

# BIJAN MAZAHERI

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I study topics related to causality, distribution shift, decision fusion, and mixture models, particularly with respect to the task of combining data and knowledge from multiple places, topics, and modalities. I approach problems through a bifocal lens, with theory guiding data-realistic approaches to application and application giving rise to new fundamental discoveries.

## EDUCATION

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**California Institute of Technology - Pasadena, CA** *Oct 2017 - Aug 2023*  
*Ph.D.*

Department of Computing and Mathematical Sciences, GPA: 3.9/4.0

Awarded NSF Graduate Research Fellowship and Amazon AI4Science Research Fellowship

Thesis Title: Combining Sources and Leveraging Contexts

**Cambridge University (Emmanuel College) - Cambridge, UK** *Oct 2016 - Jun 2017*  
Mathematics Part 1B

Supported by a Herchel Smith Fellowship

Additional classes in Computer Science and Mathematics Part II

**Williams College - Williamstown, MA** *Sep 2012 - Jun 2016*  
*Bachelor of Arts*

Physics and Computer Science, GPA: 3.92/4.00

Highest Honors (Physics), Phi Beta Kappa, Sigma Xi, Magna Cum Laude

Thesis Title: RNA Macrostates and Macrokinetics

## WORK EXPERIENCE

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**Broad Institute of MIT and Harvard - Cambridge, MA** *Oct 2023 - Now*  
*Eric and Wendy Schmidt Postdoctoral Associate*

Current projects focus on batch-effect correction, causal inference, missing data, and efficient experimental design. Primarily working with Prof. Caroline Uhler.

**Amazon Research Causality Lab - Tübingen, Germany** *Oct 2022 - Feb 2023*  
*Applied Scientist Intern (L5)*

Worked with Dr. Michaela Hardt, Dr. Atalanti Mastakouri, and Dr. Dominik Janzing

Lead-authored a paper accepted to UAI 2023.

**BioDiscovery - El Segundo, CA** *Jun 2017 - Sep 2017*  
*Intern*

I developed and implemented methods for clustering cancers based on genome aberrations. My work has now been integrated into BioDiscovery's software and presented at a conference.

**IBM T.J. Watson Research Center - Yorktown Heights, NY** *Jun 2016 - Sep 2016*  
*Intern*

Worked with Dr. Victor Kravets (mentor) and Dr. Andrew Sullivan (manager).

Projects included non-greedy and map-reduce algorithms for factoring sum of products representations, with the goal of developing more efficient circuits.

## TEACHING EXPERIENCE

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### Markov Chain Monte Carlo

Spring 2022

Head TA for new class on MCMC methods in theoretical computer science. Developed solutions and grading rubrics for problem sets.

### Physics and Mathematics

Sep 2013-Jun 2016

TAed for undergraduate classes in Electricity and Magnetism, Classical Mechanics, Mathematical Methods for Scientists, Premed Physics, Discrete Mathematics.

## AWARDS AND GRANTS

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### Amazon AI4Science Research Fellowship

Awarded Spring 2022

Funding for research with the potential to aid scientific discovery.

### National Science Foundation Graduate Research Fellowship

Awarded Spring 2019

3 year Ph.D. fellowship awarded for a proposal to research confounding influence in causal networks.

### Herchel Smith Fellowship

Awarded Spring 2016

Funding for 1-3 years of study at Cambridge University.

## PUBLICATIONS

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Spencer Gordon, Eric Jahn, **\*Bijan Mazaheri**, Yuval Rabani, and Leonard J Schulman. Identification of Mixtures of Discrete Product Distributions in Near-Optimal Sample and Time Complexity. In *The Thirty Seventh Annual Conference on Learning Theory*, pages 2071–2091. PMLR, 2024.

**Bijan Mazaheri**, Atalanti Mastakouri, Dominik Janzing, and Michaela Hardt. Causal Information Splitting: Engineering Proxy Features for Robustness to Distribution Shifts. In *The 39th Conference on Uncertainty in Artificial Intelligence*, 2023.

