Ollie Liu

Research Interests	I design multimodal foundation models (FM) for scientific discovery, with recent applications in astronomy [P4] and metagenomics [P3]. My work also explores inference-time methods for decision-making with FMs [C6] as well as their underlying mechanisms [C1,C2,C3,C5].

Education

University of Southern California   08/2022 - *Present*
Ph.D. in Computer Science
Advisors: Dani Yogatama, Willie Neiswanger

Northwestern University   09/2019 - 06/2021
M.S. in Industrial Engineering and Management Sciences

Carnegie Mellon University   08/2013 - 08/2019
B.S. (Hons) and M.S. in Machine Learning

Positions

The Simons Foundation & Polymathic AI, Research Scientist   09/2024 - 12/2024
Host: François Lanusse, Shirley Ho
Developed AION [P4], the first series of multimodal FMs for observational astronomy, leading
post-training efforts and contributing to pre-training and model architecture ablations.

Microsoft Research, Research Intern   05/2024 - 08/2024
Host: Corby Rosset
Worked with the AI Frontiers Team and designed a self-improving workflow for post-training large
language models from textual feedback, with applications in mathematical reasoning.

Reka AI, Research Intern   05/2023 - 07/2023
Host: Qi Liu, Dani Yogatama
Implemented training algorithms for reward models, with applications in multimodal data.

Redwood Research, Research Resident   01/2023 - 05/2023
Host: The REMIX Research Program
Applied path patching to identify reusable subgraph of language models that implement elementary
mathematical operations, with results accepted to NeurIPS 2023 [C1].

Refereed Publications

⋆: equal contribution; orange: featured publication

[C7]   Ghazal Khalighinejad, Sharon Scott, **Ollie Liu**, Kelly L. Anderson, Rickard Stureborg,
Aman Tyagi, Bhuwan Dhingra "MatVix: Multimodal Information Extraction from Visually
Rich Articles" In: *Proceedings of NAACL 2025*. [pdf] [website]

[C6]   **Ollie Liu**⋆, Deqing Fu⋆, Dani Yogatama, Willie Neiswanger "DeLLMa: Decision Making
Under Uncertainty with Large Language Models" In: *Proceedings of ICLR 2025,* Spotlight
Presentation (top 5.1% of all submissions). [pdf] [website]

[C5]   Deqing Fu⋆, Ruohao Guo⋆ , Ghazal Khalighinejad⋆, **Ollie Liu**⋆, Bhuwan Dhingra, Dani
Yogatama, Robin Jia, Willie Neiswanger "IsoBench: Benchmarking Multimodal Foundation
Models on Isomorphic Representations" In: *Proceedings of COLM 2024*. [pdf] [website]

[C4]   Ting-Rui Chiang, Xinyan Velocity Yu, Joshua Robinson, **Ollie Liu**, Isabelle Lee, Dani Yogatama "On Retrieval Augmentation and the Limitations of Language Model Training" In: *Proceedings of NAACL 2024 (short)*. [pdf] [code]

[C3]   Xianghao Kong⋆, **Ollie Liu**⋆, Han Li, Dani Yogatama, Greg Ver Steeg "Interpretable Diffusion via Information Decomposition" In: *Proceedings of ICLR 2024*. [pdf] [code]

[C2]   Ghazal Khalighinejad , **Ollie Liu**, Sam Wiseman "Approximating CKY with Transformers" In: *Proceedings of Findings of EMNLP 2023*. [pdf] [code]

[C1]   Michael Hanna, **Ollie Liu**, Alexandre Variengien "How Does GPT-2 Compute Greater-Than?: Interpreting Mathematical Abilities in a Pre-Trained Language Model" In: *Proceedings of NeurIPS 2023*. [pdf]

