Jingyi Liao

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A highly self-motivated engineer in **ambient IoT**, **wireless communication**, **PHY layer**, and **signal processing**.

Education

2022–now	Ph.D. in Communication Engineering	Aalto University, Finland (Estimated graduate: **2026 Jul**)
2025	Visiting Scholar in Electrical and Computer Engineering	University of Houston, USA
2018–2021	M.Eng. in Communication Engineering	University of Electronic Science and Technology of China, China
2014–2018	B.Eng. in Electronic Engineering	University of Electronic Science and Technology of China, China

Employment

2021–2022	RF Algorithm Engineer	Huawei Technologies Co., Ltd., China

Projects

May 2022–now **Ambient Backscatter Communication Leveraging Existing Infrastructures** Aalto University

- Designed **Ambient Backscatter Communication (AmBC)** models using **4G LTE/5G NR** pilot signals, deriving closed-form performance expressions that matched MATLAB simulation results.
- Built a **hardware AmBC prototype**; validated theory through over-the-air (OTA) experiments using **LTE**. OTA results were **independently reproduced** by Orange Paris.
- Proposed a **data-assisted AmBC framework**, analyzing its performance in **5G NR** and **Starlink** environments, and demonstrated ambient IoT feasibility on the **DECT-2020 NR+** platform.
- Contributed to **2** Europe's the largest 6G research projects and **1** project towards standardized 6G in **3GPP/IEEE/ETSI**; collaborated with industry: **Orange/MediaTek/Sequans**;

Jun 2021–Apr 2022 **5G Micro Base Station Chip: RF Algorithm Verification** Huawei Technologies Co., Ltd.

- Developed **digital predistortion (DPD)** algorithms based on Least Mean Square (LMS) to mitigate for power amplifiers nonlinearity, analog fiber induced distortion, and non-ideal component delay effect of **5G base station**.
- Analyzed and corrected **I/Q imbalance** from numerically controlled oscillators (NCOs), reducing **mirror-image interference** in Zero Intermediate Frequency (ZIF) architectures and improving error vector magnitude (EVM).
- Simulated **PHY (L1) DSP algorithms** in MATLAB and Python, implemented fixed-point **Register-Transfer Level (RTL)** versions for hardware verification, and validated subsystem performance through bit-accurate testing.

Sep 2018–Jun 2021 **LPI Radar Signal Processing** University of Electronic Science and Technology of China

- Designed LPI radar detection and sorting algorithms using **MUSIC**, **Beamforming**, **blind source separation** methods.
- Proposed a novel visibility **graph signal processing** approach for weak radar signal detection; validated performances through MATLAB simulations.
- Designed **machine learning**-based architectures for radar signal processing, including **CNN**, **ResNet** and **LSTM** models for detection, modulation classification, and emitter identification.
- Produced **5** publications and **2** deliverables; led a **3**-student research team and cooperated with **3** research institutes.

Skills

- **Machine Learning**: Pytorch, Tensorflow, Scikit, Pandas;
- **Numerical Simulation**: Matlab, Sci-Lab;
- **Programming**: Assembly Language; Pascal, C/C++, Python;
- **Software Defined Radio**: GNU radio USRP;
- **Digital Hardware**: VLSI, FPGA, VHDL;
- **Circuit Simulation**: Cadence, Altium Designer, LTspice;
- **Embedded System**: Raspberry Pi, STM32, MSP430;
- **Parallel Computing**: CUDA;
- **Automation**: Unix/Linux, Git, Make/Cmake, Shell;
- **Language**: Professional working English; native Chinese.

Awards and Grants

- Nokia Foundation Scholarship (top 29/293)
- HPY Research Foundation Grant (top 10/300)
- State Scholarship Fund × 4
- First National Scholarship (top 10%) × 2
- IEEEXtreme Programming Competition (83/9400)
- Second National Scholarship (top 25%)
- Algorithm Design Contest Second Prize
- Dean Scholarship (top 5%)
- Second Scholarship (top 4%)
- National Oympiad in Informatics Province 2nd Prize

