

Xiangyu Wang

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Research Interests

My research pursuits encompass the domains of wireless systems, mobile computing, and Internet of Things(IoT). In recent times, my attention has been directed towards the utilization of deep learning techniques and advanced signal processing to address practical wireless sensing issues encountered in the real world, hence boosting IoT application.

Education

Auburn University Jan. 2018 - Dec. 2022

PhD in Electrical and Computer Engineering Advisor: Dr. Shiwen Mao

- Dissertation: Fingerprinting-based Indoor Localization with Deep Neural Networks

Auburn University Aug. 2015 - Dec. 2017

Master of Science in Electrical and Computer Engineering Advisor: Dr. Shiwen Mao

- Thesis: WiFi Fingerprinting based Indoor Localization: When CSI Tensor Meets Deep Residual Sharing Learning

Taiyuan Institute of Technology Sep. 2010 – July 2014

Bachelor of Science in Electronic Engineering

Work Experience

Auburn University RFID Lab Auburn, Alabama

Postdoctoral Fellow, Team Leader Feb. 2024 - Current

- Explored RFID networks for resolving signal collisions between many RFID readers in order to extend reading range and improve real-time inventory and sensing.
- Mentored and guided master's and Phd students in their research projects and academic development. Provided support in thesis writing, research methodologies, and technical skills. Led the team to complete external projects with industrial partners.

SML USA Raleigh, North Carolina

Embedded Software Engineer Feb. 2023 - Dec. 2023

- Built a 77GHz mmWave FMCW Radar testbed and used it to construct a dual-radar indoor localization system based on Robot Operating System(ROS). The distance error is lower than 10cm.
- Investigated mmWave-based target identification. Prototyped a passive smart surface to assess the viability of target detection through the utilization of mmWave technology.

Auburn University AWSM Lab Auburn, Alabama

Research Assistant Feb. 2017 - Dec.2022

- Developed a two-layer Deep Gaussian Process(DGP) model to generate indoor radio maps from a small number of bimodal signal strengths, and achieved 1-meter localization accuracy by combining LSTM with signal uncertainty estimation from DGP by means of auxiliary learning.
- Co-developed a variation of ResNet for utilizing bimodal information, phase and amplitude, from Channel State Information(CSI) to enhance the localization accuracy of fingerprinting-based indoor localization systems. **[US Provisional Patent Application, Application Number: 62/741,723, Oct. 5, 2018.]**
- Proposed and deployed a Deep Convolutional Neural Network(DCNN) using Angle of Arrival(AoA) information from CSI for indoor localization. It is the first work to employ DCNN for fingerprinting-based indoor localization.
- Assisted in the implementation of Linux 802.11n measurement and experimentation platform, and developed a testbed for indoor localization systems using the platform.

Auburn University RFID Lab Auburn, Alabama

Graduate Research Assistant Mar. 2016 - Dec.2022

- Designed and prototyped a passive UHF RFID tag localization framework by taking advantage of Swin Transformer and DCNN to alleviate the intrinsic problem of the fingerprinting method. Employed contrastive learning to enhance the transferability of the framework and achieve centimeter-level localization.
- Investigated the connection between the phase readings of passive UHF RFID tags and the tag temperature, recovered lost phase readings due to high temperature using tensor completion, and implemented a Gaussian process model for tag temperature estimation based on the investigated connection.
- Implemented an RFID data collection system using CUDA GPU programming. Leveraged Robot Operating System(ROS) to synchronize the collected RFID data and the ground truth provided by the Kinect V2 equipped with a skeleton tracking algorithm.
- Co-designed a Unmanned Aerial Vehicles(UAV) pose estimation system, which computes the 6 Degrees of Freedom(DoF) pose of the UAV using commercial passive UHF RFID system.
- Co-designed an interactive Human-Computer Interaction(HCI) system to control a remote UAV by leveraging the high accuracy RFID localization results.
- Deployed a phase localization prototype using the commercial RFID system to localize the passive UHF RFID tag with centimeter-level accuracy in an aircraft cabin.

Publications

I have published **25 research papers** in high-impact venues for wireless sensing, indoor localization, and artificial intelligence of things (AIoT). These papers have obtained more than **1000 citations**.

