signal measuring device and measuring method based on millimeter wave radar". CN115436938A (China). 2023.

[P3] Qingrui Pan, **Zhenlin An**, Xiaopeng Zhao, and Lei Yang. "Antenna array optimization method, device, terminal and storage medium". CN115377702A (China). 2022.

[P4] **Zhenlin An**, Xueyuan Yang, Lei Yang, Yuan Li, Hong Liu, Jia Jia, and Renhui Sun. "Communication system, communication method and communication device". CN116263868A (China). Huawei Technologies. 2021.

[P5] Xiaopeng Zhao, **Zhenlin An**, Lei Yang, Jia Jia, Renhui Sun, and Hong Liu. "Positioning server, positioning method and back reflection communication system". CN116437435A (China). Huawei Technologies. 2021.

[P6] Qiongzheng Lin, **Zhenlin An**, and Lei Yang. "Image positioning method and device based on rotary antenna and terminal equipment". CN116437435A (China). 2019.

Invited Talks

- 2024-10-08,"Neural Radio-Frequency Radiance Fields", Rensselaer Polytechnic Institute, host: Dr. Ish Jain
- 2024-09-27,"Advancements in Wireless Sensing", Palantir Technologies, host: Dr. Di Wang
- 2024-07-18,"Learning to understand radio environment", Microsoft, host: Prof. Lili Qiu
- 2024-06-18,"RadioTwin", Interdigital Long Island Research Center, host: John Kaewell
- 2023-06-30,"Neural Radio Frequency Radiance Field", Dalian University of Technology, host: Prof. Chi Lin

Professional Activities

Referee for submissions to journals:
Transactions on Networking, Transactions on Mobile Computing, Internet of Things Journal, Transactions on Dependable and Secure Computing, Transactions on Sensor Networks, Transactions on Internet of Things, Embedded Systems Letters, Journal of Radio Frequency Identification, Transactions on Information Forensics and Security, Transactions on Automation Science and Engineering, Nature Science Reports, International Journal of Communication Systems, Journal of Computer Science and Technology

Referee for submissions to conferences:

- 2024 IEEE ICPADS, ICA3PP, ACM MobiCom Artifacts

- 2023 IEEE ICPADS, ACM MobiCom Artifacts, ACM MobiArch
- 2022 IEEE ICPADS, EAI MobiQuitous, ACM SIGCOMM SRC Juror