**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**

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| **Rensselaer Polytechnic Institute** | **Troy, NY** |
| **Doctorate of Philosophy in Computer Science (GPA 3.92/4.0)** | **Aug 2023 - Present** |

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

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| **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](https://arxiv.org/pdf/2411.05010)”. 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](https://llm-strategist.github.io/)”. 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](https://searchtechniques.onrender.com/). Featured in [State of AI Report](https://docs.google.com/presentation/d/1GmZmoWOa2O92BPrncRcTKa15xvQGhq7g4I4hJSNlC0M/edit#slide=id.g2d35a16f27e_0_24) alongside o1.
3. “[Dataset Distillation for Offline Reinforcement Learning](https://arxiv.org/abs/2407.20299)”. Jonathan Light\*, Yuanzhe Liu\*, Ziniu Hu. *ICML 2024 Datacentric machine learning research workshop.* [Website.](https://datasetdistillation4rl.github.io/)
4. “[AvalonBench: Evaluating LLMs Playing the Game of Avalon](https://arxiv.org/pdf/2310.05036.pdf)”. Jonathan Light\*, Henry Cai\*, Sheng Shen, Ziniu Hu. *NeurIPS 2023 Foundation models for decision making workshop*. [Codebase](https://github.com/jonathanmli/Avalon-LLM).
5. “[A Data-Centric Online Market for Machine Learning: From Discovery to Pricing](https://arxiv.org/pdf/2310.17843.pdf)”. Sainyam Galhotra\*, Minbiao Han\*, Jonathan Light\*, Steven Xia\*, Raul Castro Fernadez, and Haifeng Xu. *Under review*

**Research Experience**

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| **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

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| **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%

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| **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

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| **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

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| **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

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| **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**

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| **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

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| **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

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| **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

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| **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

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| **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