

Daniel J. Hsu

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Research Interests

Algorithmic statistics, machine learning, and privacy.

Academic Positions

Department of Computer Science, Columbia University, New York, NY.

Associate professor, January 2018 to present.

Assistant professor, July 2013 to December 2017.

Microsoft Research, Cambridge, MA.

Postdoctoral researcher, June 2011 to July 2013.

Department of Statistics, Rutgers University, Piscataway, NJ.

Postdoctoral associate, July 2010 to June 2011.

Department of Statistics, University of Pennsylvania, Philadelphia, PA.

Visiting postdoctoral scholar, July 2010 to June 2011.

Education

Ph.D. Computer Science, University of California, San Diego, June 2010.

Advisor: Prof. Sanjoy Dasgupta.

Dissertation title: Algorithms for Active Learning.

M.S. Computer Science, University of California, San Diego, June 2007.

B.S. Computer Science and Engineering, University of California, Berkeley, May 2004.

Highest Honors in Electrical Engineering and Computer Sciences.

Publications

Journal Articles and Book Chapters

Arushi Gupta, José Manuel Zorrilla Matilla, Daniel Hsu, and Zoltán Haiman. Non-gaussian information from weak lensing data via deep learning. *Phys. Rev. D*, 97:103515, May 2018.

Sasikiran Kandula, Daniel Hsu, and Jeffrey Shaman. Subregional nowcasts of seasonal influenza using search trends. *Journal of Medical Internet Research*, 19(11):e370, 2017.

- Cun Mu, Daniel Hsu, and Donald Goldfarb. Greedy approaches to symmetric orthogonal tensor decomposition. *SIAM Journal on Matrix Analysis and Applications*, 38(4):1210–1226, 2017.
- Lee H. Dicker, Dean P. Foster, and Daniel Hsu. Kernel ridge vs. principal component regression: Minimax bounds and the qualification of regularization operators. *Electronic Journal of Statistics*, 1(1):1022–1047, 2017.
- José Manuel Zorrilla Matilla, Zoltán Haiman, Daniel Hsu, Arushi Gupta, and Andrea Petri. Do dark matter halos explain lensing peaks? *Phys. Rev. D*, 94:083506, Oct 2016.
- Karl Stratos, Michael Collins, and Daniel Hsu. Unsupervised part-of-speech tagging with anchor hidden Markov models. *Transactions of the Association for Computational Linguistics*, 4:245–257, 2016.
- Daniel Hsu and Sivan Sabato. Loss minimization and parameter estimation with heavy tails. *Journal of Machine Learning Research*, 17(18):1–40, 2016.
- Anima Anandkumar, Daniel Hsu, Majid Janzamin, and Sham M. Kakade. When are overcomplete topic models identifiable? Uniqueness of tensor Tucker decompositions with structured sparsity. *Journal of Machine Learning Research*, 16(Dec):2643–2694, 2015.
- Cun Mu, Daniel Hsu, and Donald Goldfarb. Successive rank-one approximations for nearly orthogonally decomposable symmetric tensors. *SIAM Journal on Matrix Analysis and Applications*, 36(4):1638–1659, 2015.
- Sivan Sabato, Shai Shalev-Shwartz, Nathan Srebro, Daniel Hsu, and Tong Zhang. Learning sparse low-threshold linear classifiers. *Journal of Machine Learning Research*, 16(Jul):1275–1304, 2015.
- Anima Anandkumar, Dean P. Foster, Daniel Hsu, Sham M. Kakade, and Yi-Kai Liu. A spectral algorithm for latent Dirichlet allocation. *Algorithmica*, 72(1):193–214, 2015.
- Anima Anandkumar, Rong Ge, Daniel Hsu, Sham M. Kakade, and Matus Telgarsky. Tensor decompositions for learning latent variable models. *Journal of Machine Learning Research*, 15(Aug):2773–2831, 2014.
- Anima Anandkumar, Rong Ge, Daniel Hsu, and Sham M. Kakade. A tensor approach to learning mixed membership community models. *Journal of Machine Learning Research*, 15(Jun):2239–2312, 2014.
- Daniel Hsu, Sham M. Kakade, and Tong Zhang. Random design analysis of ridge regression. *Foundations of Computational Mathematics*, 14(3):569–600, 2014.
- Alekh Agarwal, Dean P. Foster, Daniel Hsu, Sham M. Kakade, and Alexander Rakhlin. Stochastic convex optimization with bandit feedback. *SIAM Journal on Optimization*, 23(1):213–240, 2013.
- Daniel Hsu, Sham M. Kakade, and Tong Zhang. A tail inequality for quadratic forms of subgaussian random vectors. *Electronic Communications in Probability*, 17(52):1–6, 2012.
- Daniel Hsu, Sham M. Kakade, and Tong Zhang. A spectral algorithm for learning hidden Markov models. *Journal of Computer and System Sciences*, 78(5):1460–1480, 2012.
- Daniel Hsu, Sham M. Kakade, and Tong Zhang. Tail inequalities for sums of random matrices that depend on the intrinsic dimension. *Electronic Communications in Probability*, 17(14):1–13, 2012.