Preprints

[P4]   The Polymathic AI Collaboration, François Lanusse, Liam Holden Parker, Jeff Shen, **Ollie Liu**, Tom Hehir, Leopoldo Sarra, Lucas Thibaut Meyer, Micah Bowles, Sebastian Wagner-Carena, Helen Qu, Siavash Golkar, Alberto Bietti, Hatim Bourfoune, Pierre Cornette, Keiya Hirashima, Geraud Krawezik, Ruben Ohana, Nicholas Lourie, Michael McCabe, Rudy Morel, Payel Mukhopadhyay, Mariel Pettee, Bruno Régaldo-Saint Blancard, Kyunghyun Cho, Miles Cranmer, Shirley Ho "AION: Omnimodal Foundation Model for Astronomy" In: *arXiv Preprint*. [pdf] [website]

[P3]   **Ollie Liu**, Sami Jaghouar, Johannes Hagemann, Shangshang Wang, Jason Wiemels, Jeff Kaufman, Willie Neiswanger "METAGENE-1: Metagenomic Foundation Model for Pandemic Monitoring" In: *arXiv Preprint*. [pdf] [website] [models & datasets]

[P2]   Jiarui Zhang, **Ollie Liu**, Tianyu Yu, Jinyi Hu, Willie Neiswanger "Euclid: Supercharging Multimodal LLMs with Synthetic High-Fidelity Visual Descriptions" In: *arXiv Preprint*. [pdf] [website] [models & datasets]

[P1]   Wenyue Hua, **Ollie Liu**, Lingyao Li, Alfonso Amayuelas, Julie Chen, Lucas Jiang, Mingyu Jin, Lizhou Fan, Fei Sun, William Yang Wang, Xintong Wang, Yongfeng Zhang "Game-Theoretic LLM: Agent Workflow for Negotiation Games" In: *arXiv Preprint*. [pdf]

Honors and Awards

Spotlight Presentation, DeLLMa: Decision Making Under Uncertainty with Large Language Models, The Thirteenth International Conference on Learning Representations (ICLR), 2025
Technical Innovation Fellowship, University of Southern California, 2025
Nebius Research Credits Program, est. $200,000, Nebius Group, 2025
University Organizer Fellowship, est. $30,000, Open Philanthropy, 2024
Provost's Fellowship, est. $2,000 per year, University of Southern California, 2022
Data Science Fellowship, est. $10,000, Northwestern University, 2019
Royal E. Cabell Fellowship, est. $10,000, Northwestern University, 2019
Senior Leadership Recognition, Carnegie Mellon University, 2018

Invited Talks

CSCI 699: Probabilistic and Generative Models, Guest Lecture on Flow Matching.
Intel EAI Tech Talk, DeLLMa: Decision Making Under Uncertainty with Large Language Models.
USC Information Science Institute NLG Seminar, DeLLMa: Decision Making Under Uncertainty with Large Language Models. [video]

USC NLP Lunch, IsoBench: Benchmarking Multimodal Foundation Models on Isomorphic Representations.

USC NLP Lunch, How Does GPT-2 Compute Greater-Than?: Interpreting Mathematical Abilities in a Pre-Trained Language Model.

Teaching Experiences	**TA**, Generative Models (Ph.D. Elective), University of Southern California, Spring 2025
	TA, Machine Learning (Master), University of Southern California, Fall 2023
	Co-Instructor, Machine Learning (Ph.D. Elective), Northwestern University, Fall 2021
	Co-Instructor, Mathematical Statistics (Ph.D. Core), Northwestern University, Fall 2020
	TA, Introduction to Machine Learning (Master), Carnegie Mellon University, 2 Semesters.
	TA, Principles of Computing (Undergraduate), Carnegie Mellon University, 4 Semesters.
Doctoral Courseworks	Machine Learning, Natural Language Processing, Computer Vision, Learning Theory, Scalable Learning Systems, Theoretical Optimization
Services and Activities	**Reviewer**, ICML (2024, 2025); NeurIPS (2024); ICLR (2025); ACL Rolling Review (2024)
	President, AI Safety Group, University of Southern California
	Student organizer, Center for Optimization and Statistical Learning, Northwestern University
Skills	**Software**: Python (JAX, PyTorch, 🤗 Hugging Face), Linux, R, LaTeX
	Language: Chinese (*native*), English (*proficient*, GRE V169+Q168)