Ryan Welch

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Research Interests

Methodology in statistics and machine learning: Causal structure learning, representation learning, reinforcement learning, treatment effect estimation

Scientific Applications: Genomics, healthcare, social sciences

Education

Stanford University September 2025 – Present

Candidate for Ph.D. in Computer Science

Massachusetts Institute of Technology June 2024 – May 2025

M.Eng. in Artificial Intelligence and Decision Making

- *Thesis Advisor*: Caroline Uhler
- *GPA*: 5.0/5.0

Massachusetts Institute of Technology August 2020 – May 2024

B.S. in Artificial Intelligence and Decision Making (6-4) and in Mathematics (18)

- *GPA*: 4.9/5.0
- *Organizations*: Eta Kappa Nu Honors Society, Eric and Wendy Schmidt Center Innovation Scholar, Interfraternity Council Executive Board
- *Athletics*: NCAA Division III Men's Varisty Lacrosse (2020-2022)

Work Experience

Graduate Researcher, Broad Institute of MIT and Harvard June 2024 – August 2025

- Working with Professors Caroline Uhler and Aldo Pacchiano in the Eric and Wendy Schmidt Center to pioneer algorithms for experimental design
- Developing autoregressive transformer models to learn optimal exploration policies in complex environments

Undergraduate Researcher, Broad Institute of MIT and Harvard September 2023 – May 2024

- Collaborated with Professor Caroline Uhler and a PhD student to investigate identifiability guarantees for causal disentanglement from purely observational data
- Derived a novel identifiability result and developed a practical algorithm to achieve it

Quantitative Research Intern, Schonfeld Strategic Advisors June 2023 – August 2023

- Worked on the Neutrality Trading Desk
- Engineered real-time dashboard using Elasticsearch and Kibana to monitor short squeeze risks across all publicly traded assets, leveraging sentiment insights from media platforms Reddit and X

Quantitative Research Intern, HAP Capital June 2022 – August 2023

- Worked on the Global Electronic Options Trading Team
- Developed model to predict structural flows of various underlying assets and statistically modeled its causal effect on conditional variance of returns

Undergraduate Researcher, Laboratory for Financial Engineering at MIT June 2020 – June 2022

- Worked with Professor Andrew Lo and graduate students in the Fintech and AI Research Group
- Assisted in modeling the differences in stock price performance between the biotech and pharmaceutical sectors in reponse to macro events in healthcare

Data Science Intern, Tookitaki Technologies June 2021 – August 2021

- Worked in the Anti-Money Laundering Division of the Research Engineering Team
- Developed machine learning pipeline to predict the techniques and financial instruments involved in suspicious transactions given a text report by the user

Publications

Identifiability Guarantees for Causal Disentanglement from Purely Observational Data May 2024

Ryan Welch*, Jiaqi Zhang*, Caroline Uhler

NeurIPS 2024, MIT News, GitHub

In-Context Learning for Pure Exploration May 2025

Alessio Russo*, ***Ryan Welch****, Aldo Pacchiano

ICML EXAIT 2025

Learning to Explore: An In-Context Learning Approach for Pure Exploration May 2025

Alessio Russo*, ***Ryan Welch****, Aldo Pacchiano

ArXiv Preprint

Teaching Experience

Massachusetts Institute of Technology

- Teaching Assistant: *Quantitative Methods for NLP (6.8610/6.864)* Fall 2024
- Teaching Assistant: *Design and Analysis of Algorithms (6.1220/6.046)* Spring 2024
- Grader: *Design and Analysis of Algorithms (6.1220/6.046)* Fall 2024

Service

Reviewer, ICRL, ICML & NeurIPS 2024 - Present

Risk Manager, MIT Interfraternity Council Winter 2022 - Fall 2023

Community Service, House Management & Recruitment Chair, MIT Chi Phi Fraternity Spring 2022 - Fall 2022

Skills and Interests

Languages: Python, R, SQL, Java, Objective-C, Swift, WebPPL, Julia

Academic Interests: Causal Inference, Reinforcement Learning, Natural Language Processing, Optimization, Healthcare, Entrepreneurship

Personal Interests: Rock Climbing, Skiing, Basketball, Tennis, Poker