Google Scholar: <https://scholar.google.com/citations?user=d62Bii8AAAAJ&hl=en>

Journal & Magazine Publications

- **Xiangyu Wang**, Jian Zhang, Shiwen Mao, Senthilkumar C.G. Periaswamy, and Justin Patton, "A Framework for Locating Multiple RFID Tags Using RF Hologram Tensors," Elsevier Digital Communications and Networks, Dec.2023. DOI:10.1016/j.dcan.2023.12.004 **IF:7.9**
- **Xiangyu Wang**, Zhitao Yu, Shiwen Mao, Jian Zhang, Senthilkumar C.G. Periaswamy, and Justin Patton, "MapLoc: LSTM-Based Location Estimation Using Uncertainty Radio Map," IEEE Internet of Things Journal, vol. 10, no. 15, pp. 13474-13488, Aug. 2023. **IF:10.6**
- **Xiangyu Wang**, Xuyu Wang, Shiwen Mao, Jian Zhang, Senthilkumar C.G. Periaswamy, and Justin Patton, "Adversarial deep learning for indoor localization," IEEE Internet of Things Journal, vol.9, no.19, pp.18182-18194, Oct. 2022. **IF:10.6**
- **Xiangyu Wang**, Xuyu Wang, and Shiwen Mao, "Indoor fingerprinting with bimodal CSI tensors: A deep residual sharing learning approach," IEEE Internet of Things Journal, vol.8, no.6, pp.4498-4513, Mar. 2021. **IF:10.6**
- **Xiangyu Wang**, Xuyu Wang, Shiwen Mao, Jian Zhang, Senthilkumar CG Periaswamy, and Justin Patton, "Indoor radio map construction and localization with deep Gaussian Processes," IEEE Internet of Things Journal, vol.7, no.11, pp. 11238-11249, Nov. 2020. **IF:10.6**
- **Xiangyu Wang**, Jian Zhang, Zhitao Yu, Shiwen Mao, Senthilkumar C.G. Periaswamy, and Justin Patton, "On remote temperature sensing using commercial UHF RFID tags," IEEE Internet of Things Journal, vol.6, no.6, pp. 10715-10727, Dec. 2019. **IF:10.6**
- Jian Zhang, **Xiangyu Wang**, Zhitao Yu, Yibo Lyu, Shiwen Mao, Senthilkumar CG Periaswamy, Justin Patton, and Xuyu Wang, "Robust RFID based 6-DoF localization for unmanned aerial vehicles," IEEE Access Journal, Special Section on Network Resource Management in Flying Ad Hoc Networks: Challenges, Potentials, Future Applications, and Wayforward, vol.7, no.1, pp. 77348-77361, June 2019.
- Jian Zhang, Zhitao Yu, **Xiangyu Wang**, Yibo Lyu, Shiwen Mao, Senthilkumar CG Periaswamy, Justin Patton, and Xuyu Wang, "RFHUI: An RFID based human-unmanned aerial vehicle interaction system in an indoor environment," Elsevier Digital Communications and Networks Journal, vol.6, no.1, pp.14-22, Feb. 2020.
- Xuyu Wang, **Xiangyu Wang**, and Shiwen Mao, "RF sensing for Internet of Things: A general deep learning framework," IEEE Communications, Feature Topic on Exploring Caching, Communications, Computing and Security for the Emerging Smart Internet of Things, vol.56, no.9, pp.62-67, Sept. 2018.
- Xuyu Wang, **Xiangyu Wang**, and Shiwen Mao, "Deep convolutional neural networks for indoor localization with CSI images," IEEE Transactions on Network Science and Engineering, Special Issue on Network Science for Internet of Things (IoT), vol.7, no.1, pp.316-327, Jan./Mar. 2020. (**No. 2/3/4 in Popular Documents: Oct. 2018 ~ June 2020**) (**Web of Science ESI Highly Cited Paper**)

