

MARINA KNITTEL

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RESEARCH INTERESTS

My research focuses on graph algorithms for fairness and scalability on massive graphs. Some of my previous and ongoing works include: (1) adaptive and non-adaptive massively parallel matching, edge coloring, clustering, minimum cut, and geometric embedding, (2) fair hierarchical clustering and resource allocation, and (3) incentive structures in multi-agent games of influence and matching markets.

EDUCATION

University of Maryland, College Park

College Park, MD

PhD in Computer Science, 3.97 GPA

Expected: Dec 2023

MS in Computer Science

May 2020

Advisors: Prof. MohammadTaghi Hajiaghayi and Prof. John Dickerson

Coursework: Approximation Algorithms, Modern Discrete Probability, Algorithms in Machine Learning, Computational Geometry, Algorithmic Lower Bounds, Computational Linguistics, Quantum Information Theory, Computational Genomics

Harvey Mudd College

Claremont, CA

B.S. in Computer Science and Mathematics, 3.75 GPA

May 2018

High Distinction, Honors in Math and Computer Science, Dean's List

Advanced Coursework: Advanced Algorithms, Computational Complexity, Graph Theory, Convex Set Theory, Machine Learning, Artificial Intelligence, Logic, Advanced Linear Algebra

HONORS AND AWARDS

External	NIH Summer Cancer Research Training Award	2023
	Jane Street Graduate Research Fellowship Finalist	2023
	Meta Research PhD Fellowship Finalist	2022
	ARCS Endowment Award	2021 - 2022
	AAMAS Student Scholarship	2020
University of Maryland	Ann G Wylie Dissertation Fellowship	2021
	Dean's Fellow	2018 - 2020
Harvey Mudd College	Class of '94 Award	2018
Palo Alto High School	Sandra Forsythe Memorial Scholarship	2014

TEACHING EXPERIENCE

Lecturer

Spring 2022

University of Maryland, College Park

College Park, MD

- Taught and designed the hybrid course CMSC 498T: Mechanism Design alongside Prof. John Dickerson with equal teaching responsibilities, adapting platform and materials dynamically to student needs
- Adapted curriculum from graduate material and introduced new material for undergraduate students
- Duties included: lecturing, curriculum design, office hours, research mentorship, and grading

Teaching Assistant

Fall 2018 - Fall 2019

University of Maryland, College Park

College Park, MD

- Courses: Discrete Structures, Cryptography
- Responsibilities: Led recitations, held tutoring hours, graded tests

Grader and Tutor

Harvey Mudd College

Spring 2015 - Spring 2018

Claremont, CA

- Courses: Algorithms, Computational Complexity, Machine Learning, Data Structures & Program Development, Introductory Computer Science, Multivariable Calculus
- Responsibilities: Held tutoring hours, graded homeworks

Homework Hotline Tutor

Harvey Mudd College

Fall 2014 - Fall 2016

Claremont, CA

- Provided free over-the-phone tutoring for K-12 students

RESEARCH EXPERIENCE

The National Institute of Health

Fellow; Advised by Cenk Sahinalp

May 2023 - August 2023

Bethesda, MD

- Developed a fixed-parameter tractable algorithm for tree edit distance with multi-labeled nodes modeled after cancer phylogeny mapping (expecting to write a full publication between me and another fellow)
- Corrected a work on graph traversal edit distance and proved why experiments mismatched theory

Google

Research Intern

May 2022 - August 2022

Mountain View, CA

- Built neural network for program worst case execution time prediction using quantile regression
- Achieved quantile prediction accuracy within 2% of target quantile leveraging statistical data insights

Toyota Technological Institute at Chicago

Research Intern; Advised by Avrim Blum and Saeed Seddighin

June 2021 - August 2021

Chicago, IL

- Conducted research in fair allocation with a focus on EFX (envy free up to any one item) solutions
- Developed algorithms and proved solution existence and nonexistence for new instances

Amazon

Research Scientist Intern

June 2020 - August 2020

Seattle, WA

- Learned and evaluated dense embeddings of ads metadata for click-through rate prediction
- Parsed and vectorized complex boolean expressions as a part of ads metadata

Google

Research-focused Software Engineering Intern

June 2019 - August 2019

Seattle, WA

- Developed and bounded efficient algorithms for hierarchical clustering without over-representation
- Migrated and improved open sourced tools for graph regularization using Keras (TensorFlow)

NASA Ames & Harvey Mudd College

Senior Capstone Project Manager and Member

August 2017 - June 2018

Claremont, CA

- Led a team of 5 in a research-based project in scheduling algorithms
- Researched new methods for optimizing multi-agent system rescheduling with limited communication
- Theoretically and experimentally verified effect of communication on success