Selected Publications

Journal Papers

1. **J. Liao**, X. Wang, K. Ruttik, et al., "Ambient Backscatter Communications in 5G Downlink with Periodically Nonuniform Sampling," in *IEEE Transactions on Cognitive Communications and Networking*, to be submitted.
2. **J. Liao**, T. Zhang, K. Ruttik, et al., "Ambient Backscatter Communication in LTE Uplink Using Sounding Reference Signals," in *IEEE Internet of Things Journal*, doi: 10.1109/JIOT.2025.3612303.
3. A. Al-nahari, **J. Liao**, R. Jäntti, et al., "Ambient IoT Connectivity Topologies: Technology Enablers, Applications, and Challenges," *IEEE Internet of Things Magazine*, doi: 10.1109/MIOT.2025.3596177.
4. **J. Liao**, R. Jäntti (co-first author), T. Zhang, et al., "Integration of Backscatter-based Ambient IoT to Cellular Communication Systems," *IEEE Communications Standards Magazine*, doi: 10.1109/MCOMSTD.2025.3573817.
5. **J. Liao**, X. Wang, K. Ruttik, et al., "In-Band Ambient FSK Backscatter Communications Leveraging LTE Cell-Specific Reference Signals," *IEEE Journal of Radio Frequency Identification*, vol. 7, pp. 267-277, May 2023, doi: 10.1109/JRFID.2023.3280108. **(Awarded in IEEE RFID-TA 2024)**

Conference Papers

1. **J. Liao**, K. Ruttik, R. Jäntti and Z. Han, "Data Assisted Backscatter Communications using DECT-2020 NR+ as Ambient Signal," *IEEE 26th SPAWC*, Surrey, UK, 2025, doi: 10.1109/SPAWC66079.2025.11143257.
2. **J. Liao**, K. Ruttik, R. Jäntti and Z. Han, "Starlink Ku-band Downlink Based Ambient Backscatter Communication," *IEEE 26th SPAWC*, Surrey, UK, 2025, doi: 10.1109/SPAWC66079.2025.11143459.
3. **J. Liao**, K. Ruttik, R. Jäntti, et al., "Measurement of Coded Backscatter Communication Utilizing Commercial LTE Ambient Signal," *3rd 6GNet*, Paris, France, 2024, doi: 10.1109/6GNet63182.2024.10765673.
4. **J. Liao**, K. Ruttik and R. Jäntti, "Data Assistance Cellular Signal Based Ambient Backscatter Receiver," *IEEE 25th SPAWC*, Lucca, Italy, 2024, doi: 10.1109/SPAWC60668.2024.10694415.
5. **J. Liao**, X. Wang, K. Koskinen, et al., "Indoor Backscattering Communication by Using Commercial LTE Pilots," *IEEE VTC2024-Spring*, Singapore, 2024, doi: 10.1109/VTC2024-Spring62846.2024.10683260.

Chapters

1. **J. Liao**, B. Xie and D.-T. Phan-Huy, "Cellular-backscattered ZEDs," in *Final Design of Enabling Technologies for 6G Devices and Infrastructure*, European Union, 2025.
2. **J. Liao** and D.-T. Phan-Huy, "ZE PoC," in *Initial Design and Validation of Technologies and Architecture of 6G Devices and Infrastructure*, European Union, 2024.

Demonstrations

1. **J. Liao**, K. Ruttik, R. Jäntti and D.-T. Phan-Huy, "Demo: Ambient Backscatter Communication with Convolutional Code based on LTE Pilots," *EuCNC/6G Summit*, Antwerp, Belgium, 2024, doi: 10.5281/zenodo.15642846.
2. **J. Liao**, K. Koskinen, X. Wang, et al., "Demo: UE Assisted Ambient Internet of Things in LTE Downlink, Energy Autonomous," *6G Summit Abu Dhabi*, 2023, doi: 10.5281/zenodo.10171662.
3. **J. Liao**, K. Ruttik, R. Jäntti and D.-T. Phan-Huy, "Demo: UE Assisted Ambient IoT in LTE Downlink, in Real-time and Open Source," *ACM MobiSys '23*, Helsinki, Finland, 2023, doi: 10.1145/3581791.3597285.

Software

1. 4G Downlink Receiver based on C++ USRP: github.com/Aalto5G/CellularAmBC
2. 5G DECT-2020 MATLAB Toolbox: github.com/Aalto5G/DECT-NR-Matlab-Toolbox

Service

Teaching

- Teaching Assistant for **5** courses, e.g., Real-time OS, VLSI, Digital System Design, Electric Power, Dynamics & Control.
- Thesis Advisor for **5** Master Theses and **1** Bachelor thesis.
- Research Project Mentor for **3** projects.

Committee Service

- Deputy Doctoral Student Representative in Aalto University, School of ELEC Doctoral Programme Committee.
- Peer Reviewer for **2** journal and conference papers.
- Student Volunteer for **1** conference.

Funding Proposal

- NSF 25-539: Verticals-enabling Intelligent Network Systems (VINES).

Referees

PhD. Supervising Professor: **Prof. Riku Jäntti** (riku.jantti@aalto.fi) Professor, Aalto University, Finland.
PhD. Thesis Advisor: **Dr. Kalle Ruttik** (kalle.ruttik@aalto.fi) Senior University Lecturer, Aalto University, Finland.