Conference Publications

- Bernard Amoah, **Xiangyu Wang**, Jian Zhang, Shiwen Mao, Senthilkumar CG Periaswamy, and Justin Patton, "DCA-KEAE: A dynamic context-aware key exchange and adaptive encryption scheme for secure RFID systems," in Proc. IEEE ICC 2025, Montreal, Canada, June 2025.
- Bernard Amoah, **Xiangyu Wang**, Jian Zhang, Shiwen Mao, Senthilkumar Periaswamy, and Justin Patton, "RFID-Net: A network layer protocol for multiple RFID readers collaboration," in Proc. IEEE ICC 2025, Montreal, Canada, June 2025.
- Bernard Amoah, **Xiangyu Wang**, Jian Zhang, Shiwen Mao, Senthilkumar CG Periaswamy, and Justin Patton, "Decentralized neighborhood discovery and management in dense RFID systems," in Proc. 2024 IEEE International Conference on RFID Technology and Applications (RFID-TA 2024), Daytona Beach, FL, Dec. 2024
- Bernard Amoah, **Xiangyu Wang**, Jian Zhang, Shiwen Mao, Senthilkumar CG Periaswamy, and Justin Patton, "Optimizing adaptive power control for enhancing robustness in RFID sensing," in Proc. 2024 IEEE International Conference on RFID Technology and Applications (RFID-TA 2024), Daytona Beach, FL, Dec. 2024
- Prama Dutta, Jian Zhang, Bernard Amoah, **Xiangyu Wang**, Kanchon Kanti Podder, Shiwen Mao, "Enhancing RFID observations using masked autoencoders for improved indoor localization," in Proc. 2024 IEEE International Conference on RFID Technology and Applications (RFID-TA 2024), Daytona Beach, FL, Dec. 2024
- Junwei Ma, **Xiangyu Wang**, Shiwen Mao, Jian Zhang, Senthilkumar CG Periaswamy, Justin Patton, "Navigating Uncertainty: Ambiguity Quantification in Fingerprinting-based Indoor Localization," in Proc. IEEE AIoT 2024, Melbourne, Australia, July 2024, pp. 123-128.
- Junwei Ma, **Xiangyu Wang**, Caleb Powell, Jian Zhang, Shiwen Mao, Senthilkumar CG Periaswamy, Justin Patton, "Digital Twin of Retail Stores with RFID Tags Localization," in Proc. IEEE SpltTech 2024, Bol and Split, Croatia, June 2024, pp. 01-06.
- **Xiangyu Wang**, Jian Zhang, Shiwen Mao, Senthilkumar C.G. Periaswamy, and Justin Patton, "Locating multiple RFID tags with Swin Transformer-based RF hologram tensor filtering," in Proc. IEEE VTC-Fall 2022, London, UK, Sept. 2022.
- **Xiangyu Wang**, Jian Zhang, Shiwen Mao, Senthilkumar C.G. Periaswamy, and Justin Patton, "MulTLoc: RF hologram tensor filtering and upscaling for indoor localization using multiple UHF passive RFID tags," invited paper, in Proc. ICCCN 2021, Athens, Greece, July 2021.
- Mohini Patil, Xuyu Wang, **Xiangyu Wang**, and Shiwen Mao, "Adversarial attacks on deep learning-based floor classification and indoor localization," invited paper, in Proc. 2021 ACM Workshop on Wireless Security and Machine Learning (WiseML'21), Abu Dhabi, United Arab Emirates, June-July 2021, pp.7-12.
- **Xiangyu Wang**, Jian Zhang, Zhitao Yu, Eric Mao, Senthilkumar C. G. Periaswamy and Justin Patton, "RFThermometer: A Temperature Estimation System with Commercial UHF RFID Tags," in Proc. IEEE ICC 2019, Shanghai, China, May, 2019, pp.1-6.
- **Xiangyu Wang**, Xuyu Wang, Shiwen Mao, Jian Zhang, Senthilkumar C.G. Periaswamy, and Justin Patton, "DeepMap: Deep Gaussian Process for indoor radio map construction and location estimation," in Proc. IEEE GLOBECOM 2018, Abu Dhabi, United Arab Emirates, Dec. 2018, pp.1-7.
- Jian Zhang, Zhitao Yu, **Xiangyu Wang**, Yibo Lyu, Shiwen Mao, Senthilkumar C.G. Periaswamy, Justin Patton, and Xuyu Wang*, "RFHUI: An intuitive and easy-to-operate human-UAV interaction system for controlling a UAV in a 3D space," in Proc. EAI MobiQuitous 2018, New York City, NY, Nov. 2018, pp.69-76.

Conference Publications

- Xuyu Wang, **Xiangyu Wang**, and Shiwen Mao, "ResLoc: Deep residual sharing learning for indoor localization with CSI tensors," in Proc. IEEE PIMRC 2017, Montreal, QC, Canada, Oct. 2017. (**The IEEE PIMRC 2017 Best Student Paper Award**)
- Xuyu Wang, **Xiangyu Wang**, and Shiwen Mao, "CiFi: Deep convolutional neural networks for indoor localization with 5GHz Wi-Fi," in Proc. IEEE ICC 2017, Paris, France, May 2017, pp.1-6.

