JONATHAN LI

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RESEARCH INTERESTS

- Studies the interplay between **incentives** (economics), **algorithms** (computer science), and **learning** (statistics), notably in: sequential decision making, planning, algorithmic game theory, online learning, market design for data, reinforcement learning, **autonomous agents**, human-AI collaboration, and aligning AI towards human preferences
- My current work focuses on **foundation models for decision making**, integrating their generalization with the **planning and reasoning** required for interactive sequential decision making. We aim to create **self-improving** agents adept at **collaboration** with both humans and other autonomous agents, such as in **math, games, and coding**

EDUCATION

RENSSELAER POLYTECHNIC INSTITUTE — **Troy, NY**
Ph.D. in Computer Science (GPA: 3.92/4.0) — **Aug 2023 - Present**

The University of Chicago — **Chicago, IL**
Master of Science in Financial Mathematics (GPA: 3.82/4.0) — **Aug 2021 - Mar 2023**

REED COLLEGE — **Portland, OR**
Bachelor of Science in Mathematics and Economics (GPA: 3.93/4.0) — **Aug 2017 – May 2021**

- Also completed all requirements for a computer science degree, surpassing required coursework by nine additional courses

SELECT HONORS, AWARDS, AND SERVICE

ICLR Conference Reviewer, 2025
NeurIPS Conference Reviewer, 2025
Member of Phi Beta Kappa, 2021
Reed Commendation for Excellence in Scholarship, 2018, 2019, 2020, 2021
Reed Science Research Fellow, 2020; Reed Financial Services Fellow, 2019

SELECT PUBLICATIONS

1. "DISC: Dynamic Decomposition Improves LLM Inference Scaling". Jonathan Light, Wei Cheng, Benjamin Riviere, Wu Yue, Masafumi Oyamada, Mengdi Wang, Yisong Yue, Santiago Paternain, Haifeng Chen. *NeurIPS 2025.*
2. "Scattered Forest Search: Smarter Code Space Exploration with LLMs". Jonathan Light, Yue Wu, Yiyou Sun, Wenchao Yu, Yanchi Liu, Xujiang Zhao, Ziniu Hu, Wei Cheng. *ICLR 2025.*
3. "Strategist: Self-improvement of LLM Decision Making via Bi-Level Tree Search". Jonathan Light, Henry Cai, Weiqin Chen, Guanzhi Wang, Xiusi Chen, Wei Cheng, Yisong Yue, Ziniu Hu. *ICLR 2025.* Web app. Featured in State of AI Report alongside o1.
4. "Dataset Distillation for Offline Reinforcement Learning". Jonathan Light*, Yuanzhe Liu*, Ziniu Hu. *ICML 2024 Datacentric machine learning research workshop.* Website.
5. "AvalonBench: Evaluating LLMs Playing the Game of Avalon". Jonathan Light*, Henry Cai*, Sheng Shen, Ziniu Hu. *NeurIPS 2023 Foundation models for decision making workshop*. Codebase.
6. "A Data-Centric Online Market for Machine Learning: From Discovery to Pricing". Sainyam Galhotra*, Minbiao Han*, Jonathan Light*, Steven Xia*, Raul Castro Fernadez, and Haifeng Xu. *Under review.*

RESEARCH EXPERIENCE

CALTECH, CMS – ADVISOR: YISONG YUE — **Pasadena, CA**
Visiting Scholar, LLM Reasoning and Inference Scaling — **Jan 2025 - Present**

- Pioneered a novel way to integrate LLM reasoning with search, enabling efficient exploration of reasoning paths
- Developed a method to automatically decompose reasoning traces into steps without human supervision, domain heuristics, or reward models
- Improved base model accuracy by up to 4x at low cost, outperforming advanced reasoning models such as **R1**

RPI COMPUTER SCIENCE – ADVISOR: ZINIU HU — **Troy, NY**
PhD student, Self-improving LLM agents — **Jul 2023 – Present**

