

Christopher Musco

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Academic Positions

Princeton University <i>Research Instructor, Department of Computer Science</i>	Princeton, NJ 2018 – present
Massachusetts Institute of Technology <i>Research and Teaching Assistant, Theory of Computation Group</i>	Cambridge, MA 2013 – 2018
Yahoo Labs <i>Summer Research Intern, Scalable Machine Learning Group</i>	New York, NY 2015

Research Areas

foundations of data science • scalable machine learning • numerical linear algebra • theory of algorithms
randomization • dimensionality reduction • sketching & streaming • spectral graph algorithms • optimization

Education

Massachusetts Institute of Technology <i>Ph.D. in Computer Science</i> Advisor: Jonathan Kelner Ph.D. Thesis: Faster Linear Algebra for Data Analysis and Machine Learning M.S. Thesis: Dimensionality Reduction for Sparse and Structured Matrices	Cambridge, MA 2013 – 2018
Yale University <i>B.S. in Applied Mathematics, B.S. in Computer Science</i>	New Haven, CT 2008 – 2012

Publications

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

A Universal Sampling Method for Reconstructing Signals with Simple Fourier Transforms. Haim Avron, Michael Kapralov, Cameron Musco, Christopher Musco, Ameya Velingker, Amir Zandieh. *ACM Symposium on Theory of Computing (STOC)* 2019.

Learning Networks from Random Walk-Based Node Similarities. Jeremy Hoskins, Cameron Musco, Christopher Musco, Charalampos Tsourakakis. *Conference on Neural Information Processing Systems (NIPS)* 2018.

Eigenvector Computation and Community Detection in Asynchronous Gossip Models. Frederik Mallmann-Trenn, Cameron Musco, Christopher Musco. *International Colloquium on Automata, Languages, and Programming (ICALP)* 2018.

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.

Teaching

Advanced Algorithm Design (Princeton COS 521)

Instructor

Fall 2018

Advanced Algorithms (MIT 6.854/18.415)

Teaching Assistant

Spring 2016

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

Workshop Leader

Spring 2016

Introduction to Computer Science (Yale CPSC-201)

Teaching Assistant

Spring 2012

Introduction to Programming (Yale CPSC-112)

Teaching Assistant

Fall 2011

Mentorship and Outreach

MIT Graduate Communication Lab

Communication Advisor

2015 – 2018

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. Offered feedback, guidance, and coaching to individual students during weekly office hours (100+ individual appointments).

CSAIL Algorithms Office Hours

Member

2016 – 2018

Advised researchers, generally in applied fields, on framing and solving algorithmic problems arising in their work.

Research Science Institute at MIT

Summer Research Advisor

2014

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

Talks and Presentations

Learning Signals with Simple Fourier transforms

Columbia University, Theory Seminar

Oct. 2018

UC Berkeley, Simons Institute Workshop

Sept. 2018

Princeton University, Theory Seminar

Sept. 2018

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

Service

Conference Programming.....	
NIPS 2019 Area Chair	
Conference Reviewer.....	
COLT (2016, 2018), ESA (2015, 2017), FOCS (2015,2018), ICALP (2015, 2017, 2018), ICML (2018,2019) ITCS (2018), IWOCA (2018), NIPS (2015, 2016, 2017, 2018), NDSS (2015), RANDOM (2017,2018), STACS (2018), SODA (2016, 2017, 2018, 2019), STOC (2018), WALCOM (2018)	
Journal Reviewer.....	
SIAM Journal on Matrix Analysis and Applications (2016, 2017), SIAM Journal on Scientific Computing (2019), Science Advances (2018), Mathematical Programming (2018), IEEE Transactions on Signal Processing (2016, 2017, 2018), Journal of Machine Learning Research (2018,2019), Advances in Data Analysis and Classification (2018), IEEE Transactions on Knowledge and Data Engineering (2017),	
Notables.....	
ICML 2018 Outstanding Reviewer	

Other Research Experience

UC Berkeley, Simons Institute for the Theory of Computing	
<i>Invited participant</i>	2018
Workshop on Randomized Numerical Linear Algebra and Applications.	
Japan National Institute of Informatics	
<i>Invited participant</i>	2016
Shonan meeting on Recent Advances in Randomized Numerical Linear Algebra.	

Honors and Awards

National Science Foundation	2014-2017
<i>Graduate Research Fellowship, recipient.</i>	
Yale University	2012
<i>Cum Laude, Distinction in Both Majors.</i>	

Grants and Funding

Travel Awards.....	
SIAM Early Career 2019, NIPS 2018, NIPS 2015	

Other 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

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 4 million dollars in seed funding.