Xuanzhou "Lorraine" Chen

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EDUCATION

Ph.D.	**Georgia Institute of Technology**, GA Machine Learning, School of Electrical and Computer Engineering Advisor: Prof. Ashwin Pananjady	09/2023 – 03/2027
M.S.	**New York University**, NY Computer Engineering, School of Electrical & Computer Engineering Advisors: Prof. Siddharth Garg and Prof. Elza Erkip	09/2021 – 06/2023
B.S.	**University of Wisconsin-Madison**, WI Mathematics (Minor: Computer Science), College of Letters & Science Supervision: Prof. Eric Bach	09/2016 – 12/2020

RESEARCH INTERESTS & EXPERIENCE

Machine Learning Algorithms, Statistical Modeling, High Dimensional Statistics, Signal Processing, Natural Language Processing, Image Processing, Multi-modalities, Vision Language Model, Generative AI, Color Vision, AI for Science, AI Agents, Human-AI alignment, and ML securities

Research Assistant, ***Georgia Tech*** (with Prof. Ashwin Pananjady) Sep. 2023 – Present

PAQ in Color Vision: 1) Built statistical models for learning personalized color vision profile by leveraging low dimensional geometric structure in color space and formulated the problem of estimating individual copunctal point. 2) Developed data-driven methods for estimating ellipses and copunctal point by using Least Squares, SVD, and Linear Programming techniques. 3) Leveraged high-dimensional metric learning (Mahalanobis distance) and Davis-Kahan Theorem to prove probabilistic guarantees on the copunctal point estimation error. 4) Showcased the sample complexity of PAQ and validated algorithms with both controlled and end-to-end simulations. 5) Built a user interface to collect real-world human perceptual data using perceptual adjustment queries (PAQ) for large-scale user study.

PAQ in Depression/PAQ theoretical framework: 1) Built an identity-preserving facial morphing pipeline using diffusion models to generate PAQ slider paths from neutral to happy. 2) Incorporated the Rasch model to formalize PAQ for depression as a psychometric test, enabling calibrated stimulus scales, latent trait estimation, and adaptive query reduction. 3) Modeled PAQ as linear regression with multiplicative noise to address heteroskedasticity, providing a statistical framework for efficient estimation and individual-level normalization.

Research Intern, ***Shanghai Jiao Tong University*** (Remote) Dec. 2024 – Present

VL4SEM: 1) Curated a multimodal dataset with Scanning Electronic Microscopy (SEM) images of hydrogels with expert annotations. 2) Built a few-shot vision-language framework by using pretrained Llama models for textual encoding, LoRA adapters for fine-tuning, FiLM projectors for text-image alignment, and U-Net-based diffusion models for SEM image generation conditioned on new prompts. 3) VL4SEM outperforms ChatGPT-4.0 in predicting the fibrous, heterogeneous microstructures of real soft hydrogels.

Research Assistant, ***New York University*** (with Prof. Siddharth Garg) Jun. 2022 – Sep. 2023

Adversarial NLP: 1) Modified PGD into a block-sparse adversarial attack for Transformer text classifiers, achieving wallclock speedup (10x) at comparable attack-success rate. 2) Designed a cosine-similarity K-means semantic pre-selection to cluster token embeddings and restrict perturbations to high-impact blocks, cutting gradient evaluations/memory and enabling batch attacks on long inputs. 3) Applied the method to a GPT-2 text-classification pipeline (PyTorch/HF), maintaining baseline ASR while lowering per-example compute; delivered ablation scripts to quantify the time-ASR trade-off.

Research Fellow, ***Zhejiang University*** (with Prof. Yingke Xu) Jan. 2021 – Aug. 2021

Image Processing (Microscope): 1) Collected & curated tumor-cell microscope images from ZJU-affiliated hospitals, standardizing metadata/labels to create a clean training/evaluation dataset for semantic segmentation. 2) Built a Keras/TensorFlow preprocessing pipeline for image data augmentation to expand effective training samples and reduce overfitting in downstream models. 3) Fine-tuned a pretrained U-Net with Dice loss for tumor-cell segmentation, achieving 81.4% mean IoU in 3-fold cross-validation.

Customer Review Research Intern, ***Amazon*** Sep. 2020 – Nov. 2020

NLP + Full Stack: 1) Developed and deployed a full-stack web app (using Python, Flask, JavaScript, jQuery, HTML/CSS) that automatically ingest, fetch and analyze online customer reviews, reducing manual collection from 2 h to 10 min (~92%) per dataset. 2) Built an NLP preprocessing pipeline for financial data cleaning/denoising, tokenization, and normalization that reduced noisy tokens by 38% and improved top-k term stability (Jaccard 0.56 → 0.82). 3) Delivered interactive word-cloud visualization.

