Austin Xu

Contact Information

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https://austinxu87.github.io/

Research Interests

Interested in ranking systems and learning from non-metric/perceptual similarity queries, with applications to preference learning and representation/embedding learning. Additional interests include explainable and fair machine learning.

Education

Georgia Institute of Technology 2019 – 2024 (expected)

PhD in Electrical and Computer Engineering

Concentration: Digital Signal Processing and Machine Learning
Advisor: Dr. Mark Davenport

University of Michigan, Ann Arbor 2015 – 2019

BSE in Electrical Engineering, Summa Cum Laude

Concentration: Digital Signal Processing

Conference Publications

[C3] N. Nadagouda, **A. Xu**, and M. A. Davenport, "Active metric learning and classification using similarity queries." *Under review*, January 2022.

[C2] A. McRae, **A. Xu**, J. Jin, N. Nadagouda, N. Ahad, P. Guan, S. Karnik, M. A. Davenport, "Delta distancing: A lifting approach to localizing items from user comparisons.", to appear in *Proc. IEEE Int. Conf. on Acoustics, Speech, and Signal Processing (ICASSP)*, May 2022.

[C1] **A. Xu** and M. A. Davenport, "Simultaneous Preference and Metric Learning from Paired Comparisons.", in *Proc. Conf. on Neural Information Processing Systems (NeurIPS)*, Online, December 2020. **Selected for Spotlight Presentation (4%)**

Journal Publications

[J1] **A. Xu**, A. Pananjady, M. A. Davenport, "Human perception metric learning from parametric adjustment queries." *In Preparation.*

Industry Experience

Amazon Summer 2022
Applied Scientist Intern, Amazon Style San Francisco, CA

Sandia National Laboratories Summer 2018
Undergraduate R&D Intern, Flight and Instrumentation Systems Group Albuquerque, NM

- Developed features for GUI (C++, Qt Creator) that communicates to FPGA and imaging array via SpaceWire/RMAP. Implemented modular design that incorporated hardware specific communication and file parsing. Optimized testing workflow for hardware changes, which enabled rapid future hardware prototyping.
- Implemented internal image processing algorithm (MATLAB). Quantified algorithm accuracy under fixed point and floating point datatypes to determine hardware implementation viability.

General Motors Summer 2017
Student Intern, Automated Driving and Active Safety Group Warren, MI

- Collaborated with GM and tier 1 supplier to develop and implement supply-chain-wide thermal validation plan for rear view camera coaxial cable. Validation plan was adopted for rear view cameras in all future GM vehicles.
- Utilized internal software to de-warp rear view camera images to meet internal and government guidelines. Discovered discrepancy between test vehicle de-warping output and specifications, resulting in re-calibrated software update.

Research Experience

Georgia Institute of Technology, Atlanta, GA
Advisor: Mark Davenport

Learning from parametric adjustment queries. 2021 - present

- Investigating robust metric learning under non-parametric human noise models from parametric adjustment queries.
- Developing sample complexity guarantees using techniques from high-dimensional statistics and low-rank matrix sensing.

Deep metric learning from nearest-neighbor queries. 2020 - 2022

- Developed information-theoretic criterion for adaptive selection of a novel nearest neighbor query. Query responses directly improve learned embeddings, allowing for direct application of adaptive query selection to both active deep metric learning (DML) and active classification.
- Implemented DML experiments (python) which outperformed recent active DML approaches on multiple synthetic and real-world datasets (food-100, Georgia Tech graduate student admissions)

Simultaneous preference and metric learning from paired comparisons. 2019 - 2020

- Developed novel joint ideal point and Mahalanobis metric estimation algorithm from paired comparisons. Utilized alternating minimization to iteratively refine initial estimates.
- Implemented ideal point estimation on synthetic and real-world datasets (Georgia Tech graduate student admissions), resulting in interpretable learned metrics and ideal points.

University of Michigan, Ann Arbor, MI
Advisor: Laura Balzano

- Investigated use of order-weighted L1 (OWL) norm for determining relevant features for learning human preferences from paired comparisons. Characterized effects parameter tuning for OWL norm for promoting group sparsity.
- Developed algorithm to perform blind sensor calibration for data drawn from time-varying low-rank subspaces. Alternated sensor gain learning via Total Least Squares and subspace estimation via GROUSE. Achieved $< 5\%$ sensor calibration error with good initialization.
- Formulated additive union of subspaces sensor model and blindly estimated sensor gains via orthogonal projection.

Presentations

"Simultaneous Preference and Metric Learning from Paired Comparisons," Spotlight Presentation at 2020 Conference on Neural Information Processing Systems (NeurIPS) | Virtual

Workshops

Gene Golub SIAM Summer School: "Theory and Practice of Deep Learning" 2021
African Institute for Mathematical Sciences (AIMS) | Virtual

Teaching Experience

Graduate Teaching Assistant Spring 2022
Statistical Machine Learning (ECE 6254) | Georgia Institute of Technology

Graduate Teaching Assistant Fall 2019, Spring 2020, Summer 2020
Professional and Technical Communications (ECE 3005) | Georgia Institute of Technology

Instructional Aide Fall 2018, Winter 2019
Discrete Mathematics (EECS 203) | University of Michigan

AWARDS

Machine Learning at Georgia Tech Fellow | Georgia Institute of Technology 2021
President's Fellowship | Georgia Institute of Technology 2019
Distinguished Academic Achievement Award | University of Michigan 2019
Outstanding Service Award, EECS Dept. | University of Michigan 2018
EECS Scholar | University of Michigan 2018
Eta Kappa Nu Scholarship | University of Michigan 2017
UROP Outstanding Research Presentation Award | University of Michigan 2017
James B. Angell Scholar | University of Michigan 2017
William J. Branstrom Freshman Prize | University of Michigan 2016
Dean's List/University Honors | University of Michigan 2015 - 2019

SERVICE

Undergraduate Engineering Student Advisory Board (UESAB) 2018 - 2019
Electrical Engineering Representative | University of Michigan

Eta Kappa Nu - Beta Epsilon Chapter 2018
Officer - Historian | University of Michigan

ECE Undergraduate Advising Office 2017 - 2018
Peer Advisor | University of Michigan

STEM Society 2017 - 2018
Laboratory Leader | University of Michigan

Eta Kappa Nu - Beta Epsilon Chapter 2018
Tutoring Chair | University of Michigan