# Mehrdad Ghadiri

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## EXPERIENCE

**MIT Sloan** — September 2023 - Present
Postdoctoral Associate — Host: Swati Gupta

**Adobe - Real-time Experiences and Algorithms Lab** — May 2022 - August 2022
Research Scientist Intern — Hosts: Anup Rao, Tung Mai, David Arbour
- Worked on experimental design, average treatment effect (ATE) and individual treatment effect (ITE).
- Developed sampling algorithms for ATE based on regression adjustment via numerical linear algebra techniques.
- Advantages of our method is that (1) it achieves smaller variance/error compared to other methods; (2) it is more cost-effective since it uses a small number of samples for estimation; (3) it is computationally efficient and can be run in input-sparsity time; (4) it easily extends to settings with more than two outcomes/treatments in the experiment and the case of online experimental design.

**Google - Algorithms and Optimization Team** — Aug 2021 - May 2022
Student Researcher — Hosts: Matthew Fahrbach, Thomas Fu
- Worked on tensor decomposition and its applications in deep learning and feature engineering.
- Devised the first subquadratic algorithm for solving the Kronecker product regression problem with applications in Tucker decomposition.
- Devised a metric version of the CMIM feature selection algorithm with a theoretical guarantee.

**Google - Algorithms and Optimization Team** — May 2021 - Aug 2021
Research Intern — Hosts: Matthew Fahrbach, Thomas Fu
- Worked on tensor decomposition and its applications in deep learning and feature engineering.
- Devised the first algorithm to choose the size of core tensor in Tucker decomposition with theoretical guarantees.

## EDUCATION

**Georgia Institute of Technology** — 2019 - 2023
Ph.D. in Algorithms, Combinatorics and Optimization / Computer Science — Advisor: Santosh Vempala
Thesis title: "Scalable, Efficient, and Fair Algorithms for Structured Convex Optimization Problems."

**University of British Columbia** — 2017 - 2019
M.Sc. in Computer Science — Advisors: Bruce Shepherd and Mark Schmidt
Thesis title: "Beyond Submodular Maximization: One-Sided Smoothness and Meta-Submodularity."

**Sharif University of Technology** — 2011 - 2016
B.Sc. in Information Technology Engineering
Thesis title: "Discrete Voronoi Games."

## RESEARCH INTERESTS

- Numerical linear algebra, and continuous and discrete optimization and their applications in machine learning.
- Societal aspects of algorithms such as fairness and differential privacy.

## HONERS AND AWARDS

- **ARC-TRIAD Student Fellowship** — 2022

- **ML@GT Fellowship** — 2021

- **IDEaS-TRIAD Research Scholarship for Ph.D. Students and Postdocs** — 2020

- **Borealis AI Global Fellowship Award** — 2018
  This fellowship is awarded to **only 10 students per year** who pursue graduate degrees (M.Sc. or Ph.D.) at Canadian universities in computer science and related fields with a focus on machine learning or artificial intelligence. I was the **only M.Sc. student** who won this award that year.

- **Silver Medal in Iranian National Mathematical Olympiad** — 2010

## PUBLICATIONS

The authors are listed alphabetically for papers denoted by ($\alpha$-$\beta$). Equal Contribution is denoted by *.
- *The Bit Complexity of Efficient Continuous Optimization*, [Link]. M. Ghadiri, R. Peng, S. Vempala. **FOCS** 2023.
- *On Symmetric Factorizations of Hankel Matrices*, M. Ghadiri. **FOCS** 2023.
- *Approximately Optimal Core Shapes for Tensor Decompositions*, M. Ghadiri*, M. Fahrbach*, G. Fu, V. Mirrokni, [Link], **ICML** 2023.
- *Subquadratic Kronecker Regression with Applications to Tensor Decomposition*, M. Fahrbach and G. Fu, M. Ghadiri, **NeurIPS** 2022. [Link] ($\alpha$-$\beta$)
- *Amortized Rejection Sampling in Universal Probabilistic Programming*, S. Naderiparizi, A. Scibior, A. Munk, M. Ghadiri, A. G. Baydin, B. G. Hansen, C. S. de Witt, R. Zinkov, P. Torr, T. Rainforth, Y. W. Teh, F. Wood, **AISTATS** 2022. [**Oral Presentation**] [Link]
  — A preliminary version appeared in PROBPROG 2020.
- *Socially Fair k-Means Clustering*, M. Ghadiri, S. Samadi, S. Vempala, **FAccT** 2021. [Link]
- *Beyond Submodular Maximization via One-Sided Smoothness*, M. Ghadiri, R. Santiago, B. Shepherd, **SODA** 2021. [Link] ($\alpha$-$\beta$)
- *Distributed Maximization of Submodular Plus Diversity Functions for Multi-label Feature Selection on Huge Datasets*, M. Ghadiri, M. Schmidt, **AISTATS** 2019. [Link]
- *Scalable Feature Selection via Distributed Diversity Maximization*, S. Abbasi Zadeh*, M. Ghadiri*, V. Mirrokni and M. Zadimoghaddam, **AAAI** 2017. [**Oral Presentation**] [Link]
- *A Multiscale Agent-Based Framework Integrated with a Constraint-Based Metabolic Network Model of Cancer for Simulating Tumor Growth*, M. Ghadiri*, M. Heidari*, S. A. Marashi and S. H. Mousavi, **Molecular BioSystems**, 13(9): 1888-1897, 2017. [Link]
- *Linear Relaxations for Finding Diverse Elements in Metric Spaces*, A. Bhaskara, M. Ghadiri, V. Mirrokni, O. Svensson, **NeurIPS** 2016. [Link] ($\alpha$-$\beta$)
- *Minimizing the Total Movement for Movement to Independence Problem on a Line*, M. Ghadiri, S. Yazdanbod, **CCCG** 2016. [Link] ($\alpha$-$\beta$)
- *Active Distance-Based Clustering using K-medoids*, A. Aghaee*, M. Ghadiri*, M. Soleymani Baghshah, **PAKDD** 2016. [Link]

