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** that integrates the generalization of foundation models with the **planning and reasoning** of interactive sequential decision making. We aim to create agents adept at **communication and collaboration** with both humans and other autonomous agents, such as **games and coding**

EDUCATION

RENSSELAER POLYTECHNIC INSTITUTE — **Troy, NY**
Doctorate of Philosophy 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

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
ICLR Conference Reviewer, 2025

SELECT PUBLICATIONS

1. "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*
2. "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. *ICML 2024 Automated RL workshop. ICLR 2025.* Web app. Featured in State of AI Report alongside o1.
3. "Dataset Distillation for Offline Reinforcement Learning". Jonathan Light*, Yuanzhe Liu*, Ziniu Hu. *ICML 2024 Datacentric machine learning research workshop.* Website.
4. "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.
5. "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

RPI COMPUTER SCIENCE – ZINIU HU — **Troy, NY**
LLMs and Gameplay Project — **Jul 2023 - Present**

- Introduced a new benchmark for LLMs for the challenging social deduction game Resistance Avalon
- Developing stronger LLM agents by integrating memory and planning techniques like Monte Carlo tree search
- Designed methods for foundation models to learn collaboration and reasoning skills through self-improvement

NEC LABORATORIES AMERICA – WEI CHENG — **Princeton, NJ**
Research Intern — **May 2024 – Present**

- Developed search-based methods leveraging inference scaling to refine LLM code generations.
- Achieved SOTA on code generation benchmarks (HumanEval, Leetcode, APPS), boosting performance by over 5.5%

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 optimal incentive structure for data markets with privacy protections

BOOTH SCHOOL OF BUSINESS – 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

THESIS PROJECT – FELIPE CARRERA AND JONATHAN WELLS **Portland, OR**
Title: Coalition Formation in Dynamic Stochastic Cooperative Games under Uncertainty **Aug 2020 – May 2021**

- Simulated coalition bargaining and formation of reinforcement learning agents across time using Python
- Conducted data analysis on the collective behavior of agents concerning changes to initializations

RANDOM MATRIX THEORY RESEARCH – JONATHAN WELLS **Portland, OR**
Mathematics and Statistics Research Project **Jun 2020 – Aug 2020**

- Formulated and proved multiple theorems like hyper Sylvester's identity, deriving intuition from MC simulations
- Discovered algorithms that stabilized forms recursively for random sampling of invertible forms

WORK AND TEACHING EXPERIENCE

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

Courses: AI and Blockchain, Decoding Fintech, Options Pricing, Bayesian Statistical Inference and ML

- Designed assignments and lectures for Booth executive MBA students on applications of AI

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

- Supervised operations and handled emergencies at the only reactor in the US operated by undergraduates
- Directed and planned research projects that involved neutron irradiation and gamma spectroscopy

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 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 COURSES

* denotes courses I was also teaching assistant for

- **Math Courses:** Real Analysis, Abstract algebra, Probability theory*, Linear algebra, Multivariable calculus
- **Statistics Courses:** Mathematical statistics*, Statistical learning, Data science, Modern methods in statistics, Generalized linear models, Stochastic processes,
- **Computer Science Courses:** Data structures and algorithms, Computer systems, Approximation algorithms, Artificial intelligience, Computability and complexity, Discrete structures,
- **Machine Learning Courses**: Reinforcement learning, Deep learning, Machine learning fundamentals, Theory of ML, Algorithmic game theory, Decision making under uncertainty, Information theory,
- **Economics and Finance Courses:** Decision and strategy, Option pricing, Market microstructures, Portfolio theory, Data economics, Information economics, Econometrics*, Microeconomics*, Macroeconomics*

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