

# BIJAN MAZAHERI

🔗 [github.com/honeybijan](https://github.com/honeybijan) 🌐 [bijanmazaheri.com](https://bijanmazaheri.com) ✉ [bmazaher@caltech.edu](mailto:bmazaher@caltech.edu)

📍 Pasadena, CA ☎ (781)-985-0881

I am a computer scientist and mathematician interested in hidden variables in causal structures: when and if they can be learned and how they affect networks of opinions. I am currently pursuing a Ph.D. in Computing and Mathematical Sciences at Caltech supported by a NSF Graduate Research Fellowship.

## EDUCATION

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**Williams College - Williamstown, MA**

*Sep 2012 - Jun 2016*

*Bachelor of Arts*

Majors: Physics and Computer Science, GPA: 3.92

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

**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

**California Institute of Technology - Pasadena, CA**

*Oct 2017 - present*

*Ph.D. Candidate*

NSF Graduate Research Fellowship

## RESEARCH TOPICS

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**Data Fusion:** We have developed “Expert Graphs” to study consistencies and inconsistencies in partial, but overlapping expertise. As it turns out, this problem is deeply related to issues in voting theory, such as the Cordocet Paradox.

**Mixture Models for Causality:** Interventional distributions acted on by a universal unobserved confounder can be thought of as a mixture model. Assuming a bound on the number of sources in the mixture allows identification of within-component probability distributions. This process can be used to access to interventional distributions that were previously considered unidentifiable.

**Domain Adaptation and Transportability:** I am interested in using causal principles to guide models that are robust to distribution shift in datasets. Forthcoming work completed at Amazon Research uses concepts from causality and information theory to inform how auxiliary training tasks can improve robustness to distribution shift.

## WORK EXPERIENCE

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**Amazon Research Causality Lab - Tübingen, Germany**

*Oct 2022 - Feb 2023*

*Applied Scientist Intern (L5)*

Worked with Mila Hardt, Atalanti Mastakouri, and Dominik Janzing

Paper submitted to UAI 2023

**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

**BioDiscovery - El Segundo, CA**

*Jun 2017 - Sep 2017*

*Intern*

Unsupervised machine learning on cancer genomes. Developed and implemented methods that lead to a conference poster.

## TEACHING EXPERIENCE

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**Markov Chain Monte Carlo**

*Spring 2022*

Head TA for Leonard Schulman's new class.

## PUBLICATIONS

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S. Gordon, \***B. Mazaheri**, Y. Rabani, L. Schulman. "*Identifying Discrete Mixtures of Bayesian Networks.*"

Accepted to CLEAR 2023.

S. Jain, **B. Mazaheri**, N. Raviv, J. Bruck. "*Glioblastoma signature in the DNA of blood-derived cells*" PLoS ONE 16(9): e0256831. 2021.

**B. Mazaheri**, S. Jain, J. Bruck. "*Expert Graphs: Synthesizing New Expertise via Collaboration.*" IEEE ISIT 2021.

S. Gordon, \***B. Mazaheri**, Y. Rabani, L. Schulman. "*Source Identification for Mixtures of Product Distributions.*" COLT 2021.

**B. Mazaheri**, S. Jain, J. Bruck. "*Robust Correction of Sampling Bias using Cumulative Distribution Functions.*" NeurIPS 2020.

\* = Authorship order in Theoretical CS is alphabetical.

## PREPRINTS

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**B. Mazaheri**, S. Jain, M. Cook, J. Bruck. "*Combining Binary Classifiers Leads to Nontransitive Paradoxes.*"

Accepted IEEE Transactions on Information Theory 2022 but retracted due to inability to attend conference in person.

S. Gordon, \***B. Mazaheri**, Y. Rabani, L. Schulman. "*The Sparse Hausdorff Moment Problem, with Applications to Topic Models.*" arXiv 2020.

S. Jain, **B. Mazaheri**, N. Raviv, J. Bruck. "*Cancer Classification from Healthy DNA using Machine Learning.*" bioRxiv 2019.

S. Jain, **B. Mazaheri**, N. Raviv, J. Bruck. "*Short Tandem Repeats Information in TCGA is Statistically Biased by Amplification.*" bioRxiv 2019.

\* = Authorship order in Theoretical CS is alphabetical. Co-authorship is implied.

## PATENTS

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S. Jain, **B. Mazaheri**, N. Raviv, J. Bruck. “Mutation profile and related labeled genomic components, methods and systems.” 2019.

## PROJECTS

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### **LACCTiC.com**

*Sep 2021 - present*

Website for ranking collegiate cross country with 10,000 regular users.

Algorithms/machine learning for adjusting times in different conditions.

Backend using Django, frontend using React, database hosted on AWS.

## AWARDS

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### **National Science Foundation Graduate Research Fellowship**

*Awarded Spring 2019*

Awarded in 2019 for a proposal to research confounding influence in causal networks.

### **Amazon AI4Science Grant**

*Awarded Spring 2021*

Funding for research with the potential to aid scientific discovery.

## MENTORSHIP

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### **Caltech Cross Country Team**

*Sep 2018 - present*

*Assistant Coach*

Mentoring and supporting undergraduate students at Caltech.