Rutgers University

REU Scholar in Theoretical Computer Science

May 2017 - August 2017

Piscataway, NJ

- Summer 2017 NSF-funded REU position under Professor Eric Allender at DIMACS
- Studied the Minimum Circuit Size Problem, Kolmogorov Random Strings and the Polynomial Hierarchy
- Modified the Turing machine to produce a hierarchy almost isomorphic to the Polynomial Hierarchy

Harvey Mudd College

Researcher in Computational Biology

August 2016 - May 2018

Claremont, CA

- Developed a new algorithm for fast and effective reconciliation for non-binary phylogenetic trees
- Proved various mathematical properties of a data structure used in phylogenetic reconciliation research
- Analyzed effectiveness of the binary phylogenetic tree reconciliation algorithm

Harvey Mudd College

Researcher in Web Development

June 2015 - May 2016

Claremont, CA

- Improved a research websites appeal and functionality (HTML, CSS, Javascript, PHP and Drupal)
- Trained new researchers in web development and coding practices to join the web development team

PUBLICATIONS AND PRESENTATIONS

^{abc} Denotes that authors are listed **alphabetically**. This is the convention in theoretical computer science.

Computer science traditionally uses competitive conferences (15-30% accepted) as the main publication venue.

Conference:

1. Marina Knittel, Max Springer, John Dickerson, and MohammadTaghi Hajiaghayi. “Fair, Polylog-Approximate Low-Cost Hierarchical Clustering”. *Submitted to NeurIPS*.
2. Marina Knittel, Max Springer, John Dickerson, and MohammadTaghi Hajiaghayi. “Generalized Reductions: Making any Hierarchical Clustering Fair and Balanced with Low Cost”. International Conference on Machine Learning (ICML), 2023.
3. ^{abc}AmirMohsen Ahanchi, Alexandr Andoni, MohammadTaghi Hajiaghayi, Marina Knittel, and Peilin Zhong, “Massively Parallel Tree Embeddings for High Dimensional Spaces”. Symposium on Parallelism and Architectures (SPAA), 2023.
4. ^{abc}MohammadTaghi Hajiaghayi, Marina Knittel, Jan Olkowski, and Hamed Saleh, “Adaptive Massively Parallel Algorithms for Cut Problems”. Symposium on Parallelism and Architectures (SPAA), 2022.
5. Marina Knittel, Samuel Dooley, and John P. Dickerson, “The Dichotomous Affiliate Stable Matching Problem: Approval-Based Matching with Applicant-Employer Relations”. International Joint Conference on Artificial Intelligence (IJCAI), 2022.
6. ^{abc}MohammadTaghi Hajiaghayi, Marina Knittel, Hamed Saleh, and Hsin-Hao Su, “Adaptive Massively Parallel Constant-round Tree Contraction”. Innovations in Theoretical Computer Science (ITCS), 2022.
7. ^{abc}Fotini Christia, Michael Curry, Constantinos Daskalakis, Erik Demaine, John P. Dickerson, MohammadTaghi Hajiaghayi, Adam Hesterberg, Marina Knittel, and Aidan Millif, “Scalable Equilibrium Computation in Multi-agent Influence Games on Networks”. The Association for the Advancement of Artificial Intelligence (AAAI), 2021.
8. ^{abc}Sara Ahmadian, Alessandro Epasto, Marina Knittel, Ravi Kumar, Mohammad Mahdian, Benjamin Moseley, Sergei Vassilvitskii, Philip Pham, and Yuyan Wang. “Fair Hierarchical Clustering”. The Conference on Neural Information Processing Systems (NeurIPS), 2020.

9. ^{abc}MohammadTaghi Hajiaghayi and Marina Knittel, “Matching Affinity Clustering: Improved Hierarchical Clustering at Scale with Guarantees”. The International Conference on Autonomous Agents and Multiagent Systems (AAMAS), 2020. Extended abstract.
10. ^{abc}Soheil Behnezhad, Mahsa Derakhshan, MohammadTaghi Hajiaghayi, Marina Knittel, and Hamed Saleh, “Streaming and Massively Parallel Algorithms for Edge Coloring”. The 27th Annual European Symposium on Algorithms (ESA), 2019.
11. Jordan R. Abrahams, David A. Chu, Grace Diehl, Marina Knittel, Judy Lin, William Lloyd, James C. Boerkoel Jr., and Jeremy Frank, “DREAM: An Algorithm for Mitigating the Overhead of Robust Rescheduling”. The 29th International Conference on Automated Planning and Scheduling (ICAPS), 2019.
12. Hoaxing Du, Yi Sheng Ong, Marina Knittel, Ross Mawhorter, Ivy Liu, Gianluca Gross, Reiko Tojo, Ran Libeskind-Hadas, and Yi-Chieh Wu, “Multiple Optimal Reconciliations with Gene Duplication, Loss, and Coalescence”. The 17th Asia Pacific Bioinformatics Conference (APBC), 2019.

