

Ankur Moitra

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CITIZENSHIP	USA	
RESEARCH INTERESTS	algorithms and learning	
APPOINTMENTS	<i>Assistant Professor</i> of Applied Mathematics, Massachusetts Institute of Technology <i>Principal Investigator</i> , Computer Science and Artificial Intelligence Lab (CSAIL) Fall 2013-present Research in various aspects of theoretical computer science <i>Postdoc</i> in School of Mathematics, Institute for Advanced Study Fall 2011-Spring 2013 Supported by an NSF Computing and Innovation Fellowship Also: Senior Postdoc at Princeton University, Summer 2012-Spring 2013	
EDUCATION	Massachusetts Institute of Technology, Cambridge, MA USA Ph.D., Computer Science, June 2011 <ul style="list-style-type: none">• Thesis Title: <i>Vertex Sparsification and Universal Rounding Algorithms</i>• Received the George M. Sprowls Thesis Award (best thesis)• Adviser: Professor F. Thomson Leighton• Area of Study: Theoretical Computer Science S.M., Computer Science, May 2009 <ul style="list-style-type: none">• Thesis Title: <i>A Solution to the Papadimitriou-Ratajczak Conjecture</i>• Received the William A. Martin Memorial Thesis Award (best thesis)• Adviser: Professor F. Thomson Leighton• Area of Study: Theoretical Computer Science Cornell University, Ithaca, NY USA B.S., Electrical and Computer Engineering, May 2007 <ul style="list-style-type: none">• Class Rank in School of Engineering: 1st of 714• <i>Summa Cum Laude</i>• Minor in Applied Mathematics	
AWARDS	NSF CAREER Award, 2015 Google Research Award, 2014 NSF Computing and Innovation Fellowship, 2011-2013 Fannie and John Hertz Foundation Fellowship, 2008-2011 George M. Sprowls Thesis Award, 2011 William A. Martin Memorial Thesis Award, 2009 Siebel Scholar, Class of 2009 MIT Presidential Fellowship, 2007-2008 Barry M. Goldwater Scholar, 2006-2007	

- A. Moitra. The Threshold for Superresolution via Extremal Functions. *Proceedings of the 47th Annual ACM Symposium on Theory of Computing* (STOC 2015), to appear.
- S. Arora, R. Ge, A. Moitra. New Algorithms for Learning Incoherent and Overcomplete Dictionaries. *Proceedings of the 27th Annual Conference on Learning Theory* (COLT 2014), pages 779–806.
- A. Bhaskara, M. Charikar, A. Moitra, A. Vijayaraghavan. Smoothed Analysis of Tensor Decompositions. *Proceedings of the 46th Annual ACM Symposium on Theory of Computing* (STOC 2014), pages 594–603.
- C. Daskalakis, A. De, I. Diakonikolas, A. Moitra, R. Servedio. A Polynomial Time Approximation Scheme for Fault-tolerant Distributed Storage. *Proceedings of the 25th Annual ACM-SIAM Symposium on Discrete Algorithms* (SODA 2014), pages 628–644.
- A. Moitra, M. Saks. A Polynomial Time Algorithm for Lossy Population Recovery. *Proceedings of the 54th Annual IEEE Symposium on Foundations of Computer Science* (FOCS 2013), pages 110–116.
- M. Hardt, A. Moitra. Algorithms and Hardness for Robust Subspace Recovery. *Proceedings of the 26th Annual Conference on Learning Theory* (COLT 2013), pages 354–375.
- S. Arora, R. Ge, Y. Halpern, D. Mimno, A. Moitra, D. Sontag, Y. Wu, M. Zhu. A Practical Algorithm for Topic Modeling with Provable Guarantees. *Proceedings of the 30th International Conference on Machine Learning* (ICML 2013), pages 280–288.
- Invited to Communications of the ACM, Research Highlights**
- M. Braverman, A. Moitra. An Information Complexity Approach to Extended Formulations. *Proceedings of the 45th Annual ACM Symposium on Theory of Computing* (STOC 2013), pages 161–170.
- A. Moitra. An Almost Optimal Algorithm for Computing Nonnegative Rank. *Proceedings of the 24th Annual ACM-SIAM Symposium on Discrete Algorithms* (SODA 2013), pages 1454–1464.
- S. Arora, R. Ge, A. Moitra, S. Sachdeva. Provable ICA with Unknown Gaussian Noise, and Implications for Gaussian Mixtures and Autoencoders. *Advances in Neural Information Processing Systems* (NIPS 2012), pages 2384–2392.
- Invited to Algorithmica Special Issue on Machine Learning**
- S. Arora, R. Ge, A. Moitra. Learning Topic Models – Going Beyond SVD. *Proceedings of the 53rd Annual IEEE Symposium on Foundations of Computer Science* (FOCS 2012), pages 1–10.
- A. T. Kalai, A. Moitra, G. Valiant. Disentangling Gaussians. *Communications of the ACM* February 2012, Research Highlights.
- S. Arora, R. Ge, R. Kannan, A. Moitra. Computing a Nonnegative Matrix Factorization – Provably. *Proceedings of the 44th Annual ACM Symposium on Theory of Computing* (STOC 2012), pages 145–162.
- Invited to SIAM Journal on Computing Special Issue for STOC 2012**
- N. Alon, A. Moitra, B. Sudakov. Nearly Complete Graphs Decomposable into Large Induced Matchings and Their Applications. *Proceedings of the 44th Annual ACM Symposium on Theory of Computing* (STOC 2012), pages 1079–1090.

