

# Lilin Xu

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## Biography

Third-year Ph.D. student in Electrical Engineering at Columbia University, working on LLM agents and multimodal sensing systems. My research develops **LLM-based proactive agents** on mobile and wearable devices, grounded in **real-world egocentric and multimodal data** for timely, non-intrusive everyday assistance, and investigates how multimodal foundation models reason over sensor data to power such agents. Publications at NeurIPS, IMWUT, MobiSys, SenSys, and ICDCS.

## Education

### Columbia University

Ph.D. in Electrical Engineering, GPA 4.04/4.00

Advisor: Prof. Xiaofan (Fred) Jiang

New York, USA

Aug 2024 – Present

### Zhejiang University

M.Eng. in Control Science and Engineering, GPA 3.92/4.00

Advisor: Prof. Shibo He and Prof. Chaojie Gu

Hangzhou, China

Sep 2021 – Mar 2024

### Zhejiang University

B.Eng. in Automation, GPA 3.95/4.00, Rank 5/120

Hangzhou, China

Sep 2017 – Jun 2021

## Experience

### Intelligent and Connected Systems Lab, Columbia University

*Graduate Research Assistant*

New York, USA

Aug 2024 – Present

**Proactive Context-Aware LLM Agents:** Developed proactive agents that anticipate user needs from egocentric multimodal perceptions captured by wearable and mobile devices to deliver timely assistance without explicit queries. Evolved agent design from an AR-glasses-based social assistant to open-world context-aware proactive reasoning and end-to-end on-glass deployment via on-demand sensory triggering. Expanded the temporal horizon from one-shot assistance for isolated short-term events to continuous on-glass step-aware guidance for multi-step procedural tasks and long-horizon assistance for delayed intentions via context-aware prospective memory. (NeurIPS'25, IMWUT'26  $\times 2$ , IMWUT'25)

**Multimodal Foundation Models:** Investigated how foundation models understand and reason over non-traditional physical-world inputs, including top-down imagery, IMU signals, and longitudinal mobile sensor streams. Developed benchmarks for spatial-reasoning robustness, and designed training-free and post-training methods to align time-series streams with LLM reasoning for fine-grained activity understanding, behavioral modeling, and implicit persona profiling. (NeurIPS'26, IMWUT'26, FMSys'25)

### AIoT Lab, The Chinese University of Hong Kong

*Visiting Research Assistant*

Hong Kong

Jan 2024 – Jul 2024

**Sensor-Augmented LLM Systems:** Built interactive systems and benchmarks that bridge LLMs with heterogeneous sensing modalities, spanning an LLM diagnostic reasoning system enhanced by integrating smart-device sensor streams with clinical domain knowledge, an agentic planning framework that compiles natural-language queries into executable IoT sensor workflows, and a large-scale benchmark for evaluating foundation models on human activity understanding. (MobiSys'26, SenSys'24/25, IMWUT'24)

### State Key Lab of Industrial Control Technology, Zhejiang University

*Graduate Research Assistant*

Hangzhou, China

Sep 2021 – Jun 2024

▷ Visiting Research Assistant, NTU IoT Research Group

Singapore, Apr – Oct 2023

**Multimodal Intelligent Systems:** Developed human-centered sensing systems across diverse modalities

(mmWave, acoustic, IMU, depth, and skeleton), spanning a cross-modal contrastive learning framework for label-efficient unimodal activity recognition, a mmWave-based user identification system for gesture recognition, and an acoustic sensing method for facial authentication. (SenSys'23, ICDCS'24, TOSN'25)

## Skills

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- **Programming:** Python, C++ , C, Java, MATLAB, JavaScript, HTML, CSS
- **Frameworks & Platforms:** PyTorch, TensorFlow, Linux, Android