Spencer Gordon, **\*Bijan Mazaheri**, Yuval Rabani, and Leonard J Schulman. Causal Inference Despite Limited Global Confounding via Mixture Models. In *2nd Conference on Causal Learning and Reasoning*, 2023.

Siddharth Jain, **Bijan Mazaheri**, Netanel Raviv, and Jehoshua Bruck. Glioblastoma signature in the DNA of blood-derived cells. *PLOS ONE* 16(9): e0256831. 2021.

**Bijan Mazaheri**, Siddharth Jain, and Jehoshua Bruck. Expert Graphs: Synthesizing New Expertise via Collaboration. In *2021 IEEE International Symposium on Information Theory (ISIT)*, pages 2447–2452, 2021.

Spencer Gordon, **\*Bijan Mazaheri**, Yuval Rabani, and Leonard Schulman. Source Identification for Mixtures of Product Distributions. In *Conference on Learning Theory*, pages 2193–2216. PMLR, 2021.

**Bijan Mazaheri**, Siddharth Jain, and Jehoshua Bruck. Robust Correction of Sampling Bias using Cumulative Distribution Functions. *Advances in Neural Information Processing Systems*, volume 33, pages 3546–3556. Curran Associates, Inc., 2020.

\* = Authorship order is alphabetical.

## PREPRINTS

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**Bijan Mazaheri**, Spencer Gordon, Yuval Rabani, and Leonard J Schulman. Causal Discovery under Latent Class Confounding. *arXiv:2311.07454*, 2023. Under Review.

**Bijan Mazaheri**, Siddharth Jain, Matthew Cook, and Jehoshua Bruck. Omitted Labels in Causality: A Study of Paradoxes *arXiv:2311.06840*, 2023. Under Review.

Spencer Gordon, \***Bijan Mazaheri**, Leonard J Schulman, and Yuval Rabani. The sparse Hausdorff moment problem, with application to topic models. *arXiv:2007.08101*, 2020.

Siddharth Jain, **Bijan Mazaheri**, Netanel Raviv, and Jehoshua Bruck. Cancer Classification from Healthy DNA using Machine Learning. *BioRxiv*, page 517839, 2019.

Siddharth Jain, **Bijan Mazaheri**, Netanel Raviv, and Jehoshua Bruck. Short Tandem Repeats Information in TCGA is Statistically Biased by Amplification. *BioRxiv*, page 518878, 2019.

\* = Authorship order is alphabetical.

## PATENTS

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Siddharth Jain, **Bijan Mazaheri**, Netanel Raviv, and Jehoshua Bruck. Mutation profile and related labeled genomic components, methods and systems. 2019.

## WORKSHOPS

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**Simon's Institute for Theory of Computing: Causality** *Spring 2022*  
4 week workshop on Causal inference methods.

## INVITED TALKS

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**Simon's Institute for Theory of Computing** *May 2023*  
Title: "Causal Discovery under Limited Global Confounding"

**Jones Seminar, Thayer School of Engineering at Dartmouth** *May 2024*  
Title: "Latency and Heterogeneity in Data and What to do About it"

**Stanford Online Causal Inference Seminar** *Oct 2024*  
Title: "Synthetic Potential Outcomes and the Hierarchy of Causal Identifiability"

## PROJECTS

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**LACCTiC** *Sep 2021 - present*  
I maintain a website for collegiate cross country with 10,000 regular users that applies concepts from batch-effect correction to ranking performances on differing terrain. The backend runs on Python and Django and the frontend uses React, and the database is hosted on AWS. I have helped advise over 20 student projects using this data.

## MENTORSHIP

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**MIT UROP** *Summer 2024*  
I have directly supervised two undergraduate students on projects related to causality.

**Caltech Cross Country Team** *Sep 2018 - Sep 2022*  
Mentoring and supporting undergraduate students at Caltech as an assistant coach.

**Data Science Projects** *Sep 2019 - present*  
I have supported over 20 projects with undergraduate students using data on my website, and have advised some of these students in applying to graduate school.

## **SERVICE**

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Reviewer for AIStats, CLear, Nature, The American Statistician.

Sports statistics outreach for Cross Country and correspondent at D3 Glory Days.

Caltech Community Associate - volunteer position for building community in Caltech housing.