

# ALEC XU

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## RESEARCH INTERESTS

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Interested in exploring how low-dimensional structure and optimizers enable parameter efficiency and enhance generalization abilities in deep learning models.

## EDUCATION

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### University of Michigan, Ann Arbor

*PhD Electrical and Computer Engineering*

Expected Aug. 2027

**Concentration:** Signal & Image Processing and Machine Learning

**Advisor:** Dr. Qing Qu

**GPA:** 4.00/4.00

*MSE Electrical and Computer Engineering*

Dec. 2022

**Concentration:** Signal & Image Processing and Machine Learning

**Advisor:** Dr. Jeffrey Fessler

**GPA:** 4.00/4.00

*BSE Electrical Engineering, Summa Cum Laude*

Dec. 2021

**GPA:** 3.97/4.00

## INDUSTRY EXPERIENCE

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### Apple

Sunnyvale, CA

*Machine Learning Intern*

May 2026 - Sept. 2026

- Developing training-free deep learning approaches for 3D object reconstruction.

### MIT Lincoln Laboratory

Lexington, MA

*Co-Op Research Student*

Jan. 2023 - July 2023

- Developed novel edge detection reconstruction self-supervised learning (SSL) task for 3D axon segmentation [PyTorch]. U-Nets pre-trained on proposed task achieved up to 5% improvement on downstream segmentation metrics (Dice score) over previous SSL tasks.

*Summer Research Intern*

May 2022 - Aug. 2022

- Developed and implemented novel two-stage deep learning pipeline for multi-channel signal detection and modulation recognition using YOLO object detector and DeepSig's ResNet convolutional network [PyTorch].

*Summer Research Intern*

May 2021 - Aug. 2021

### JHU Applied Physics Laboratory

Laurel, MD

*Summer Intern*

May 2020 - Aug. 2020

### H3D, Inc.

Ann Arbor, MI

*Summer Intern*

May 2019 - Aug. 2019

## SELECT PUBLICATIONS & PREPRINTS

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<sup>†</sup> Denotes equal contribution

[6] **A. S. Xu**, C. Yaras, M. Asato, Q. Qu, L. Balzano. “Emergent Low-Rank Training Dynamics in MLPs with Smooth Activations,” *arXiv:2602.06208*.

[5] S. Kwon<sup>†</sup>, **A. S. Xu**<sup>†</sup>, C. Yaras, L. Balzano, Q. Qu. “Out-of-Distribution Generalization of In-Context Learning: A Low-Dimensional Subspace Perspective,” in *Conference on Artificial Intelligence and Statistics (AISTATS)*, 2026.

Short versions in *Causality in the Age of AI and Scaling Workshop at Conference on Artificial Intelligence and Statistics (AISTATS)*, 2026 (**Best Paper**) and *What Can('t) Transformers Do? Workshop at Conference on Neural Information Processing Systems (NeurIPS)*, 2025.

- [4] **A. S. Xu**, C. Yaras, P. Wang, Q. Qu. “Linearly Separable Features in Shallow Nonlinear Networks: Width Scales Polynomially with Intrinsic Data Dimension,” in *Conference on Artificial Intelligence and Statistics (AISTATS)*, 2026.
- [3] C. Yaras, **A. S. Xu**, P. Abillima, C. Lee, L. Balzano. “MonarchAttention: Zero-Shot Conversion to Fast, Hardware-Aware Structured Attention,” in *Conference on Neural Information Processing Systems (NeurIPS)*, 2025 (**Spotlight**).
- [2] **A. S. Xu**, N. I. Shamsi, L. A. Gjestebj, L. J. Brattain. “Self-Supervised Edge Detection Reconstruction for Topology-Oriented 3D Axon Segmentation and Centerline Detection,” in *IEEE/CVF Winter Conference on Applications of Computer Vision (WACV)*, 2024.
- [1] **A. S. Xu**, L. Balzano, J. A. Fessler, “HeMPPCAT: Mixtures of Probabilistic Principal Component Analysers for Data with Heteroscedastic Noise,” in *IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP)*, 2023.

## AWARDS

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**Best Paper** | Causality in the Age of AI Scaling Workshop

**Best Poster Runner-Up** | University of Michigan ECE Industry Day

**ECE Department Fellowship** | University of Michigan

**EECS Scholar** | University of Michigan

**James B. Angell Scholar** | University of Michigan

**William J. Branstrom Freshman Prize** | University of Michigan

**Dean’s List/University Honors** | University of Michigan

## TEACHING

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**Graduate Student Instructor** | University of Michigan

*ECE 559: Optimization Methods for Signal Processing and Machine Learning*

2026

*ECE 551: Matrix Methods for Signal Processing & Machine Learning*

2022, 2024

**Undergraduate Instructional Aide** | University of Michigan

*EECS 455: Wireless Communication Systems*

2021

*EECS 398 / 498: Software Defined Radio*

2021