R. Gelles, A. Moitra, A. Sahai. Efficient and Explicit Coding for Interactive Communication. *Proceedings of the 52nd Annual IEEE Symposium on Foundations of Computer Science* (FOCS 2011), pages 768–777.

A. Moitra, R. O’Donnell. Pareto Optimal Solutions for Smoothed Analysts. *Proceedings of the 43rd Annual ACM Symposium on Theory of Computing* (STOC 2011), pages 225–234.

Invited to SIAM Journal on Computing Special Issue for STOC 2011

N. Immorlica, A. Kalai, B. Lucier, A. Moitra, A. Postlewaite, and M. Tennenholtz. Dueling Algorithms. *Proceedings of the 43rd Annual ACM Symposium on Theory of Computing* (STOC 2011), pages 215–224.

M. Andrews, M.T. Hajiaghayi, H. Karloff, A. Moitra. Capacitated Metric Labeling. *Proceedings of the 22nd Annual ACM-SIAM Symposium on Discrete Algorithms* (SODA 2011), pages 976–995.

A. Moitra, G. Valiant. Settling the Polynomial Learnability of Mixtures of Gaussians. *Proceedings of the 51st Annual IEEE Symposium on Foundations of Computer Science* (FOCS 2010), pages 93-102.

Invited to Communications of the ACM, Research Highlights

M. Charikar, T. Leighton, S. Li, A. Moitra. Vertex Sparsifiers and Abstract Rounding Algorithms. *Proceedings of the 51st Annual IEEE Symposium on Foundations of Computer Science* (FOCS 2010), pages 265-274.

A.T. Kalai, A. Moitra, G. Valiant. Efficiently Learning Mixtures of Two Gaussians. *Proceedings of the 42nd Annual ACM Symposium on Theory of Computing* (STOC 2010), pages 553-562.

T. Leighton, A. Moitra. Extensions and Limits to Vertex Sparsification. *Proceedings of the 42nd Annual ACM Symposium on Theory of Computing* (STOC 2010), pages 47-56.

A. Moitra. Approximation Algorithms for Multicommodity-Type Problems with Guarantees Independent of the Graph Size. *Proceedings of the 50th Annual IEEE Symposium on Foundations of Computer Science* (FOCS 2009), pages 3-12.

Invited to SIAM Journal on Computing Special Issue for FOCS 2009

T. Leighton, A. Moitra. Some Results on Greedy Embeddings in Metric Spaces. *Proceedings of the 49th Annual IEEE Symposium on Foundations of Computer Science* (FOCS 2008), pages 337-346.

