Ollie Liu

Research Interests	I design multimodal foundation models (FM) for scientific discovery, with recent applications in astronomy [C9] 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,P4].

Education

University of Southern California 08/2022 - 05/2026
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

FAIR at Meta, Research Intern 05/2025 - 10/2025
Collaborator(s): Brandon Amos, Arman Zharmagambetov, Xian Li
Developing algorithms that elicit optimization thinking in large language models.

The Simons Foundation & Polymathic AI, Research Scientist 09/2024 - 12/2024
Collaborator(s): 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
Collaborator(s): 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
Collaborator(s): Qi Liu, Dani Yogatama
Implemented training algorithms for reward models, with applications in multimodal data.

Redwood Research, Research Resident 01/2023 - 05/2023
Collaborator(s): 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

[C9] 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-1: Omnimodal Foundation Model for Astronomy" In: *Proceedings of NeurIPS 2025,* Oral Presentation at the NeurIPS 2025 AI for Science Workshop. [pdf] [website]

[C8]   Xiaoyuan Zhu, Muru Zhang, **Ollie Liu**, Robin Jia, Willie Neiswanger "LLM Unlearning Without Expert Curated Dataset" In: *Proceedings of COLM 2025*. [pdf] [website]

[C7]   Ghazal Khalighinejad, Sharon Scott, **Ollie Liu**, Kelly L. Anderson, Rickard Stureborg, Aman Tyagi, Bhuwan Dhingra "MᴀᴛVɪx: 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. [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

[P11]   The Polymathic AI Collaboration, Jeff Shen, François Lanusse, Liam Holden Parker, **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 "Universal Spectral Tokenization via Self-Supervised Panchromatic Representation Learning" In: *arXiv Preprint & NeurIPS 2025 AI for Science Workshop*. [pdf]

[P10]   Shangshang Wang, **Ollie Liu**, Jiarui Zhang, Willie Neiswanger "OpenMETAGENE: Large-Scale, Diverse, and Open Data Recipes for Multimodal Metagenomics Models" In: *arXiv Preprint & NeurIPS 2025 AI for Science Workshop*. [pdf]

[P9]   **Ollie Liu**, Arman Zharmagambetov, Willie Neiswanger, Xian Li, Brandon Amos "OᴘᴛTʜɪɴᴋᴇʀ: Optimization Reasoning with Large Language Models" In: *arXiv Preprint*. [pdf] [website]

[P8]   Bang Liu, Xinfeng Li, Jiayi Zhang, Jinlin Wang, Tanjin He, Sirui Hong, Hongzhang Liu, Shaokun Zhang, Kaitao Song, Kunlun Zhu, Yuheng Cheng, Suyuchen Wang, Xiaoqiang Wang, Yuyu Luo, Haibo Jin, Peiyan Zhang, **Ollie Liu**, Jiaqi Chen, Huan Zhang, Zhaoyang Yu, Haochen

Shi, Boyan Li, Dekun Wu, Fengwei Teng, Xiaojun Jia, Jiawei Xu, Jinyu Xiang, Yizhang Lin, Tianming Liu, Tongliang Liu, Yu Su, Huan Sun, Glen Berseth, Jianyun Nie, Ian Foster, Logan Ward, Qingyun Wu, Yu Gu, Mingchen Zhuge, Xiangru Tang, Haohan Wang, Jiaxuan You, Chi Wang, Jian Pei, Qiang Yang, Xiaoliang Qi, Chenglin Wu "Advances and Challenges in Foundation Agents: From Brain-Inspired Intelligence to Evolutionary, Collaborative, and Safe Systems" In: *arXiv Preprint*. [pdf] [website]

[P7]   Shangshang Wang, Julian Asilis, Ömer Faruk Akgül, Enes Burak Bilgin, **Ollie Liu**, Deqing Fu, Willie Neiswanger "Resa: Transparent Reasoning Models via SAEs" In: *arXiv Preprint & NeurIPS 2025 Efficient Reasoning Workshop*. [pdf] [website] [models & datasets]

[P6]   Ang Li⋆, Charles L. Wang⋆, Kaiyu Yue⋆, Zikui Cai⋆, **Ollie Liu**⋆, Deqing Fu⋆, Peng Guo⋆, Wang Bill Zhu⋆, Vatsal Sharan, Robin Jia, Willie Neiswanger, Furong Huang, Tom Goldstein, Micah Goldblum "Zebra-CoT: A Dataset for Interleaved Vision Language Reasoning" In: *arXiv Preprint*. [pdf] [models & datasets]

[P5]   Shangshang Wang, Julian Asilis, Ömer Faruk Akgül, Enes Burak Bilgin, **Ollie Liu**, Willie Neiswanger "Tina: Tiny Reasoning Models via LoRA" In: *arXiv Preprint*. [pdf] [website] [models & datasets]

[P4]   Haosheng Gan⋆, Deqing Fu⋆, Julian Asilis⋆, **Ollie Liu**⋆, Dani Yogatama, Vastal Sharan, Robin Jia, Willie Neiswanger "Textual Representations Alone Can Steer Multimodal Models" 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 & NeurIPS 2024 Foundation Models for Science Workshop*. [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, 2025); ICLR (2025, 2026); ACL Rolling Review (2024, 2025) **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)