

# Christopher Musco

32 Vassar Street – Cambridge, MA 02139 – Office G578

☎ (401) 578 2541 • ✉ cpmusco@mit.edu • 🌐 chrismusco.com

## Education

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### 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

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theory of algorithms • scalable machine learning • randomized linear algebra • low rank approximation  
dimensionality reduction • sketching and streaming • algorithmic graph theory • iterative matrix algorithms

## Publications

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

Conference and Journal Papers.....

**Random Fourier Features for Kernel Ridge Regression.** Haim Avron, Michael Kapralov, Cameron Musco, Christopher Musco, Ameya Velingker, Amir Zandieh. *ICML 2017*.

**Input Sparsity Time Low-Rank Approximation via Ridge Leverage Score Sampling.** Michael B. Cohen, Cameron Musco, Christopher Musco. *SODA 2017*.

**Determining Tournament Payout Structures for Daily Fantasy Sports.** Christopher Musco, Maxim Sviridenko, Justin Thaler. *ALENEX 2017*.

**Principal Component Projection Without Principal Component Analysis.** Roy Frostig, Cameron Musco, Christopher Musco, Aaron Sidford. *ICML 2016*.

**Randomized Block Krylov Methods for Stronger and Faster Approximate Singular Value Decomposition.** Cameron Musco, Christopher Musco. *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. *STOC 2015*.

**Principled Sampling for Anomaly Detection.** Brendan Juba, Fan Long, Christopher Musco, Stelios Sidiropoulos-Douskos, Martin Rinard. *NDSS 2015*.

**Uniform Sampling for Matrix Approximation.** Michael B. Cohen, Yin Tat Lee, Cameron Musco, Christopher Musco, Richard Peng, Aaron Sidford. *ITCS 2015*.

**Single Pass Spectral Sparsification in Dynamic Streams.** Michael Kapralov, Yin Tat Lee, Cameron Musco, Christopher Musco, Aaron Sidford. *FOCS 2014, SIAM Journal on Computing 2017*.

Other.....

**Recursive Sampling for the Nyström Method.** Cameron Musco, Christopher Musco. *In submission*.

## Teaching and Mentorship

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### **Advanced Algorithms (MIT 6.854/18.415)**

*Teaching Assistant*

2016

Held weekly office hours, wrote problem sets, and compiled notes and resources for an updated version of this capstone 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.

### **MIT Graduate Communication Lab**

*Communication Advisor*

2015 – present

Helping 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 (75+ individual appointments to date).

### **CSAIL Algorithms Office Hours**

*Student Member*

2016 – present

Meet with researchers, generally in applied fields, who seek advice on solving or framing algorithmic problems that appear in their research.

### **Research Science Institute at MIT**

*Summer Research Advisor*

2014

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

### **Introduction to Computer Science (Yale CPSC-201)**

*Teaching Assistant*

2012

Covered functional programming, boolean algebra, 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.

## Industry Research

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### **Yahoo Labs**

**New York, NY**

*Research Intern, Scalable Machine Learning Group*

*Summer 2015*

Mentors: Justin Thaler, Maxim Srividenko, Edo Liberty

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

## Talks

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### **Recursive Sampling for the Nyström Method**

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	<i>Sept. 2016</i>
<b>Principal Component Projection without Principal Component Analysis</b>	
International Conference on Machine Learning (ICML)	<i>June 2016</i>
<b>Ridge Leverage Score Sampling</b>	
National Institute of Informatics, Shonan Meeting	<i>July 2016</i>
MIT, Algorithms & Complexity Seminar	<i>July 2016</i>
University of Utah, Data Group Meeting	<i>Jan. 2016</i>
<b>Randomized Block Krylov Methods</b>	
Neural Information Processing Systems (NIPS) Poster Session	<i>Dec. 2015</i>
<b>Large Scale Column Subset Selection</b>	
Yahoo Labs, Science Week Poster Session	<i>July 2015</i>
<b>Dimensionality Reduction for K-Means Clustering</b>	
IBM T.J. Watson, Mathematical Sciences Research Seminar	<i>Aug. 2015</i>
Symposium on Theory of Computing (STOC)	<i>June 2015</i>
MIT, Theory Lunch	<i>June 2014</i>
<b>Principled Sampling for Anomaly Detection</b>	
MIT, Defense Advanced Research Projects Agency Site Visit	<i>Mar. 2015</i>
Network and Distributed System Security Symposium (NDSS)	<i>Feb. 2015</i>
<b>Uniform Sampling for Matrix Approximation</b>	
Yahoo Labs, Scalable Machine Learning Research Seminar	<i>June 2015</i>
<b>Single Pass Spectral Sparsification in Dynamic Streams</b>	
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

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External Reviewer.....	
International Workshop on Randomization and Computation (RANDOM)	<i>2017</i>
SIAM Journal on Matrix Analysis and Applications (SIMAX)	<i>2017</i>
IEEE Transactions on Knowledge and Data Engineering (TKDE)	<i>2017</i>
Conference on Learning Theory (COLT)	<i>2016</i>
Symposium on Discrete Algorithms (SODA)	<i>2016, 2017</i>
IEEE Transactions on Signal Processing (TSP)	<i>2016, 2017</i>
Neural Information Processing Systems (NIPS)	<i>2015, 2016</i>
European Symposia on Algorithms (ESA)	<i>2015, 2017</i>
Foundations of Computer Science (FOCS)	<i>2015</i>
International Colloquium on Automata, Languages and Programming (ICALP)	<i>2015, 2017</i>
Network and Distributed System Security Symposium (NDSS)	<i>2015</i>

## Other Research Experience

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**Japan National Institute of Informatics** 2016  
*Invited participant, Shonan meeting on Recent Advances in Randomized Numerical Linear Algebra*

## Honors and Awards

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**National Science Foundation** 2014-2017  
*Graduate Research Fellowship, recipient.*

**Facebook Research** 2017  
*Ph.D. Fellowship, finalist (40/800 applicants)*

**Yale University** 2012  
*Cum Laude, Distinction in Both Majors.*

## Professional Experience

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

**Moody's Investors Service** **New York, NY**  
*Intern, Asset Finance Group* *Summer 2009*  
Established and monitored bond ratings on securitizations in three asset classes. Wrote code to automate analysis for student loan data and to compile records on aircraft leases.

**U.S. Department of Agriculture** **East Greenwich, RI**  
*Intern, Natural Resources Conservation Service* *Summer 2007*  
Collected and analyzed data for two major state conservation and research projects. Integrated mapping software and database tools to develop a system for compiling and presenting soil data.