Invited to Discrete and Computational Geometry

MANUSCRIPTS

B. Barak, A. Moitra. Tensor Prediction, Rademacher Complexity and Random 3-XOR. Manuscript, 2015

S. Arora, R. Ge, T. Ma, A. Moitra. Simple, Efficient and Neural Algorithms for Sparse Coding. Manuscript, 2015.

TALKS

Simple, Efficient and Neural Algorithms for Sparse Coding

ITA, February 2015

Workshop on Algorithmic Challenges in Machine Learning (UCSD), January 2015

Symposium on Learning, Algorithms and Complexity (IISc), January 2015

Workshop on Learning Theory (FOCM), December 2014

The Threshold for Superresolution

MSR/MIT Reading Group, November 2014

Workshop on Sparse Fourier Transform (FOCS), October 2014

Tensor Decompositions and Their Applications

- Learning at Scale (MADALGO), August 2014

New Algorithms for Dictionary Learning

- Learning at Scale (MADALGO) August 2014
- Curves and Surfaces, June 2014
- Mathematical Foundations of Learning Theory, June 2014
- COLT, June 2014
- Workshop on Overcoming Intractability in Learning (STOC), May 2014

Extended Formulations and Information Complexity

- Dagstuhl Tutorial**, March 2014

A Polynomial Time Algorithm for Lossy Population Recovery

- Duke University Algorithms Seminar, August 2014
- ICERM, May 2014
- ITA, February 2014
- FOCS, October 2013
- TCS+ Seminar, September 2013
- Princeton University Discrete Math Seminar, May 2013
- Princeton University Theory Lunch, April 2013

Polynomial Methods in Learning and Statistics

- UAI Tutorial**, July 2013
- Institute for Advanced Study Members Seminar**, March 2012

An Information Complexity Approach to Extended Formulations

- MIT TOC Colloquium, September 2013
- STOC, June 2013
- NYC Theory Day**, May 2013
- Columbia University Discrete Math Seminar, April 2013
- ARC Theory Day**, April 2013
- Center for Computational Intractability Meeting, December 2012

New Algorithms for Nonnegative Matrix Factorization and Beyond

- Harvard CS Colloquium, October 2014
- Learning at Scale (MADALGO), August 2014
- University of Washington CS Colloquium, November 2014
- University of Texas, Austin CS Colloquium, April 2013
- University of California, San Diego CS Colloquium, April 2013
- Carnegie Mellon University CS/MLD Colloquium, March 2013
- Google Research NYC Theory Seminar, March 2013
- Cornell University CS Colloquium, March 2013
- Princeton University CS/PACM Colloquium, February 2013
- MIT Applied Math Special Seminar, February 2013
- Columbia University IEOR/CS Colloquium, February 2013
- IBM T.J. Watson Theory Seminar, February 2013
- Microsoft Research, Silicon Valley Theory Seminar, February 2013
- Caltech CMS Colloquium, January 2013
- Microsoft Research, New England Theory Seminar, January 2013

An Almost Optimal Algorithm for Computing Nonnegative Rank

- SODA, January 2013

Learning Topic Models – Going Beyond SVD

FOCS, October 2012

Computing a Nonnegative Matrix Factorization – Provably

Cornell University Theory Seminar, October 2012

IBM T.J. Watson Theory Lunch, July 2012

Google Research NYC Theory Seminar, June 2012

Carnegie Mellon University Theory Seminar, December 2011

University of Texas, Austin Theory Seminar, November 2011

Finding Structure in Big Data (popular talk)