Daniel Hsu, Nikos Karampatziakis, John Langford, and Alex J. Smola. Parallel online learning. In Ron Bekkerman, Misha Bilenko, and John Langford, editors, *Scaling Up Machine Learning: Parallel and Distributed Approaches*, chapter 14, pages 283–306. Cambridge University Press, 2012.

Daniel Hsu, Sham M. Kakade, and Tong Zhang. Robust matrix decomposition with sparse corruptions. *IEEE Transactions on Information Theory*, 57(11):7221–7234, 2011.

Refereed Conference Proceedings

Mikhail Belkin, Daniel Hsu, and Partha Mitra. Overfitting or perfect fitting? risk bounds for classification and regression rules that interpolate. In *Advances in Neural Information Processing Systems 31*, 2018.

Michał Dereziński, Manfred K. Warmuth, and Daniel Hsu. Leveraged volume sampling for linear regression. In *Advances in Neural Information Processing Systems 31*, 2018.

Ji Xu, Daniel Hsu, and Arian Maleki. Benefits of over-parameterization with em. In *Advances in Neural Information Processing Systems 31*, 2018.

Rishabh Dudeja and Daniel Hsu. Learning single-index models in Gaussian space. In *Thirty-First Annual Conference on Learning Theory*, 2018.

Daniel Hsu, Kevin Shi, and Xiaorui Sun. Linear regression without correspondence. In *Advances in Neural Information Processing Systems 30*, 2017.

Arushi Gupta and Daniel Hsu. Parameter identification in markov chain choice models. In *Twenty-Eighth International Conference on Algorithmic Learning Theory*, 2017.

Alexandr Andoni, Daniel Hsu, Kevin Shi, and Xiaorui Sun. Correspondence retrieval. In *Thirtieth Annual Conference on Learning Theory*, 2017.

Florian Tramér, Vaggelis Atlidakis, Roxana Geambasu, Daniel Hsu, Jean-Pierre Hubaux, Mathias Humbert, Ari Juels, and Huang Lin. Fairest: Discovering unwarranted associations in data-driven applications. In *Second IEEE European Symposium on Security and Privacy*, 2017.

Alina Beygelzimer, Daniel Hsu, John Langford, and Chicheng Zhang. Search improves label for active learning. In *Advances in Neural Information Processing Systems 29*, 2016.

Ji Xu, Daniel Hsu, and Arian Maleki. Global analysis of Expectation Maximization for mixtures of two Gaussians. In *Advances in Neural Information Processing Systems 29*, 2016.

Avner May, Michael Collins, Daniel Hsu, and Brian Kingsbury. Compact kernel models for acoustic modeling via random feature selection. In *Forty-First IEEE International Conference on Acoustics, Speech and Signal Processing*, 2016.

Daniel Hsu, Aryeh Kontorovich, and Csaba Szepesvári. Mixing time estimation in reversible Markov chains from a single sample path. In *Advances in Neural Information Processing Systems 28*, 2015.

Tzu-Kuo Huang, Alekh Agarwal, Daniel Hsu, John Langford, and Robert E. Schapire. Efficient and parsimonious agnostic active learning. In *Advances in Neural Information Processing Systems 28*, 2015.