## PREPRINTS

- *Constant-Factor Approximation Algorithms for Socially Fair k-Clustering*, M. Ghadiri, M. Singh, S. Vempala, arXiv preprint: 2206.11210. In submission.
- *Non-asymptotic Regression Adjustment*, M. Ghadiri, A. Rao, C. Musco, D. Arbour, T. Mai, In submission.

## TALKS

- *On Symmetric Factorizations of Hankel Matrices*, at **Carnegie Mellon University (CMU)**, Pittsburgh, PA, May 2023.
- *Bit Complexity of Efficient Optimization*, at **University of British Columbia (UBC)**, Vancouver, BC, April 2023.
- *On Symmetric Factorizations of Hankel Matrices*, at **American Mathematical Society (AMS) Special Session on Algebraic Methods in Algorithms, II**, Atlanta, GA, March 2023.
- *Bit Complexity of Efficient Optimization*, at **Canadian Mathematical Society (CMS) Special Session on Algorithms and Complexity aspects of Optimization**, Toronto, ON, December 2022.
- *Socially Fair k-Clustering*, at **INFORMS Special Session on Ethical AI and Optimization - Part II**, Indianapolis, IN, October 2022.
- *Faster p-Norm Regression Using Sparsity*, at **University of Washington (UW)**, Seattle, WA, May 2022.
- *Socially Fair k-Means Clustering*, at the 8th Biennial Canadian Discrete and Algorithmic Mathematics Conference (**CanaDAM**), Virtual, May 2021.
- *Beyond Submodular Maximization via One-Sided Smoothness and Meta-Submodularity*, at **Google Research**, Virtual, January 2021.
- *In Search of Tractable Supermodular Maximization Problems*, at the 7th Biennial Canadian Discrete and Algorithmic Mathematics Conference (**CanaDAM**), Vancouver, BC, May 2019.
- *Beyond Submodular Maximization*, at the **Bellairs Workshop on Discrete Optimization**, Barbados, April 2019.
- *Scalable Feature Selection via Distributed Submodular and Diversity Maximization*, at the **Element AI Research Workshop**, Vancouver, BC, August 2018.

## TEACHING ASSISTANTSHIPS

- Georgia Institute of Technology: Computation and the Brain (Graduate Course), Dynamic Algebraic Algorithms (Graduate Course).
- University of British Columbia: Combinatorial Optimization (Graduate Course), Intermediate Algorithm Design and Analysis, Advanced Algorithm Design and Analysis.
- Sharif University of Technology: Discrete Structures (3 times), Fundamentals Of Programming, Engineering Probability and Statistics, Signals and Systems, Technical and Scientific Presentation.

## Professional Service

- **Founding member** and student/faculty affairs chair of School of Computer Science **Graduate Student Association** (SCS-GSA) at Georgia Institute of Technology (May 2021- April 2022).
- **Reviewed** for the following **journals**: INFORMS Journal on Computing, Operations Research Letters, Journal of Machine Learning Research, Journal of Combinatorial Optimization, and SIAM Journal on Discrete Mathematics.
- **Reviewed** for the following **conferences**: NeurIPS (2016, 2019, 2020, 2022, 2023), APPROX 2019, SODA (2020, 2023), AAAI 2021, ICLR 2021, STOC (2021, 2022), FORC 2021, ICALP 2022, ICML 2022, FAccT 2023, FOCS 2023.
- Co-organized a special session on **algebraic methods in algorithms** at 2023 spring southeastern sectional meeting of **American Mathematical Society (AMS)**, Atlanta, GA.
- Organized a **reading group on differential privacy** in Spring 2022 at Georgia Institute of Technology.
- Co-organized the UBC **machine learning reading group** in Fall 2018, Spring 2019, and Summer 2019.

## References

- Georgia Institute of Technology: Santosh Vempala (Ph.D advisor), Mohit Singh, Richard Peng
- University of British Columbia: Bruce Shepherd (M.Sc. advisor), Mark Schmidt (M.Sc. advisor)
- Google: Vahab Mirrokni, Morteza Zadimoghaddam, Matthew Fahrbach