Curriculum Vitae

Jessica Shi

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RESEARCH INTERESTS

I am interested in designing scalable graph mining and hypergraph processing algorithms, with strong theoretical guarantees and scalable and efficient implementations under unified frameworks.

EDUCATION

Massachusetts Institute of Technology **Expected Graduation June 2023**
Ph.D. Candidate; Major: Computer Science
Advisor: Julian Shun

Massachusetts Institute of Technology **Graduated May 2020**
Master of Science; Major: Computer Science
Thesis: Parallel algorithms for butterfly computations, Advisor: Julian Shun

Princeton University **Graduated June 2018**
A.B. with Highest Honors; Major: Mathematics; Minor: Computer Science
GPA 3.92/4.00; Major GPA 4.00/4.00
Thesis: Dominating sets in graphs with no long induced paths, Advisor: Maria Chudnovsky

Oxford University **January 2017 - June 2017**
Study Abroad Program
Grade: A+ on all courses
Relevant courses: Representation Theory, Game Theory, Probability, Combinatorics

PUBLICATIONS & PRESENTATIONS

Quanquan C. Liu, Jessica Shi, Shangdi Yu, Laxman Dhulipala, and Julian Shun, "Parallel Batch-Dynamic k-Core Decomposition", In Submission

Laxman Dhulipala, David Eisenstat, Jakub Łącki, Vahab Mirrokni, and Jessica Shi, "Hierarchical Agglomerative Graph Clustering in Nearly-Linear Time", International Conference on Machine Learning (ICML) 2021

Jessica Shi, Laxman Dhulipala, and Julian Shun, "Parallel Clique Counting and Peeling Algorithms", SIAM Conference on Applied and Computational Discrete Algorithms (ACDA) 2021

Louisa Ruixue Huang, Jessica Shi, and Julian Shun, "Parallel Five-Cycle Counting Algorithms", International Symposium on Experimental Algorithms (SEA) 2021

Laxman Dhulipala, Jessica Shi, Tom Tseng, Guy Blelloch, and Julian Shun, "The Graph Based Benchmark Suite (GBBS)", Graph Data Management Experiences and Systems (GRADES) and Network Data Analytics (NDA) 2020 (GRADES-NDA20)

Jessica Shi and Julian Shun, "Parallel Algorithms for Butterfly Computations", SIAM Symposium on Algorithmic Principles of Computer Systems 2020 (APOCS20)

Jérémie Lumbroso and Jessica Shi, "Exponential Bounds on Graph Enumerations from Vertex Incremental Characterizations", Analytic Algorithmics and Combinatorics 2018 (ANALCO18)

Jessica Shi, Francisco Unda and Jacob Fox, "The Speeds of Families of Intersection Graphs", presented at MAA Undergraduate Poster Session at Joint Mathematics Meetings 2014 (JMM14)

RESEARCH EXPERIENCE

Department of Computer Science, MIT **Master's Thesis (Fall 2018 – Spring 2020)**
"Parallel algorithms for butterfly computations"
Advisor: Julian Shun
Research focused on designing a framework called PARBUTTERFLY that produces new parallel algorithms for butterfly counting and peeling. PARBUTTERFLY modularizes options with tradeoffs between theoretical work-efficiency and empirical speedups. Strong theoretical guarantees on the algorithms were proven and significant parallel speedups were obtained.

Department of Mathematics, Princeton University **Senior Thesis (Fall 2017 - Spring 2018)**
"Dominating sets in graphs with no long induced paths"
Advisor: Maria Chudnovsky
Research focused on characterizing the dominating sets in P_t-free graphs for $t \geq 6$, in the context of the 3-coloring problem. Proved that there exist constant bounded dominating sets in {P_6, triangle}-free and {P_7, triangle}-free graphs (excepting reducible configurations) and provided a semi-automatic proof for the latter case.

Department of Computer Science, Princeton University **Fall 2015 - Spring 2016**
"Exponential bounds on graph enumerations from vertex incremental characterizations"
Advisor: Jérémie Lumbroso
Research focused on developing a new methodology to enumerate graph classes, using their vertex incremental characterizations and analytic combinatorics. Asymptotic upper bounds were established for two graph classes.

Research Science Institute (RSI) & Department of Mathematics, MIT **Summer 2013**
Title: "The speeds of families of intersection graphs"
Advisor: Jacob Fox
Research focused on bounding the number of intersection graphs of families of algebraic curves, and tight upper and lower bounds were established. Upper bounds were discovered algebraically and lower bounds were discovered combinatorically. RSI is sponsored by the Center for Excellence in Education and hosted by MIT.

WORK EXPERIENCE

Google **Summer 2020**

Research Intern

Worked with the Graph Mining team to design, implement, and evaluate shared-memory parallel affinity clustering and correlation clustering algorithms. Demonstrated significant parallel speedups of up to 6.09x over the best sequential implementations of these algorithms, on real-world graphs with up to tens of billions of edges using a 16-core machine with two-way hyperthreading.

D.E. Shaw & Co. **Summer 2017**

Software Engineering Intern

Worked with the Futures division to add features to their underlying array infrastructure, including sharding, extending axes, indexing with keys, and indexing with arrays and boolean masks. Investigated cache conflicts between using memory mapped arrays and IBM General Parallel File System (GPFS).

Google **Summer 2016**

Software Engineering Intern

Worked with the Fiber Ads Team on building a system to continuously evaluate the quality in which Fiber TV ads are inserted over underlying TV network streams. Created a video alignment tool to locate and verify where TV ads are injected into the stream, and collect associated stream data.

Bloomberg L.P. **Summer 2015**

Software Development Intern

Worked with the News Division on overhauling legacy multimedia functions. Created two services: one extracts subtitles from fragmented-MP4 video containers and processes keywords for expanded search functionality, and the other extracts, processes, and stores thumbnails from videos.

HONORS & AWARDS

- National Science Foundation (NSF) Graduate Research Fellowship (2018 - present)
- Middleton Miller '29 Prize, Mathematics Department, Princeton University (2018)
  Awarded for the best independent work in mathematics.
- Phi Beta Kappa, Princeton University (2018)
- Computing Research Association (CRA) Outstanding Undergraduate Researchers Award: Honorable Mention (2017)
- Computer Science Poster Winner, Computer Science Department, Princeton University (2015)
- Outstanding Presentation Winner of the MAA Undergraduate Poster Session at 2014 Joint Mathematics Meetings (JMM), Baltimore, MD (2014)
- Intel Science Talent Search (Intel STS) Finalist (2014)

TEACHING EXPERIENCE

- **Mentor for MIT EECS Graduate Application Assistance Program (GAAP)** (Fall 2020)
  Mentored EECS PhD applicants from underrepresented groups, including guidance through the EECS PhD application process and feedback on statements of purpose and resumes.
- **Academic Mentor for MIT Program for Research in Mathematics, Engineering, and Science for High School Students (PRIMES)** (Spring 2020 – Fall 2020)

Mentored high school students through a research project involving designing and implementing shared-memory parallel dynamic subgraph counting algorithms.

- **Academic Tutor for Research Science Institute** (Summer 2019)
  Advised high school students throughout their individual research projects, on best practices in research, paper writing, and presenting skills.
- **Course Assistant for Introduction to Graph Theory (MAT375), Princeton University** (Spring 2018)
- **Grader for Algorithms and Data Structures (COS226), Princeton University** (Fall 2016)