Austin Xu

CONTACT INFORMATION

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RESEARCH INTERESTS

Interested human preference learning, recommender systems, ranking systems, and learning from non-metric queries. Broadly interested in leveraging the learned representations of foundational models (generative models, large language models, etc.) for learning.

EDUCATION

Georgia Institute of Technology Aug. 2019 - May 2024 (expected)

PhD in Electrical and Computer Engineering

Concentration: Digital Signal Processing and Machine Learning
Advisor: Dr. Mark Davenport
GPA: 4.00/4.00

University of Michigan, Ann Arbor Sept. 2015 - May 2019

BSE in Electrical Engineering, Summa Cum Laude

Concentration: Digital Signal Processing
GPA: 3.98/4.00

PUBLICATIONS

[5] **A. Xu**, J. Wang, A. D. McRae, A. Pananjady, M. A. Davenport, "Parametric adjustment queries: A new paradigm for human data elicitation with applications to metric learning," *In preparation.*

[4] N. Nadagouda, **A. Xu**, and M. A. Davenport, "Active metric learning and classification using similarity queries, to appear in *Uncertainty in Artificial Intelligence (UAI)*, Pittsburgh, August 2023. (31% conference acceptance rate)
Short version in *Neural Information Processing Systems (NeurIPS) Workshop on Human in the Loop Learning*, New Orleans, December 2022.

[3] **A. Xu**, M. I. Vasileva, A. Dave, A. Seshadri, "HandsOff: Labeled dataset generation with no additional human annotations," to appear in *IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR)*, Vancouver, June 2023. **Highlight Award (top 2.5% of submissions, 26% conference acceptance rate).**
Short version in *Neural Information Processing Systems (NeurIPS) SyntheticData4ML Workshop*, New Orleans, December 2022.

[2] A. D. 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," in *IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP)*, Singapore, May 2022.

[1] **A. Xu** and M. A. Davenport, "Simultaneous Preference and Metric Learning from Paired Comparisons," in *Conference on Neural Information Processing Systems (NeurIPS)*, Online, December 2020. **Spotlight Presentation (top 4% of submissions, 20% conference acceptance rate).**

INDUSTRY EXPERIENCE

Duolingo, Pittsburgh, PA Incoming, Summer 2023
AI Research Intern

Amazon, San Francisco, CA May 2022 - December 2022
Applied Scientist Intern, Amazon Style

- Investigated pixel-wise labeled synthetic dataset generation with generative adversarial networks (GANs). Leveraged GAN inversion to utilize existing labeled images for label generator training. Achieved state-of-the-art performance in faces, cars, full-body humans, urban driving domains on semantic segmentation, keypoint detection, depth estimation tasks.
- Project resulted in the first full conference publication for the Amazon Style organization: Paper accepted at CVPR as a Highlight Award (top 2.5% of submissions, top 10% of accepted papers). Workshop version presented at NeurIPS.

- Developed variance-maximization algorithm for selecting initial items to be shown to users for binary like/dislike ratings (cold start problem). Experimented combinations of CLIP and model embeddings to determine embedding to maximize inter-and intra-category variance.
- Designed and implemented data fidelity experiments which exposed recommendation model embedding shortcomings. Findings handed off to management for review, potentially leading to a massive simplification of training pipeline and user experience.

Sandia National Laboratories, Albuquerque, NM — May 2018 - Aug. 2018
Undergraduate R&D Intern, Flight and Instrumentation Systems Group

General Motors, Warren, MI — May 2017 - Aug. 2017
Student Intern, Automated Driving and Active Safety Group

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 novel 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 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.

Presentations

"HandsOff: Labeled dataset generation with no additional human annotation." — May 2023
ML Collective Deep Learning: Classics and Trends reading group | Virtual.

"HandsOff: Labeled dataset generation with no additional human annotation." — April 2023
Georgia Tech Center for Signal and Information Processing (CSIP) Seminar | Atlanta, GA.

"HandsOff: Labeled dataset generation with no additional human annotation." — December
Neural Information Processing Systems (NeurIPS) SyntheticData4ML Workshop | New Orleans, LA.

"Simultaneous Preference and Metric Learning from Paired Comparisons." — Dec. 2020
Neural Information Processing Systems (NeurIPS) Spotlight Presentation | Virtual.

Workshops

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

Teaching Experience

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

Graduate Teaching Assistant — Fall 2019 - 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 — 2018 - 2019
Electrical Engineering Representative | University of Michigan.

Eta Kappa Nu - Beta Epsilon Chapter — 2018
Officer - Historian, Tutoring Chair | University of Michigan.

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