HONORS & AWARDS

2025 **ML@GT Student Award (First Place)**, Georgia Tech

2023 **Marion A. and Henry C. Bourne Fellowship**, Georgia Tech

2021 **Merit Scholarship**, New York University

2016-2020 **Dean's list**, UW-Madison

2018 **S grade in The Mathematical Contest in Modeling**, UW-Madison

PUBLICATIONS

SUBMITTED

1. From Agricultural Waste to Device: Corncob-Derived Biocarbon for Coupled Solar Evaporation and Photocatalysis
   C. Zhang, Y. Jia, **X. Chen**, Y. Liu, L. D. Zhang, Y. Zhang. *ACS Sustain. Chem. Eng*. **2025**. (Submission)
2. Ice-Templated Zwitterionic Sponge Hydrogels for Stable and Efficient Solar Desalination in High-Salinity Brines
   C. Zhang, J. Gu, P. Xiao*, T. Chen, **X. Chen**, L. D. Zhang, Y. Zhang. *ACS Appl. Mater. Interfaces* **2025**. (Submission)
3. From Fragility to Robustness: Salt-Induced Toughening of Zwitterionic Hydrogels
   G. Wang, H. Ni, Y. Deng, **X. Chen**, X. Li, L. Che, S. Zheng, J. Yang, D. Zhang. *Small*. **2025**. (Submission)
4. VL4SEM: A Few-Shot Vision-Language Framework for SEM Image Analysis in Materials Science
   X. Chen, D. Zhang, Z. Chen. (Submission)
5. Understanding Transformer Encoder-Decoder Representations through Bernoulli Dropout
   X. Chen. (Submission)

PUBLISHED

6. From Compute to Content: Building an AI-Wikipedia for Reliable and Efficient Artificial Intelligence
   D. Zhang, **X. Chen**. *Matter 2026*. (In Press)
7. Learning the Eye of the Beholder: Statistical Modeling and Estimation for Personalized Color Perception
   X. Chen, A. Xu, J. Wang, A. Pananjady. ***60th Annual Allerton Conference on Communication, Control, and Computing***. **2024**, 1–8.
8. Learning the Eye of the Beholder: Statistical Modeling and Estimation for Personalized Color Perception
   X. Chen, A. Xu, J. Wang, A. Pananjady. ***ICML (Humans, Algorithmic Decision-Making and Society: Modeling Interactions and Impact)***. **2024**.
9. Photothermally Triggered Smart Bandages for Temperature-Controlled Fixation and Bone Regeneration
   Y. Wang, J. Li, S. Yang, N. Bao, H. Jiang, **X. Chen**, D. Zhang, L. Che, D. Song. *Adv. Func. Mater*. **2025**, *35*, 2514519.
10. A Universal Zwitterionic Crosslinking Strategy for Designing Conductive Soft Electronics with Enhanced Mechanical Properties
    J. Luo, K. Zhao, S. Wang, Y. Chen, L. Che, **X. Chen**, D. Zhang, J. Yang, H. Yin. *ACS Appl. Mater. Interfaces* **2024**, *16*, 54706–54715.
11. Unlocking the Potential of CO_2 Capture: A Synergistic Hybridization Strategy for Polymeric Hydrogels with Tunable Physicochemical Properties
    Y. Gu, G. Wang, **X. Chen**, X. Xu, Y. Liu, J. Yang, D. Zhang. *Small* **2024**, *20*, 2402529.

PRESENTATIONS

1. **[2024/10 · Georgia Statistics Day]** "Statistical Modeling and Estimation for Personalized Color Perception". (**Invited Talk**)
2. **[2024/09 · 60th Allerton Conference on Communication, Control, and Computing]** "Statistical Modeling and Estimation for Personalized Color Perception". (**Invited Talk**)
3. **[2024/07 · ICML Workshop: Humans, Algorithmic Decision-Making and Society]** "Statistical Modeling and Estimation for Personalized Color Perception".
4. **[2025/10 · ML@GT Student Conference Poster Session]** "Learning the Eye of the Beholder: Statistical Modeling and Estimation for Personalized Color Perception".
5. **[2025/07 · Informs Applied Probability Society Conference]** "Statistical Modeling and Estimation for Personalized Color Perception".

TEACHING EXPERIENCE

Fall 2023	Digital Image Processing, Graduate Teaching Assistant	Atlanta, GA
Spring 2023	Fundamentals of Machine Learning, Graduate Teaching Assistant	Atlanta, GA
Summer 2022	K12 Summer ML Teaching Program, Instructor	Brooklyn, NY

MENTORING EXPERIENCE

2023-2025 Undergraduate Students (Georgia Institute of Technology): Xinyu Li

ACADEMIC SERVICES

PEER REVIEWERS

14 reviews for: *Association for the Advancement of Artificial Intelligence* (AAAI) and *Conference on Neural Information Processing Systems* (NeurIPS).