Emily Liu

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EDUCATION

Massachusetts Institute of Technology (B.S. Sep 2020 — May 2024, M.Eng Feb 2024 – Jan 2025)

Double Major in Computer Science, Mathematics — GPA 5.0/5.0

Relevant Coursework: Design and Analysis of Algorithms, Computation Structures, Computer Systems, Discrete Mathematics, Probability and Random Variables, Software Engineering, Machine Learning (G), Machine Vision (G), Statistical Learning Theory (G), Efficient Deep Learning (G), Hardware Architecture for Deep Learning (G)

RESEARCH EXPERIENCE

Uhler Group, MIT EECS + IDSS — Cambridge, MA

UROP/SuperUROP (Sep 2022 — June 2024), Research Assistant (Sep 2024 — Present)

PI: Caroline Uhler

- Investigated the effect of introducing unseen genetic perturbations in transcriptomic single-cell datasets on gene expression profiles.
- Used variational autoencoder (VAE) inspired representation learning methods to identify latent causal variables.
- Developed code library for out-of-distribution cell response prediction using causally-aware neural network architectures.
- Ran experiments to verify accuracy of causal predictions against state-of-the-art baselines, achieving ~40% improvement on mean squared error, ~10% improvement on differential expression, and ~4% improvement on distributional loss metrics.

Robust Robotics Group, MIT CSAIL – Cambridge, MA

UROP (Sep 2021 — June 2022), Research Collaborator (Jan 2024 — June 2024)

PI: Nicholas Roy

- Solved robotic door-opening task using hierarchical autoencoder-based technique; demonstrated advantages of pretraining and set-based learning in visual inference and manipulation tasks. Achieved 2-fold error reduction for door pose (angle) inference.
- Extended hierarchical autoencoder architecture to a few-shot semi-supervised learning bandit task for teaching a robot to open a door given highly limited training data.

Senseable Intelligence Group, MIT CSAIL – Cambridge, MA

UROP (Sep 2020 — Dec 2020)

PI: Satrajit Ghosh

- Trained Bayesian Neural Networks on image segmentation tasks for high-resolution MRI neuroimage data
- Implemented federated learning framework using distributed weight consolidation for inter-hospital collaboration.

PAPERS AND PUBLICATIONS

Learning Genetic Perturbation Effects with Variational Causal Inference. Emily Liu*, Jiaqi Zhang*, Caroline Uhler. Submitted to Research in Computational Molecular Biology (RECOMB) Conference 2025. Under review.

Semi-Supervised Neural Processes for Articulated Object Interaction (2024). Emily Liu, Michael Noseworthy, Nicholas Roy. Robotics Science and Systems 2024 Workshop on Structural Priors as Inductive Biases for Learning Robot Dynamics.

Leveraging Intermediate Neural Collapse with Simplex ETFs for Efficient Deep Neural Networks (2024). Emily Liu. Neural Information Processing Systems (NeurIPS) 2024 Workshop on Mathematics of Modern Machine Learning.

DISTINCTIONS AND HONORS

Eric and Wendy Schmidt Center Funded Research and Innovation Scholar *(June 2023)*

- In support of the research for "Causal Representation Learning for Predicting Drug Effects on Gene Expression."

MIT Eta Kappa Nu (HKN) Honor Society *(Sep 2022 – Jun 2024)*

- MIT chapter of the National Honor Society for Electrical Engineering and Computer Science, serving MIT EECS community.

CalHacks 2023 Grand Prize Recipient *(June 2023)*

- Grand Prize + Audience Choice award *Aligned*, open-source website for detecting LLM biases/hallucinations. Developed automated flexible taxonomy classifier for sensitive prompts using GPT-4 model as part of OpenAI alignment grant.

TEACHING

Teaching/Lab Assistant, *Introduction to Machine Learning*, **MIT EECS** *(Sep 2021 — May 2023, Feb 2024—May 2024)*
- Host weekly office hours and guide hands-on lab sessions. Lead 15-20 students in post-lab recap discussions with directed questions to prompt deeper thinking of concepts beyond the lab.
- Preview weekly homework, labs, and lecture material before release to students. Identify points of improvement and collaborate closely with course professors to tailor content to current relevant topics in machine learning.

Teaching Assistant, *Linear Algebra and Optimization*, **MIT Math/EECS** *(Sep 2023 —Dec 2023)*
- Host weekly office hours, monitor online classroom forum, provide online study resources, hold exam review sessions for computation-based linear algebra course.

Teacher, *Randomized Algorithms*, **MIT HSSP** *(July 2023 – August 2023)*
- Taught virtual six-week course on randomized algorithms for middle and high schoolers as part of an outreach program.
- Prepare teaching materials and give lectures; keep weekly email correspondence with students.

WORK EXPERIENCE

ByteDance, Machine Learning Engineering Intern (June 2024 — Aug 2024) — San Jose, CA
Core Feed Recommendations
- Implemented sequence models using different transformer architectures for learn-to-rank (LTR) models to incorporate recent user history into recommendations. Conducted A/B testing and found significant increase in user interaction metrics.
- Experimented the effect of changing reward functions for beam search in video re-ranking in the final step of core feed recommendation pipeline.

Scale AI, Software Engineering Intern (June 2023 – Aug 2023) – San Francisco, CA
Catalog Team
- Implemented automated reduced-cost label classification pipeline for e-commerce applications using open-source large language models (LLMs), increasing accuracy and F1 score of automatic product labeling procedures up to 10% from baseline.
- Configured pipelines for NER text extraction and multiclass/multilabel text classification from product descriptions using pre-trained BERT and RoBERTa models.

Meta, Software Engineering Intern (June 2022 — Aug 2022) — Menlo Park, CA
Facebook Ads Creative Optimization Team
- Implemented end-to-end logic for creation and rendering of ad video highlights using Hack (PHP)
- Deployed changes to production and analyzed increase in user engagement with highlighted video ads via A/B testing
- Assisted in framework migration and integration of Facebook and Instagram ads backend

Genesis Therapeutics, Software Engineering Intern (June 2021 – Aug 2021) – Burlingame, CA
- Developed autoencoder and integrated into core deep learning pipeline.
- Conducted experiments on data augmentation, transfer learning, data efficiency on graph neural nets for drug discovery.
- Maintained and developed new user features for internal web server.

LEADERSHIP AND SERVICE

MIT Eta Kappa Nu (HKN) Director of Marketing (Sep 2023 — June 2024)
- In charge of planning, fundraising and budget for community social events.
- Designed and distributed merchandise (T-shirts, sweatshirts) to student body**.**

National Science Bowl Volunteer, Washington, DC. April 2023 & April 2024
- Served in the judging team for the high school division of 64 teams across the nation. All teams advanced to National as Regional champions.
- Help with event setup, team greeting, check-in, and team warm-up activities

Regional Science Bowl Volunteer (2017 - present)
- New England High School Science Bowl Regional, @ MIT, 2021-2024. Serve in the judging team for 24-30 high schools from the New England Area.
- SLAC Middle School Science Bowl Regional, @ Stanford Linear Accelerator Center, 2017 - 2020. Serve in the judge team for 24 Middle School teams from the South Bay area.

Math Prize for Girls Volunteer (2021 — 2023)
- Graded exams, organized Games night for ~200 high school girls across the nation.

Teacher, SPLASH for MIT (2021)
- Taught class on cellular automata for 30 HS students in Greater Boston Area, provided starter code for Conway's Game of Life.