- Achieved human-level performance without guidance on Avalon through self-improvement and evolutionary search
- Created AvalonBench, a benchmark evaluating LLMs in the challenging social deduction game *Resistance Avalon*
- Advanced LLM agent design by integrating memory and planning techniques (e.g., Monte Carlo tree search)
- Agents learned novel collaboration and reasoning strategies beyond their initial training

NEC LABORATORIES AMERICA – ADVISOR: WEI CHENG **Princeton, NJ**
Part-time Researcher, Code Generation **May 2024 – Present**

- Achieved SOTA on code generation benchmarks (HumanEval, Leetcode, APPS), boosting performance by over 5.5%
- Developed inference-scaling search methods for LLM code generation, surpassing AlphaEvolve in scaling
- Discovered a novel technique to boost LLM exploration via prompt perturbations, enhancing solution diversity

UCHICAGO COMPUTER SCIENCE – HAIFENG XU AND RAUL CASTRO FERNADEZ **Chicago, IL**
Market and Mechanism Design Research Project **Aug 2022 – Jun 2023**

- Developed a mathematical model for optimal pricing of machine learning algorithms and data valuation
- Designed and implemented an incentive structure for data markets with built-in privacy protections

BOOTH SCHOOL OF BUSINESS – ADVISOR: DACHENG XIU **Chicago, IL**
Econometrics and Statistics Research Project **Aug 2021 – Jul 2023**

- Converted and optimized time series ML data simulation functions from Python to C++, with 95% less runtime
- Developed online algorithms for asset pricing using Monte Carlo methods, outperforming the benchmarks by 2x

REED COLLEGE – ADVISORS: FELIPE CARRERA AND JONATHAN WELLS **Portland, OR**
Undergraduate Research and Thesis on Game Theory and Probability **Aug 2020 – May 2021**

- Simulated coalition bargaining and formation of reinforcement learning agents across time
- Formulated and proved new results (e.g., hyper Sylvester's identity) supported by Monte Carlo simulations.
- Designed algorithms that stabilized forms recursively for random sampling of invertible forms

WORK AND TEACHING EXPERIENCE

BOOTH SCHOOL OF BUSINESS (UNIVERSITY OF CHICAGO) **Chicago, IL**
Teaching Assistant **Mar 2022 - Jul 2023**

- Designed coursework and gave lectures for Booth executive MBA students on applications of AI to industry

REED RESEARCH REACTOR **Portland, OR**
Supervisor and Senior Reactor Operator (NRC Licensed) **Sep 2017 – May 2021**

- Handled emergencies and supervised operation, including neutron irradiation and gamma spectroscopy projects

DELOITTE CONSULTING **Guangzhou, China**
Tax Consultancy Intern **Jul 2019 – Aug 2019**

- Built and compared financial models under different taxation scenarios, researching the relevant regulations
- Uncovered and resolved unscrupulous accounting practices while conducting a field study at the client's factory

SIEMENS MANAGEMENT CONSULTING **Beijing, China**
Analyst Intern **Jul 2018 – Aug 2018**

- Identified key information for potential partnerships, leading to success two weeks ahead of schedule
- Researched and educated consultants on new data management and analysis methods as a substitute for Excel

SELECTED COURSEWORK

* denotes courses I was also teaching assistant for

- **Math/Stats:** Real analysis*, probability theory*, stochastic processes, generalized linear models, modern statistics*
- **CS/ML:** Algorithms*, computer systems, RL*, deep learning, algorithmic game theory, ML theory, complexity theory
- **Economics/Finance:** Econometrics*, option pricing*, market design, market microstructures, portfolio theory

SKILLS AND INTERESTS

Computer languages: C++ - Advanced, Python - Advanced, R - Advanced, Golang, SQL, Mathematica, PyTorch
Human languages: English (native speaker), Chinese (native speaker)
Interests: Board games, strategy games, card games, hidden identity games, tabletop RPGs, game design, fencing, archery, squash, music composition, Ultimate Frisbee, badminton