

Christopher Musco

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Education

Massachusetts Institute of Technology

Ph.D. Candidate, Computer Science – Theory of Computation

Advisor: Jonathan Kelner

Masters Thesis: “Dimensionality Reduction for Sparse and Structured Matrices (Spring 2015)”

Cambridge, MA

2013 – present

Yale University

B.S. Applied Mathematics, B.S. Computer Science

Applied Mathematics Thesis: Fast Discrete Laplace Transforms (with Vladimir Rokhlin)

Computer Science Thesis: Graph Constructions for Machine Learning (with Daniel Spielman)

New Haven, CT

2008 – 2012

Research Areas

foundations of data science • scalable machine learning • randomized linear algebra • theory of algorithms
dimensionality reduction • sketching and streaming • algorithmic graph theory • iterative matrix algorithms

Publications

Authors appear in alphabetical order, in the tradition of mathematics and theoretical computer science.

Minimizing Polarization and Disagreement in Social Networks. Cameron Musco, Christopher Musco and Charalampos Tsourakakis. *The Web Conference (WWW)* 2018.

Stability of the Lanczos Method for Matrix Function Approximation. Cameron Musco, Christopher Musco, Aaron Sidford. *ACM-SIAM Symposium on Discrete Algorithms (SODA)* 2018.

Recursive Sampling for the Nyström Method. Cameron Musco, Christopher Musco. *Conference on Neural Information Processing Systems (NIPS)* 2017.

Random Fourier Features for Kernel Ridge Regression: Approximation Bounds and Statistical Guarantees. Haim Avron, Michael Kapralov, Cameron Musco, Christopher Musco, Ameya Velingker, Amir Zandieh. *International Conference on Machine Learning (ICML)* 2017.

Input Sparsity Time Low-Rank Approximation via Ridge Leverage Score Sampling. Michael B. Cohen, Cameron Musco, Christopher Musco. *ACM-SIAM Symposium on Discrete Algorithms (SODA)* 2017.

Determining Tournament Payout Structures for Daily Fantasy Sports. Christopher Musco, Maxim Sviridenko, Justin Thaler. *SIAM Algorithm Engineering and Experiments (ALENEX)* 2017.

Principal Component Projection Without Principal Component Analysis. Roy Frostig, Cameron Musco, Christopher Musco, Aaron Sidford. *International Conference on Machine Learning (ICML)* 2016.

Randomized Block Krylov Methods for Stronger and Faster Approximate Singular Value Decomposition. Cameron Musco, Christopher Musco. *Conference on Neural Information Processing Systems (NIPS)* 2015. Invited for full oral presentation (1 of 15 out of 403 accepted papers). Also presented at the 2016 Copper Mountain Conference on Iterative Methods

Dimensionality Reduction for K-Means Clustering and Low Rank Approximation. Michael B. Cohen, Samuel Elder, Cameron Musco, Christopher Musco, Madalina Persu. *ACM Symposium on Theory of Computing (STOC)* 2015.

Principled Sampling for Anomaly Detection. Brendan Juba, Fan Long, Christopher Musco, Stelios Sidiroglou-Douskos, Martin Rinard. *Network and Distributed System Security Symposium (NDSS)* 2015.

Uniform Sampling for Matrix Approximation. Michael B. Cohen, Yin Tat Lee, Cameron Musco, Christopher Musco, Richard Peng, Aaron Sidford. *Innovations in Theoretical Computer Science (ITCS)* 2015.

Single Pass Spectral Sparsification in Dynamic Streams. Michael Kapralov, Yin Tat Lee, Cameron Musco, Christopher Musco, Aaron Sidford. *IEEE Symposium on Foundations of Computer Science (FOCS)* 2014, Special Issue SIAM Journal on Computing 2017.

Other.....

Learning Networks from Random Walk-Based Node Similarities. Jeremy Hoskins, Cameron Musco, Christopher Musco, Charalampos Tsourakakis. *In submission.* 2018.

Eigenvector Computation and Community Detection in Asynchronous Gossip Models. Frederik Mallmann-Trenn, Cameron Musco, Christopher Musco. *In submission.* 2018.

Teaching

Advanced Algorithms (MIT 6.854/18.415)

Teaching Assistant

2016

Held office hours, wrote problem sets, and compiled notes and resources for an updated version of this challenging graduate algorithms course. Wrote guide on topics and expectations for student projects. Prepared and delivered a lecture on linear programming relaxations.

Technical Communication Skills for Graduate Students (MIT 6.S977)

Workshop Leader

2016

Lead weekly workshops that supplemented lecture material with hands-on writing and presentation exercises. Met with students one-on-one outside of class to offer individual support and coaching in technical communication.

Introduction to Computer Science (Yale CPSC-201)

Teaching Assistant

2012

Held weekly office hours and provided support for students online, covering boolean logic, functional programming, formal language theory, and basic complexity theory.

Introduction to Programming (Yale CPSC-112)

Teaching Assistant

2011

Led weekly section for 15-25 students covering basic Java programming. Tutored 6 students individually.

Introductory Calculus (Yale MATH-112 & MATH-115)

Grader

2009 – 2010

Scored problem sets and provided explanations and solutions for students, as well as feedback to the professor.

