Jingyi Liao

School of Electronic Engineering, Aalto University, Finland

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Google Scholar: scholar.google.com/citations?user=Hd1pxLEAAAAJ

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Technical Skills

Machine Learning: Pytorch, Tensorflow, Scikit, Pandas

Numerical Simulation: Matlab, Sci-Lab

Programming: C/C++, Python, Assembly, Pascal, CUDA

Automation: Unix/Linux, Git, Make/Cmake, Shell

Software Defined Radio: GNU radio USRP

Digital Hardware: VLSI, FPGA, VHDL

Circuit Simulation: Cadence, Altium Designer, LTspice

Embedded System: Raspberry Pi, STM32, MSP430

Employment

Huawei Technologies, Chengdu, China — 2021 Jun - 2022 Apr

RF Algorithm Engineer — 5G Micro Base Station Chip Team

- Developed **fixed-point digital predistortion (DPD)** algorithms using **Least Mean Square (LMS)** adaptation, reducing transceiver distortion and quantization errors and improving 5G base station signal quality
- Improved **5G signal integrity** by designing a calibration solution for **I/Q imbalance** in novel Zero-Intermediate Frequency architecture; achieving lower mirror-image distortion and Error Vector Magnitude (EVM) than conventional Blind Quadrature DC correction
- Optimized **Numerically Controlled Oscillator (NCO)** implementation with 75% less chip resource utilization (e.g. LUT ROM, bus bit-width, and arithmetic units) and 30% lower iteration complexity, while maintaining high signal purity (SFDR up to 90 dB)
- Simulated and verified **PHY (L1) DSP algorithms** using bit-true **Register-Transfer Level (RTL)** models in MATLAB and Python to ensure clock cycle accuracy, in close collaboration with FPGA and chip design engineers

Research Experience

Aalto University, Espoo, Finland — 2022 May - now

Doctoral Researcher, Wireless Communications / 6G IoT — *Supervisor: Prof. Riku Jäntti*

- Proposed an Ambient Backscatter Communication (AmBC) architecture integrated in **LTE** / **NR** / **satellite communication**; leveraged 4G / 5G reference signals and data signals to achieve ~1000 times lower power than Bluetooth
- Prototyped a 6G battery-free IoT device utilizing AmBC; developed a hardware testbed integrating USRP-based user equipment and an srsRAN base station (Open-source [GitHub]: 4G downlink receiver based on C++ USRP)
- Contributed to flagship European 6G projects (Hexa-X / Hexa-X-II / Ambient-6G), collaborating with industry leaders **Orange**, **MediaTek**, and **Sequans** on standardization efforts within **3GPP**, **IEEE**, and **ETSI**
- Verified AmBC via over-the-air (OTA) experiments on **LTE** / **DECT-2020 NR+** systems; findings independently reproduced by Orange Paris (Open-source [GitHub]: 5G DECT-2020 MATLAB Toolbox)

University of Electronic Sci. & Tech. of China, Chengdu, China — 2018 Sep - 2021 Jun

Master Researcher, Machine Learning / Radar Signal Processing — *Supervisor: Prof. Bin Tang*

- Designed low-probability-of-intercept (LPI) radar detection algorithms using **MUSIC** and **beamforming** techniques; proposed a novel **visibility-graph-based** signal processing method
- Developed **machine learning** models (CNN, ResNet, LSTM, YOLO) for radar signal processing, achieving 85% detection accuracy, 99% modulation classification, and 98% emitter identification, outperforming traditional DSP approaches

Education

2022 May - now	Ph.D. in Communication Engineering	Aalto University, Finland
2024 Dec - 2025 Mar	Visiting Scholar in Electrical and Computer Engineering	University of Houston, USA
2018 Sep - 2021 Jun	M.Eng. in Communication Engineering	University of Electronic Science and Technology of China
2014 Sep - 2018 Jun	B.Eng. in Electronic Engineering	University of Glasgow, UK

Awards and Grants

Incentive Scholarship for Doctoral Student	Second National Scholarship (top 25%)
Nokia Foundation Scholarship (top 10%)	Algorithm Design Contest Second Prize
Helsinki Telephone Association Research Foundation Grant (top 3%)	Dean Scholarship (top 5%)
State Scholarship Fund $\times$ 4	Second Scholarship (top 4%)
First National Scholarship (top 10%) $\times$ 2	National Oympiad in Informatics Province 2nd Prize
IEEEXtreme Programming Competition (world rank 83/9400)	

Selected Publications

Journal Papers

1. **J. Liao**, X. Wang, K. Ruttik, et al., "Ambient Backscatter Communications in 5G Downlink with Periodically Nonuniform Sampling," *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," *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), T. Zhang, et al., "Integration of Backscatter-based Ambient IoT to Cellular Communication Systems," *IEEE Communications Standards Magazine*, vol. 9, no. 4, pp. 199-205, Dec. 2025, 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**, "Symbiotic radio: integrating BC into current systems" in *Initial report on low-power 6G network protocols*, European Union, 2025.

2. **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.

3. **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.

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.
- International volunteer teacher: GAPPER project in Sri Lanka.

Committee Service

- Deputy Doctoral Student Representative in Aalto University Doctoral Education Working Group.
- Deputy Doctoral Student Representative in Aalto University, School of ELEC Doctoral Programme Committee.
- Peer Reviewer for 3 journal and conference papers.
- Organizer of 1 conference workshop and Student Volunteer for 1 conference.

Funding Proposal

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

References

Ph.D. Supervising Professor: **Prof. Riku Jäntti** (riku.jantti@aalto.fi)   Professor, Aalto University, Finland.
Visiting Supervising Professor: **Prof. Zhu Han** (zhan2@uh.edu)   Professor, Houston University, USA.