## Awards & Service

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- **AIX Summit Poster Finalist**, 2026
- **Columbia University Presidential Fellowship**, 2024
- **Sun Youxian Scholarship** (Top 1%), Zhejiang University, 2024
- **Outstanding Graduate Student**, Zhejiang University, 2024
- **Technical Program Committee:** ACM HumanSys, 2026; ACM CoNEXT (Shadow), 2025
- **Reviewer:** ACM IMWUT/TIOT/Health; IEEE IoT-J
- **Teaching Assistant:** Columbia EECS 4764 IoT – Intelligent and Connected Systems, Fall 2024

## Selected Publications (\* denotes equal contribution)

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- [P13] **L. Xu**, L. He, K. Hou, Y. Fan, M. Zhao, X. Xu, X. Jiang. ProMemAgent: Long-Horizon Proactive Assistance with Context-Aware Prospective Memory from Sensory Perceptions. *Under review*, 2026.
- [P12] **L. Xu\***, B. Yang\*, S. Jiang, K. Liu, K. Hou, Y. Fan, H. Chen, Z. Yan, X. Jiang. Pro<sup>2</sup>Assist: Continuous Step-aware Proactive Assistance with Multi-modal Egocentric Perception for Long-horizon Procedural Tasks. *IMWUT*, 2026.
- [P11] K. Hou, M. Zhao, **L. Xu**, Y. Fan, X. Jiang. TDBench: Benchmarking Vision Language Models on Top-Down Image Understanding. *NeurIPS*, 2026.
- [P10] B. Yang\*, **L. Xu\***, L. Zeng, Y. Guo, S. Jiang, W. Lu, K. Liu, Y. Li, X. Jiang, G. Xing, Z. Yan. ProAgent: Harnessing On-Demand Sensory Contexts for Proactive LLM Agent Systems in the Wild. *IMWUT*, 2026.
- [P9] Y. Fan, **L. Xu**, M. Wu, J. Nie, Q. Chen, Y. Yang, Z. Zhang, X. Liu, S. Nepal, X. Jiang, X. Xu. TimeSRL: Generalizable Time-Series Behavioral Modeling via Semantic RL-Tuned LLMs – A Case Study in Mental Health. *IMWUT*, 2026.
- [P8] K. Liu, L. Zeng, **L. Xu**, B. Yang, Z. Yan. PerCache: Predictive Hierarchical Cache for RAG Applications on Mobile Devices. *IMWUT*, 2026.
- [P7] B. Yang\*, **L. Xu\***, L. Zeng, K. Liu, S. Jiang, W. Lu, H. Chen, X. Jiang, G. Xing, Z. Yan. ContextAgent: Context-Aware Proactive LLM Agents with Open-World Sensory Perceptions. *NeurIPS*, 2025.
- [P6] **L. Xu**, K. Hou, X. Jiang. Exploring the Capabilities of LLMs for IMU-based Fine-grained Human Activity Understanding. *FMSys*, 2025.
- [P5] B. Yang\*, Y. Guo\*, **L. Xu\***, Z. Yan, H. Chen, G. Xing, X. Jiang. SocialMind: LLM-based Proactive AR Social Assistive System with Human-like Perception for In-situ Live Interactions. *IMWUT*, 2025.
- [P4] K. Liu, B. Yang, **L. Xu**, Y. Guo, G. Xing, X. Shuai, X. Ren, X. Jiang, Z. Yan. TaskSense: A Translation-like Approach for Tasking Heterogeneous Sensor Systems with LLMs. *SenSys*, 2025.
- [P3] B. Yang, S. Jiang, **L. Xu**, K. Liu, H. Li, G. Xing, H. Chen, X. Jiang, Z. Yan. DrHouse: An LLM-empowered Diagnostic Reasoning System through Harnessing Outcomes from Sensor Data and Expert Knowledge. *IMWUT*, 2024.
- [P2] **L. Xu**, K. Wang, C. Gu, X. Guo, S. He, J. Chen. GesturePrint: Enabling User Identification for mmWave-based Gesture Recognition Systems. *ICDCS*, 2024.
- [P1] **L. Xu**, C. Gu, R. Tan, S. He, J. Chen. MESEN: Exploit Multimodal Data to Design Unimodal Human Activity Recognition with Few Labels. *SenSys*, 2023.