

# Haoran Wan

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## EDUCATION

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- **Princeton University** Princeton, NJ, USA  
Ph.D. in Computer Science Jul. 2023 - Jun. 2028  
Advisor: Kyle Jamieson
- **Nanjing University** Nanjing, Jiangsu, China  
M.S. in Computer Science Sep. 2019 - Jun. 2023  
Advisor: Wei Wang
- **University of Electronic Science and Technology of China** Chengdu, Sichuan, China  
B.Eng - Networking Engineering Sep. 2015 - Jul. 2019
- **National Chiao Tung University** Hsinchu, Taiwan  
Exchange Student - Electrical and Computer Engineering Feb. 2017 - Jul. 2017

## PUBLICATIONS AND RESEARCH

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- NR-Scope: A Practical 5G Standalone Telemetry Tool  
**Haoran Wan**, Xuyang Cao, Alexander Marder, and Kyle Jamieson  
**ACM CoNEXT**, Dec. 2024. [PDF]
- Athena: Seeing and Mitigating Wireless Impact on Video Conferencing and Beyond  
Fan Yi, **Haoran Wan**, Kyle Jamieson, Jennifer Rexford, Yaxiong Xie, and Oliver Michel  
**ACM HotNet**, Nov. 2024. [PDF]
- Telesa: Evolving Mobile Cloud Gaming with 5G Standalone Network Telemetry  
**Haoran Wan**, Kyle Jamieson  
**Arxiv**, Feb 2024. [PDF]
- Multi-user Room-scale Respiration Tracking using COTS Acoustic Devices  
**Haoran Wan**, Shuyu Shi, Wenyu Cao, Wei Wang, and Guihai Chen  
**ACM TOSN**, May 2023. [PDF]  
Extended version of INFOCOM 2021 paper
- SCALAR: Self-Calibrated Acoustic Ranging for Distributed Mobile Devices  
Lei Wang, **Haoran Wan**, Ting Zhao, Ke Sun, Shuyu Shi, Haipeng Dai, Guihai Chen, Haodong Liu, and Wei Wang  
**IEEE TMC 2023**, Feb. 2023. [PDF]
- ALT: Boosting Deep Learning Performance by Breaking the Wall between Graph and Operator Level Optimizations  
Zhiying Xu, Jiafan Xu, Hongding Peng, Wei Wang, Xiaoliang Wang, **Haoran Wan**, Haipeng Dai, Yixu Xu, Hao Cheng, Kun Wang, and Guihai Chen  
**ACM EuroSys 2023**, May 2023. [Arxiv]
- mSilent: Towards General Corpus Silent Speech Recognition using COTS mmWave Radar  
Shang Zeng, **Haoran Wan**, Shuyu Shi and Wei Wang  
**ACM Ubicomp/IMWUT 2023**, Oct. 2023. [PDF]
- VECTOR: Velocity Based Temperature-field Monitoring with Distributed Acoustic Devices  
**Haoran Wan**, Lei Wang, Ting Zhao, Ke Sun, Shuyu Shi, Haipeng Dai, Guihai Chen, Haodong Liu, and Wei Wang  
**ACM Ubicomp/IMWUT 2022 (Distinguished Paper Award)**, Sep. 2022. [PDF]
- HeadTracker: Fine-grained Head Orientation Tracking System Based on Headphones  
Jinpeng Song, Haipeng Dai, Shuyu Shi, Lei Wang, **Haoran Wan**, Zhizheng Yang, Fu Xiao, and Guihai Chen  
**Springer WASA 2022 (Best Paper Award)**, Nov. 2022. [PDF]
- RespTracker: Multi-user Room-scale Respiration Tracking with Commercial Acoustic Devices  
**Haoran Wan**, Shuyu Shi, Wenyu Cao, Wei Wang, and Guihai Chen  
**IEEE INFOCOM 2021**, Apr. 2021. [PDF]

## DEMOS AND POSTERS

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- Demo: Decoding Control Information Passively from Standalone 5G Network  
**Haoran Wan**, Xuyang Cao, Alexander Marder, and Kyle Jamieson  
**ACM Mobicom**, Nov. 2024. [PDF]
- Understanding the Impact of Cellular RAN-induced Delay on Video Conferencing  
Fan Yi, Oliver Michel, **Haoran Wan**, and Kyle Jamieson  
**ACM Mobicom**, Nov. 2024. [PDF]