Presentations:

1. “Adaptive Massively Parallel Constant-round Tree Contraction”. John’s Hopkins University-21. Invited talk.
2. “Scalable Equilibrium Computation in Multi-agent Influence Games on Networks”. AAAI-21. Full presentation, short presentation, and poster.
3. “Fair Hierarchical Clustering”. NeurIPS-20. Short presentation and poster.
4. “Matching Affinity Clustering: Improved Hierarchical Clustering at Scale with Guarantees”. AAMAS-20. Presentation.
5. “Fair Hierarchical Clustering”. The Sets & Partitions Workshop at NeurIPS-19. Invited presentation and poster.
6. “A Cost Function for Hierarchical Clustering”. Google internal seminar-19. Presentation.
7. “Trade-offs Between Communication, Rescheduling, and Success Rate in Uncertain Multi-Agent Schedules”. IntEX Workshop at ICAPS-18. Presentation.

Workshop Papers, etc.:

1. Marina Knittel, Samuel Dooley, and John P. Dickerson, “The Binary Affiliate Matching Problem: Approval-Based Matching with Applicant-Employer Relations”. The INFORMS Workshop on Market Design at the 22nd Conference on Economics and Computation (EC), 2021. Workshop.
2. ^{abc}Sara Ahmadian, Alessandro Epasto, Marina Knittel, Ravi Kumar, Mohammad Mahdian, and Philip Pham. “Fair Hierarchical Clustering”. The Sets & Partitions Workshop at the 33rd Conference on Neural Information Processing Systems (NeurIPS), 2019. Workshop; subsumed by conference submission.
3. ^{abc}Soheil Behnezhad, Mahsa Derakhshan, MohammadTaghi Hajiaghayi, Marina Knittel, and Hamed Saleh, “Edge Coloring: MPC and Streaming Algorithms”. The 33rd International Symposium on Distributed Computing (DISC), 2019. Brief announcement; subsumed by ESA-19 paper.
4. David A. Chu, Grace Diehl, Marina Knittel, Judy Lin, Liam Lloyd, James C. Boerkoel Jr., and Jeremy Frank, “Trade-offs Between Communication, Rescheduling, and Success Rate in Uncertain Multi-Agent Schedules”. The Integrated Planning, Acting and Execution Workshop (IntEx) at The 28th International Conference on Automated Planning and Scheduling (ICAPS), 32-40, 2018. Workshop; subsumed by ICAPS-19 paper.

INDUSTRY EXPERIENCE

Meta (previously Facebook)

Software Engineering Intern

May 2018 - August 2018

Menlo Park, CA

- Developed, trained, and tuned new neural network models for suggesting Instagram accounts to follow
- Incorporated handling for sparse, crossed, and bucketized features in the training pipeline

NASA Ames & Harvey Mudd College

Senior Capstone Project Manager and Member

August 2017 - June 2018

Claremont, CA

- Led a team of 5 in a research-based project in scheduling algorithms
- Researched new methods for optimizing multi-agent system rescheduling with limited communication
- Theoretically and experimentally verified effect of communication on success

Bloomberg

Software Engineering Intern

May 2016 - July 2016

New York City, NY

- Built a service to assume a front end process and lighten client machine processing load
- Gained a deeper understanding of computer systems, C++, and elegant and adaptable coding practices

Napses

Web Development Intern

May 2014 - August 2014

Santa Barbara, CA

- Programmed a blog in JavaScript (jQuery), HTML, and CSS, using Bootstrap for a start-up

SERVICE, WORKSHOPS, AND LEADERSHIP

Program Committee

EAAMO

2023

GAIW

2021-2022

Academic Reviewer

SODA, AAAI, ESA, ICALP, SPAA,
JAIR, SIDMA, Algorithmica

External

AAAI Fair Clustering Tutorial Organizer

2022

Women in Theory Workshop

2022

Google CSRMP Class of 2021

2021

CRA-WP Grad Cohort for Women

2021

University of Maryland

Grad CS LGBTQ+ Initiative Founder

2019 - Present

Executive Committee Member

2018 - Present

Peer Mentor

2021 - Present

Capital Area Theory Seminar Organizer

2019 - 2020

CS Women Mentor

2018 - 2020

Graduate Admissions Volunteer

2018 - 2019

Harvey Mudd College

Committee for Activities Planning Member

2017 - 2018

Women in Math Club President

2017 - 2018

LGBTQ+ Club Mentor

2017 - 2018

Orientation Leader

2015 - 2017

Dorm President

2016 - 2017

Dorm Treasurer

2015 - 2016