

# MARINA KNITTEL

mknittel@umd.edu

Iribe 5104, 8125 Paint Branch Dr, College Park, MD, 20740

Website: mknittel.github.io

## RESEARCH INTERESTS

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My research focuses on graph algorithms for fairness and scalability on massive networks. 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

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**University of Maryland, College Park**

College Park, MD

*PhD in Computer Science*

*Expected: May 2023*

*MS in Computer Science, 3.97 GPA*

*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

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<b>External</b>	Meta Research PhD Fellowship Finalist	2022
	ARCS Endowment Award	2021 - 2022
	AAMAS Student Scholarship	2020
<b>University of Maryland</b>	Ann G Wylie Dissertation Fellowship	2021
	Dean's Fellow	2018 - 2020
<b>Harvey Mudd College</b>	Class of '94 Award	2018
<b>Palo Alto High School</b>	Sandra Forsythe Memorial Scholarship	2014

## PUBLICATIONS AND PRESENTATIONS

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<sup>abc</sup>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, John Dickerson, and MohammadTaghi Hajiaghayi. "Generalized Reductions: Making any Hierarchical Clustering Fair and Balanced with Low Cost". *In submission to NeurIPS*.
2. <sup>abc</sup>AmirMohsen Ahanchi, Alexandr Andoni, MohammadTaghi Hajiaghayi, Marina Knittel, and Peilin Zhong, "Massively Parallel Tree Embeddings for High Dimensional Spaces". *In submission to SODA*.
3. <sup>abc</sup>Alexandr Andoni, MohammadTaghi Hajiaghayi, Marina Knittel, and Peilin Zhong, "Massively Parallel Bipartite Maximum Weighted Matching Via Matching Reduction". *In submission to DISC*.

4. <sup>abc</sup>MohammadTaghi Hajiaghayi, Marina Knittel, Jan Olkowski, and Hamed Saleh, “Improved 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. <sup>abc</sup>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. <sup>abc</sup>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. <sup>abc</sup>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. <sup>abc</sup>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. <sup>abc</sup>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. <sup>abc</sup>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. <sup>abc</sup>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.

## WORK AND ACADEMIC EXPERIENCE

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### Google

*Research Intern*

May 2022 - Now

*Mountain View, CA*

- Building an end-to-end system to safely predict program worst case execution time
- Combining aspects of hierarchical RNN and GNN structures to maximize system accuracy

### 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

*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)

### 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

### **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

### **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

### **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

### **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

## **TEACHING EXPERIENCE**

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### **Lecturer**

*University of Maryland, College Park*

September 2018 - December 2019

*College Park, MD*

- In conjunction with Prof. John Dickerson, I developed a new undergraduate-level course, Mechanism Design, and am currently co-teaching it with equal responsibilities.

### **Teaching Assistant**

*University of Maryland, College Park*

September 2018 - December 2019

*College Park, MD*

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

### **Grader and Tutor**

*Harvey Mudd College*

January 2015 - May 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*

September 2014 - December 2016

*Claremont, CA*

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

## SERVICE, WORKSHOPS, AND LEADERSHIP

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<b>Academic Paper Review</b>	JAIR (2022), GAIW (2021-22), ESA (2021-22), ICALP (2021), SIDMA (2021), AAAI (2020), Algorithmica (2019)	
<b>External</b>	AAAI Fair Clustering Tutorial Organizer	2022
	Google CSRMP Class of 2021	2021
	CRA-WP Grad Cohort for Women	2021
<b>University of Maryland</b>	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
<b>Harvey Mudd College</b>	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