Mentorship and Outreach

MIT Graduate Communication Lab

Communication Advisor

2015 – present

Helped to establish an EECS Communication Lab to provide over 700 graduate students with support in academic writing, oral presentation, job applications, and generally, in communicating effectively. Offer feedback, guidance, and coaching to individual students during weekly office hours (100+ individual appointments to date).

CSAIL Algorithms Office Hours

Member

2016 – present

Advise researchers, generally in applied fields, on framing and solving algorithmic problems in their research.

Research Science Institute at MIT

Summer Research Advisor

2014

Primary supervisor for Christopher Wang, a high school student participating in the prestigious RSI summer program. Chris's project, "Relaxation of a Concurrent Disjoint-Set", was selected as one of 10 program finalists.

Industry Research

Yahoo Labs

New York, NY

Research Intern, Scalable Machine Learning Group

Summer 2015

Mentors: Justin Thaler, Maxim Srividenko, Edo Liberty

Worked on streaming matrix sampling problems and on algorithms for managing Yahoo's Fantasy Sports platform.

Talks and Presentations

The Lanczos Method in Data Science: Challenges and Opportunities

Georgetown University, CS Seminar

Feb. 2018

Symposium on Discrete Algorithms (SODA)

Jan. 2018

Unifying Random Fourier Features and Leverage Scores for Kernel Matrix Approximation

Institute for Advanced Study, Computer Science and Discrete Mathematics Seminar

Feb. 2018

Harvard University, guest lecture in "Sketching Algorithms for Big Data"

Nov. 2017

Microsoft Research, Redmond

Sept. 2017

Sketching and Sampling Methods for Large Scale Linear Algebra

Twitter, Cambridge

July 2017

Recursive Sampling for the Nyström Method

Neural Information Processing Systems (NIPS) poster session

Dec. 2017

New England Machine Learning Day poster session

May 2017

Algorithms for Determining Tournament Payout Structures

Meeting on Algorithm Engineering and Experiments (ALENEX)

Jan. 2017

Introduction to Linear Sketching

MIT, Theory Retreat

Sept. 2016

Principal Component Projection without Principal Component Analysis

International Conference on Machine Learning (ICML)

June 2016

Ridge Leverage Score Sampling

National Institute of Informatics, Shonan Meeting

July 2016

MIT, Algorithms & Complexity Seminar

July 2016

University of Utah, Data Group Meeting

Jan. 2016

Randomized Block Krylov Methods

Neural Information Processing Systems (NIPS) poster session

Dec. 2015

Large Scale Column Subset Selection

Yahoo Labs, Science Week poster session

July 2015

Dimensionality Reduction for k-Means Clustering

IBM T.J. Watson, Mathematical Sciences research seminar

Aug. 2015

Symposium on Theory of Computing (STOC)

June 2015

MIT, Theory Lunch

June 2014

Principled Sampling for Anomaly Detection

MIT, Defense Advanced Research Projects Agency site visit

Mar. 2015

Network and Distributed System Security Symposium (NDSS)	<i>Feb. 2015</i>
Uniform Sampling for Matrix Approximation	
Yahoo Labs, Scalable Machine Learning research seminar	<i>June 2015</i>
Single Pass Spectral Sparsification in Dynamic Streams	
MIT, Annual Sublinear Algorithms Day poster session	<i>Apr. 2015</i>
Harvard University, Theory Seminar	<i>Nov. 2014</i>
Foundations of Computer Science (FOCS)	<i>Oct. 2014</i>

Service

Conference Reviewer.....

COLT (2016, 2018), ESA (2015, 2017), FOCS (2015), ICALP (2015, 2017, 2018), ITCS (2018), NIPS (2015, 2016, 2017), NDSS (2015), RANDOM (2017), STACS (2018), SODA (2016, 2017, 2018), WALCOM (2018)

Journal Reviewer.....

IEEE Transactions on Knowledge and Data Engineering (2017), IEEE Transactions on Signal Processing (2016, 2017, 2018), Journal of Machine Learning Research (2018), Mathematical Programming (2018), SIAM Journal on Matrix Analysis and Applications (2016, 2017)

Program Committee.....

ICML 2018 (non-organizational reviewer)

Other Research Experience

Japan National Institute of Informatics

Invited participant *2016*

Shonan meeting on Recent Advances in Randomized Numerical Linear Algebra.

Honors and Awards

National Science Foundation *2014-2017*

Graduate Research Fellowship, recipient.

Yale University *2012*

Cum Laude, Distinction in Both Majors.

Professional Experience

Redfin **Seattle, WA**

Software Engineer, Data Team *2012 – 2014*

Developed backend Java infrastructure for internet-powered real estate startup. Incorporated large-scale machine learning algorithms into production code. Managed three interns and onboarded four new-hires.

Elysium Digital **Cambridge, MA**

Summer Consultant *Summer 2011*

Provided technical expertise in software patent cases at leading litigation consulting company.

Amicus **New Haven, CT**

Software Developer *2010 – 2011*

Built applications for political campaign management and social fundraising at an early-stage startup that went on to raise nearly 4 million dollars in seed funding.