## PROJECTS

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- **Paving the Low Queuing Delay Datapath into the 5G RAN** Jun. 2023 - Current
  - In progress.
- **Enhancing Mobile Cloud Gaming through 5G Telemetry** May 2023 - Jun. 2024
  - Developed a tool to analyze 5G base station's signal with USRP and decode the downlink control information for every user in every transmission time interval (0.5 ms) in the RAN, through which we know the bandwidth resource allocated to every user and spare bandwidth in the 5G physical layer.
  - Enhanced the real-time video streaming of an open-source mobile cloud gaming platform (sunshine and moonlight) with the fine-grained RAN resource information.
  - We submitted this work to CoNEXT 2024.
- **General Corpus Silent Speech Recognition with mmWave Radar** Dec. 2021 - Nov. 2022
  - Did a comprehensive study on silent speech recognition with mmWave radar, the corpus is formed with 1000+ daily conversation sentences, and we collected 21K+ samples as our dataset.
  - Designed a signal processing pipeline, including cluster selection algorithm to localize users' head and filter out unrelated motions.
  - Proposed a transformer-based neural network backend with user-adaptive design to recognize the speech and achieved words error rate comparable with video-based SOTA ( $< 10\%$ ).
  - This work was accepted by Ubicomp/IMWUT 2023.
- **Air Temperature Field Reconstruction with COTF Acoustic Devices** Apr. 2021 - May. 2022
  - Estimate the air temperature with shorter response time than traditional temperature sensors by monitoring the speed changes of sound signal. Achieve average errors  $0.25^{\circ}\text{C}$  across months of evaluations.
  - Combine Radon transform and Taylor Series to reconstruct the air temperature field with decimeter-level spatial resolution using multiple acoustic devices.
  - Leverage LOS paths and reflections to estimate the temperature in multiple slots in a car or on the table with only one pair of devices.
  - This work was accepted by Ubicomp/IMWUT 2022 and won the Distinguished Paper Award.
- **High Accuracy Localization System between Distributed Devices** Aug. 2020 - Mar. 2021
  - Model the sampling frequency offset between distributed acoustic devices precisely.
  - Cancel the frequency offset and unknown delays in sound playback and recording process between devices in real time, and return the absolute distance measurement without user's intervention/calibration.
  - Achieve  $0.6\text{ mm}$  1D localization errors up to  $3\text{ m}$  and  $1.86\text{ mm}$  3D localization errors. Maintain the accuracy in long-term without performance drop (up to 8 hours).
  - This work was accepted by TMC.
- **Multi-user Room-scale Respiration Tracking using COTS Acoustic Devices** Oct. 2019 - Aug. 2020
  - Expand the acoustic based respiration sensing range to  $3\text{ m}$  by combining multiple reflection paths.
  - Separate multiple users with modulated Zadoff-Chu sequence, and can recover the breath patterns for at least 4 users in the same room simultaneously.
  - Track users by re-synchronizing the reflection signals before and after users move.
  - This work was accepted by INFOCOM 2021.
- **In-air Continuous Hand Gesture Recognition with Acoustic Signal** Nov. 2019 - Feb. 2020
  - Develop a continuous hand gesture recognition system on mobile phone with acoustic signal, cooperating with partners in industry.
  - Solve the practical problem of ambiguous gestures in continuous using scenario, e.g. scrolling up is similar to the reset process of scrolling down in consecutive use.
  - Design and deploy signal processing algorithm and deep learning model on mobile phone that run in real-time.

## HONORS AND AWARDS

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- Outstanding graduate students of Nanjing University - Dec. 2021
- Huawei Graduate Scholarship - Nov. 2021
- Principal Special Scholarship for Graduate Students - Nov. 2019
- Second Class People's Scholarship - Nov. 2016, 2018
- Undergraduate China National Scholarship, Nov. 2017

## SKILLS SUMMARY

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- **Languages:** C/C++, Python, MATLAB, Java, SQL, Bash, Verilog
- **Tools:** Scikit, Pytorch/TorchLightning, TensorFlow, Keras
- **Platforms:** Linux, Raspberry, Android, FPGA, Microcontroller

## TEACHING EXPERIENCE

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- Digital Logic Design and Computer Organization  
Teaching Assistant Nanjing, China  
Sep. 2021 - Jan. 2022
- Digital Circuit and Digital System Experiment  
Teaching Assistant Nanjing, China  
Sep. 2020 - Jan. 2021