ZHIHUI GAO

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EDUCATION

- **Duke University** — *Durham, USA*
  Ph.D. in Electrical and Computer Engineering — *August 2020 - Present*
  Advisor: Prof. Yiran Chen

- **Fudan University** — *Shanghai, China*
  B.Eng. in Electrical Engineering — *September 2016 - June 2020*
  Advisor: Prof. Yuedong Xu

- **University of Texas at Austin** — *Austin, USA*
  Exchange Program in Electrical and Computer Engineering — *August 2018 - December 2018*

PUBLICATION

- **Zhihui Gao**, Ang Li, Dong Li, Jialin Liu, Jie Xiong, Yu Wang, Bing Li, Yiran Chen. *MOM: Microphone based 3D Orientation Measurement.* In 2022 21th ACM/IEEE International Conference on Information Processing in Sensor Networks (**IPSN'22**), 2022.

- **Zhihui Gao**, Minxue Tang, Ang Li, Yiran Chen. *An Audio Frequency Unfolding Framework for Ultra-Low Sampling Rate Sensors.* (INVITED) In 2022 23st International Symposium on Quality Electronic Design (**ISQED'22**), 2022.

- **Zhihui Gao**, Ang Li, Yunfan Gao, Bing Li, Yu Wang, Yiran Chen. *FedSwap: A Federated Learning based 5G Decentralized Dynamic Spectrum Access System.* (INVITED) In 2021 IEEE/ACM International Conference On Computer Aided Design (**ICCAD'21**), 2021.

- **Zhihui Gao**, Ang Li, Yunfan Gao, Yu Wang, Yiran Chen. *Hermes: Decentralized Dynamic Spectrum Access System for Massive Devices Deployment in 5G.* In Proceedings of the 2021 International Conference on Embedded Wireless Systems and Networks (**EWSN'21**), 2021.

- **Zhihui Gao***, Yunfan Gao*, Sulei Wang, Dan Li, Yuedong Xu. *CRISLoc: Reconstructable CSI Fingerprinting for Indoor Smartphone Localization.* IEEE Internet of Things Journal (**IoT Journal**), 2020.

RESEARCH EXPERIENCE

MOM: Microphone based 3D Orientation Measurement.

- Exploited microphones that are widely available in commodity devices and free sound sources in our surrounding environment to track the orientation of a device.

- Adopted a distance-based method for angle-of-arrival (AoA) estimation and effectively utilize the signal's lower-frequency property to achieve accurate AoA estimation without incurring a high computational cost.

- The proposed system is flexible to be deployed in real-world settings. It works with various sound sources in the environment such as a vibrating razor and it does not need to know the locations of the sound sources.

- Implemented the system on three platforms, a 6-microphone array Seeed Studio ReSpeaker, a commodity earphone Sennheiser AMBEO headset and a commodity smartphone Google Pixel 4, demonstrating the robustness of the proposed schemes under various conditions.

Hermes: Decentralized Dynamic Spectrum Access System for Massive Devices Deployment in 5G.

- Proposed an improved multi-agent reinforcement learning that significantly reduces the channel collisions with a compact deep Q network structure of low computation and communication costs.

- Proposed a novel shuffle mechanism that shares the models over multiple UEs to achieve better fairness while the UEs' privacy is protected.

- Implemented a prototype system via simulating various 5G settings, where it reduces the collisions and improves fairness compared to the state-of-the-art decentralized techniques.

CRISLoc: Reconstructable CSI Fingerprinting for Indoor Smartphone Localization.

- Extracted CSI from Nexus 5 by eavesdropping the wireless traffic around, 20 MHz bandwidth in 2.4 GHz.

- Analyzed the pros and cons of CSI against RSS and proposed a new fingerprint-matching algorithm that fits the CSI's features.

- Proposed algorithm to detect malfunctioned or altered APs with both high recall and precision, based on which the outdated fingerprints are selectively and efficiently reconstructed by transfer learning.

- Tested our system in research laboratory and academic building over 250 square meters and the localization mean errors are, compared to RSS based localization, reduced by 35.9%, which can be maintained even if APs are malfunctioned or altered.

PROFESSIONAL SKILLS

Programming Language

- MATLAB, Python, Android Studio

Hardware Design

- Raspberry Pi, Intel 5300 NIC, Nexmon CSI Extractor