Funded Research

I assisted in the preparation of proposals for the following research grants:

- "Collaborative Research: CCSS: When RFID Meets AI for Occluded Body Skeletal Posture Capture in Smart Healthcare" NSF Communications, Circuits, and Sensing-Systems (CCSS) Program, July 22, 2023-July 31, 2026 (Estimated).
Total Awarded Amount: \$ 240,000.00 My role: main technical contributor
- "WiFiUS: RF Sensing in Internet of Things: When Deep Learning Meets CSI Tensor," NSF-CNS-1702957, April 15, 2017-March 31, 2019.
Total Awarded Amount: \$ 339,994.00 My role: main technical contributor
- "CCSS: Autonomous Drone and Ground Robot Cooperative Tasking in Complex Indoor Environments," NSF Communications, Circuits, and Sensing-Systems (CCSS) Program, August 1, 2019 - July 31, 2022.
Total Awarded Amount: \$ 438,894.00 My role: main technical contributor
- "Collaborative Research: CNS Core: Medium: Data Augmentation and Adaptive Learning for Next Generation Wireless Spectrum Systems," NSF-CNS-2107190, October 1, 2021 - September 30, 2024 (Estimated).
Total Awarded Amount: \$ 383,835.00 My role: technical contributor

Teaching Experience

The Automation Team is the research and development team of the Auburn University RFID Lab. It is composed of one undergraduate student and five graduate students, including three master's and two doctoral candidates. As the postdoctoral fellow, I lead the team to complete the internal and external projects. In the past 8 months, I have mentored students in the completion of four conference papers and an R&D task from Walmart .

Papers Under My Supervision:

- Junwei Ma, **Xiangyu Wang**, Caleb Powell, Jian Zhang, Shiwen Mao, Senthilkumar CG Periaswamy, Justin Patton, "Digital Twin of Retail Stores with RFID Tags Localization," in Proc. IEEE SpliTech 2024, Bol and Split, Croatia, June 2024, pp. 01-06.
- Junwei Ma, **Xiangyu Wang**, Shiwen Mao, Jian Zhang, Senthilkumar CG Periaswamy, Justin Patton, "Navigating Uncertainty: Ambiguity Quantification in Fingerprinting-based Indoor Localization," in Proc. IEEE AIoT 2024, Melbourne, Australia, July 2024.
- Bernard Amoah, **Xiangyu Wang**, Jian Zhang, Shiwen Mao, Senthilkumar CG Periaswamy, and Justin Patton, "Decentralized neighborhood discovery and management in dense RFID systems," in Proc. 2024 IEEE International Conference on RFID Technology and Applications (RFID-TA 2024), Daytona Beach, FL, Dec. 2024
- Bernard Amoah, **Xiangyu Wang**, Jian Zhang, Shiwen Mao, Senthilkumar CG Periaswamy, and Justin Patton, "Optimizing adaptive power control for enhancing robustness in RFID sensing," in Proc. 2024 IEEE International Conference on RFID Technology and Applications (RFID-TA 2024), Daytona Beach, FL, Dec. 2024

Professional Activities

Conference Organization

- Organizer, Special Session on "Robustness in RFID sensing," IEEE RFID Technology and Applications (RFID-TA), Dec. 2024.

TPC Membership

- IEEE Global Communications Conference (GLOBECOM) 2025
- IEEE International Conference on Computing, Networking and Communications (ICNC) 2025
- IEEE Consumer Communications & Networking Conference (CCNC) 2025
- IEEE Global Communications Conference (GLOBECOM) 2024
- IEEE International Conference on Computer Communications DeepWireless 2024
- IEEE Consumer Communications & Networking Conference (CCNC) 2024

Journal Reviewer

- IEEE Communications Magazine
- IEEE Journal on Selected Areas in Communications
- IEEE Transactions on Vehicular Technology
- IEEE Transactions on Mobile Computing
- IEEE Transactions on Cognitive Communications and Networking
- IEEE Internet of Things Journal
- IEEE Transactions on Network Science and Engineering
- IEEE Networking Letters
- IEEE Communications Letters
- Elsevier/KeAi Digital Communications and Networks
- Elsevier Pattern Recognition

Conference Reviewer

- IEEE Global Communications Conference (GLOBECOM) 2024
- IEEE International Conference on Computer Communications DeepWireless 2024
- IEEE Opportunity Research Scholars Symposium (ORSS) 2024
- IEEE 96th Vehicular Technology Conference (VTC2022-Fall)
- IEEE International Conference on Communications 2021 (ICC'21)
- IEEE 13th International Conference on Internet of Things (iThings-2020)
- The 10th International Conference on Wireless Communications and Signal Processing (WCSP'18)
- IEEE Global Communications Conference 2018 (GLOBECOM'18)