Institute for Advanced Study Board of Trustees Meeting, May 2012

Nearly Complete Graphs Decomposable into Large Induced Matchings

STOC, May 2012

Princeton University Theory Lunch, April 2012

Vertex Sparsification: An Introduction, Connections and Applications

Part I: Institute for Advanced Study CSDM Seminar, November 8th 2011

Part II: Institute for Advanced Study CSDM Seminar, November 15th 2011

Pareto Optimal Solutions for Smoothed Analysts

Princeton University Discrete Math Seminar, March 2012

Rutgers University Discrete Math Seminar, February 2012

University of California, Berkeley Theory Seminar, September 2011

Workshop on Beyond Worst Case Analysis (Stanford), September 2011

STOC, May 2011

Efficiently Learning Mixtures of Gaussians

International Workshop on Statistical Learning, June 2013

University of California, San Diego Theory Seminar, April 2013

Center for Computational Intractability Meeting, September 2011

Microsoft Research, New England Theory Seminar, January 2011

Institute for Advanced Study CSDM Seminar, January 2011

Microsoft Research, Redmond Theory Lunch, December 2010

Yale University Statistics Seminar, November 2010

Carnegie Mellon University Theory Seminar, September 2010

Microsoft Research, Silicon Valley Theory Seminar, August 2010

IBM T.J. Watson Theory Lunch, May 2010

Capacitated Metric Labeling

SODA, January 2011

Vertex Sparsification and Oblivious Reductions

Columbia University CS Colloquium, February 2012

Columbia University Discrete Math Seminar, November 2011

DIMACS Theory Seminar, October 2011

University of California, Los Angeles CS Colloquium, March 2011

Toyota Technological Institute CS Colloquium, March 2011

Stanford University CS Colloquium, February 2011

University of Southern California CS Colloquium, February 2011

Georgia Institute of Technology ARC Colloquium, January 2011

Microsoft Research, Silicon Valley Theory Seminar, January 2011

MIT Operations Research Seminar, December 2010

University of Washington Theory Seminar, December 2010

Extensions and Limits to Vertex Sparsification

STOC, May 2010

Approximation Algorithms for Multicommodity Type Problems

Carnegie Mellon University Theory Lunch, September 2010
China Theory Week (Tshingua), September 2010
Cornell University Theory Seminar, February 2010
Princeton University Theory Lunch, December 2009
University of California, Berkeley Theory Seminar, November 2009
Stanford Algorithms Seminar, November 2009
MIT Combinatorics Seminar, September 2009
FOCS, October 2009
ATT Research Theory Seminar, May 2009
Bell Labs Theory Seminar, May 2009

Some Results on Greedy Embeddings in Metric Spaces

Microsoft Research, Redmond, March 2009
FOCS, October 2008

SERVICE

Program Committees: SODA 2015, FOCS 2014, ICML 2013, APPROX 2013

Journal Reviewer: Journal of the ACM, Proceedings of the National Academy of Sciences, SIAM Journal on Computing, Israel Journal of Math, Journal of Machine Learning Research, Machine Learning, Journal of Combinatorial Theory Series B, Mathematics of Operations Research, Computational Complexity, Information and Computation, IEEE Transactions on Information Theory, IEEE Transactions on Computers, SIAM Journal on Matrix Analysis, SIAM Journal on Optimization, ACM Transactions on Algorithms, Algorithmica

Conference Reviewer: STOC 2015, ESA 2014, RANDOM 2014, COLT 2014, STOC 2014, SODA 2014, FOCS 2013, NIPS 2013, COLT 2013, STOC 2013, ICML 2013, STACS 2013, ITCS 2013, SODA 2013, ESA 2012, FOCS 2012, COLT 2012, STOC 2012, SWAT 2012, SODA 2012, ICS 2011, SODA 2011, Special Issue for FOCS 2011, ESA 2010, COLT 2010, STOC 2010, SODA 2010, SPAA 2009, Special Issue for SODA 2008

TEACHING

Massachusetts Institute of Technology, Cambridge, MA USA

Lecturer for 18.409:Algorithmic Aspects of Machine Learning Spring 2015
Updated graduate course on recent progress in machine learning

Lecturer for 6.042/18.062:Mathematics for Computer Science Fall 2014
Undergraduate course on discrete math co-taught with Tom Leighton

Lecturer for 18.434:Topics in Theoretical Computer Science Spring 2014
Undergraduate seminar on polytopes and optimization

Lecturer for 18.S996:Algorithmic Aspects of Machine Learning Fall 2013
New graduate course on modern algorithmic approaches in machine learning

Rutgers University, New Brunswick, NJ USA

Lecturer for The Math Behind the Machine Summer 2013
Summer course for high school students, aimed at introducing them to theoretical computer science

Princeton University, Princeton, NJ USA

Co-Lecturer for Spectral Methods Minicourse Summer 2013
Instructors: Luca Trevisan, Prasad Raghavendra, Ankur Moitra, Moses Charikar

REFERENCES

Sanjeev Arora (arora@cs.princeton.edu)
Charles C. Fitzmorris Professor, Princeton University

Robert Kleinberg (rdk@cs.cornell.edu)
Associate Professor, Cornell University

Tom Leighton (ftl@akamai.com)
CEO, Akamai Technologies
Professor, MIT

Avi Wigderson (avi@math.ias.edu)
Herbert H. Maass Professor, Institute for Advanced Study