

Xinhe Zhang

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SUMMARY

ML researcher working on efficient generative modeling and multimodal representation learning for high-dimensional scientific data. First-author work includes LiFT, a lightweight framework for coherent 3D medical image synthesis from 2D generators; broader research spans foundation-model adaptation, longitudinal neural dynamics, and closed-loop biological optimization.

EDUCATION

Harvard University Cambridge, MA

Ph.D. Electrical Engineering (2026) · M.Sc. Electrical Engineering (2024)

Carnegie Mellon University Pittsburgh, PA

M.Sc. Electrical and Computer Engineering (2020) · B.Sc. Electrical and Computer Engineering (2018)

TECHNICAL SKILLS

Methods: Foundation models (fine-tuning, adaptation), multimodal learning, generative models, computer vision (CNNs, Vision Transformers), signal processing, spike sorting, spatial transcriptomics analysis, Bayesian optimization, reinforcement learning, 3D medical image processing

Languages & Libraries: Python, PyTorch, JAX, NumPy, SciPy, scikit-learn, C/C++, MATLAB

Tools & Infrastructure: Linux, Git, Docker, AWS, CUDA, distributed training, large-scale data pipelines

RESEARCH EXPERIENCE

Harvard University — Liu Lab & Li Lab Cambridge, MA

Graduate Researcher, Ph.D. Electrical Engineering 2021–Present

- **3D generative modeling for medical imaging** (*arXiv 2026, first author*)
Developed LiFT, a framework that synthesizes 3D volumes from 2D slice generators via learned inter-slice feature trajectories; evaluated on BraTS 2023 and SynthRAD2023 across 3 tasks at $\sim 135\times$ lower inference cost than comparable 3D methods.
- **Multimodal electrophysiology in pancreatic organoids** (*Science 2026, co-first author*)
Owned the computational analysis pipeline integrating 3 data modalities (electrophysiology, scRNA-seq, spatial transcriptomics) with spike sorting for reliable single-cell identification; enabled the first demonstration that circadian metabolic cycles entrain single-cell electrical activity.
- **Signal processing and spatial transcriptomics in cardiac tissue** (*Science 2025, co-first author*)
Designed and implemented a spike classification algorithm separating graft-derived automaticity from host sinus rhythm at millisecond resolution; owned Slide-seq spatial transcriptomic analysis that informed the key therapeutic finding.
- **Bayesian Optimization for organoid maturation** (*bioRxiv 2024, co-first author*)
Built one of the first closed-loop AI systems controlling real biological tissue growth: autonomously optimized electrical stimulation of cardiac organoids via Gaussian Process-based Bayesian Optimization, achieving $\sim 70\%$ higher conduction velocity than fixed-parameter baselines.
- **Foundation model fine-tuning for medical imaging** (*in progress, with GE Healthcare*)
Fine-tuning GE Healthcare foundation models on MGH prostate cancer radiology data; developing a separate pathology foundation model for skin lesion prediction tasks.
- **Longitudinal neural dynamics modeling and NeuroAI** (*in progress*)
Modeling longitudinal neural dynamics from brain-computer interface recordings (Allen Visual Behavior Observatory and BraiDyn-BC datasets); investigating representational parallels between biological neural population activity and large language model internal representations.

- **Sim-to-real object detection for autonomous driving** (*IEEE ITSC 2021, co-first author*)

Created synthetic road scene images with the CARLA simulator and Autodesk Maya; trained neural networks to detect rare objects in real autonomous driving imagery.

INDUSTRY EXPERIENCE

Duolingo — Android Developer (Nov 2018–May 2019)

Pittsburgh, PA

Shipped push notification features for the Chinese market and redesigned purchasing screens, boosting membership sales.

Facebook (Meta) — Software Engineer Intern (Summer 2018)

Seattle, WA

Designed a full-stack web application for Facebook Analytics Automated Insights, querying large-scale databases.

Google — Software Engineer Intern (Summer 2017)

Mountain View, CA

Built an interactive data visualization tool (Angular, D3.js) computing logic relationships among datasets for 150 monthly users; improved filtering and animation, resolving a key pain point for 100 daily users.

Google — Engineering Practicum Intern (Summer 2016)

Boulder, CO

Implemented a C++ backend server for spatially indexed geospatial data retrieval; built an interactive 3D web display using WebGL and Google Maps API.

SELECTED PUBLICATIONS

ML / AI Methods

- [1] **X. Zhang**, Y. Zhang, P. Jin, A. Marin-Llobet, N. Li, Q. Li, *LiFT: Lifted Inter-slice Feature Trajectories for 3D Image Generation from 2D Generators*. arXiv, 2026.
- [2] R. Liu[†], Z. Ren[†], **X. Zhang**[†], et al., *An AI-Cyborg System for Adaptive Intelligent Modulation of Organoid Maturation*. bioRxiv, 2024.
- [3] X. Tang[†], J. Zhang[†], Y. He[†], **X. Zhang**, et al., *Explainable multi-task learning for multi-modality biological data analysis*. Nature Communications, 2023.

Biomedical Science

- [4] Q. Li[†], R. Liu[†], Z. Lin[†], **X. Zhang**[†], W. Wang[†], et al., *Implanted flexible electronics reveal principles of human islet cell electrical maturation*. Science, 2026.
- [5] J. Aoyama[†], R. Liu[†], **X. Zhang**[†], et al., *Flexible nanoelectronics reveal arrhythmogenesis in transplanted human cardiomyocytes*. Science, 2025.
- [6] H. Zhao[#], **X. Zhang**[#], A. Marin-Llobet, X. Lin, J. Liu, *Benchmarking spike source localization algorithms in high density probes*. PLOS Computational Biology, 2026.

[#]Co-corresponding author. [†]Equal contribution. Full list at xinhez.github.io.

SELECTED AWARDS

Poster Third Place, Schmidt Center Symposium: Biomedical Science and AI

2025

Poster Runner-Up & Early-Career Scholar, NIH BRAIN Initiative NeuroAI Workshop

2024

TEACHING & SERVICE

Teaching Fellow, Harvard (neural computation, neuroengineering, systems development for CS) 2022–2025

Teaching Assistant, CMU (12 semesters: deep RL, signals & systems, programming)

2015–2020

Reviewer: *Nature Communications*, *PLOS ONE*, NeurIPS/ICML workshops, 10+ journals.

Mentor: First-Year Advisor, Harvard (2022–2024); Academic Advisor, CMU (2020).