- Mathias Lecuyer, Riley Spahn, Yannis Spiliopoulos, Augustin Chaintreau, Roxana Geambasu, and Daniel Hsu. Sunlight: fine-grained targeting detection at scale with statistical confidence. In *Twenty-Second ACM Conference on Computer and Communications Security*, 2015.
- Yusuf Cem Sübakan, Johannes Traa, Paris Smaragdis, and Daniel Hsu. Method of moments learning for left-to-right hidden Markov models. In *IEEE Workshop on Applications of Signal Processing to Audio and Acoustics*, 2015.
- Karl Stratos, Michael Collins, and Daniel Hsu. Model-based word embeddings from decompositions of count matrices. In *Fifty-Third Annual Meeting of the Association for Computational Linguistics*, 2015.
- Alekh Agarwal, Alina Beygelzimer, Daniel Hsu, John Langford, and Matus Telgarsky. Scalable nonlinear learning with adaptive polynomial expansions. In *Advances in Neural Information Processing Systems 27*, 2014.
- Kamalika Chaudhuri, Daniel Hsu, and Shuang Song. The large margin mechanism for differentially private maximization. In *Advances in Neural Information Processing Systems 27*, 2014.
- Karl Stratos, Do-kyum Kim, Michael Collins, and Daniel Hsu. A spectral algorithm for learning class-based n -gram models of natural language. In *Thirtieth Conference on Uncertainty in Artificial Intelligence*, 2014.
- Alekh Agarwal, Daniel Hsu, Satyen Kale, John Langford, Lihong Li, and Robert E. Schapire. Taming the monster: a fast and simple algorithm for contextual bandits. In *Thirty-First International Conference on Machine Learning*, 2014.
- Daniel Hsu and Sivan Sabato. Heavy-tailed regression with a generalized median-of-means. In *Thirty-First International Conference on Machine Learning*, 2014.
- James Zou, Daniel Hsu, David Parkes, and Ryan P. Adams. Contrastive learning using spectral methods. In *Advances in Neural Information Processing Systems 26*, 2013.
- Anima Anandkumar, Daniel Hsu, Majid Janzamin, and Sham M. Kakade. When are overcomplete topic models identifiable? Uniqueness of tensor Tucker decompositions with structured sparsity. In *Advances in Neural Information Processing Systems 26*, 2013.
- Anima Anandkumar, Rong Ge, Daniel Hsu, and Sham M. Kakade. A tensor spectral approach to learning mixed membership community models. In *Twenty-Sixth Annual Conference on Learning Theory*, 2013.
- Anima Anandkumar, Daniel Hsu, Adel Javanmard, and Sham M. Kakade. Learning linear Bayesian networks with latent variables. In *Thirtieth International Conference on Machine Learning*, 2013.
- Daniel Hsu and Sham M. Kakade. Learning mixtures of spherical Gaussians: moment methods and spectral decompositions. In *Fourth Innovations in Theoretical Computer Science*, 2013.
- Anima Anandkumar, Dean P. Foster, Daniel Hsu, Sham M. Kakade, and Yi-Kai Liu. A spectral algorithm for latent Dirichlet allocation. In *Advances in Neural Information Processing Systems 25*, 2012.
- Anima Anandkumar, Daniel Hsu, Furong Huang, and Sham M. Kakade. Learning mixtures of tree graphical models. In *Advances in Neural Information Processing Systems 25*, 2012.

- Daniel Hsu, Sham M. Kakade, and Percy Liang. Identifiability and unmixing of latent parse trees. In *Advances in Neural Information Processing Systems 25*, 2012.
- Kamalika Chaudhuri and Daniel Hsu. Convergence rates for differentially private statistical estimation. In *Twenty-Ninth International Conference on Machine Learning*, 2012.
- Anima Anandkumar, Daniel Hsu, and Sham M. Kakade. A method of moments for mixture models and hidden Markov models. In *Twenty-Fifth Annual Conference on Learning Theory*, 2012.
- Daniel Hsu, Sham M. Kakade, and Tong Zhang. Random design analysis of ridge regression. In *Twenty-Fifth Annual Conference on Learning Theory*, 2012.
- Anima Anandkumar, Kamalika Chaudhuri, Daniel Hsu, Sham M. Kakade, Le Song, and Tong Zhang. Spectral methods for learning multivariate latent tree structure. In *Advances in Neural Information Processing Systems 24*, 2011.
- Alekh Agarwal, Dean P. Foster, Daniel Hsu, Sham M. Kakade, and Alexander Rakhlin. Stochastic convex optimization with bandit feedback. In *Advances in Neural Information Processing Systems 24*, 2011.
- Miroslav Dudík, Daniel Hsu, Satyen Kale, Nikos Karampatziakis, John Langford, Lev Reyzin, and Tong Zhang. Efficient optimal learning for contextual bandits. In *Twenty-Seventh Conference on Uncertainty in Artificial Intelligence*, 2011.
- Kamalika Chaudhuri and Daniel Hsu. Sample complexity bounds for differentially private learning. In *Twenty-Fourth Annual Conference on Learning Theory*, 2011.
- Alina Beygelzimer, Daniel Hsu, John Langford, and Tong Zhang. Agnostic active learning without constraints. In *Advances in Neural Information Processing Systems 23*, 2010.
- Kamalika Chaudhuri, Yoav Freund, and Daniel Hsu. An online learning-based framework for tracking. In *Twenty-Sixth Conference on Uncertainty in Artificial Intelligence*, 2010.
- Daniel Hsu, Sham M. Kakade, John Langford, and Tong Zhang. Multi-label prediction via compressed sensing. In *Advances in Neural Information Processing Systems 22*, 2009.
- Kamalika Chaudhuri, Yoav Freund, and Daniel Hsu. A parameter-free hedging algorithm. In *Advances in Neural Information Processing Systems 22*, 2009.
- Daniel Hsu, Sham M. Kakade, and Tong Zhang. A spectral algorithm for learning hidden Markov models. In *Twenty-Second Annual Conference on Learning Theory*, 2009.
- Sanjoy Dasgupta and Daniel Hsu. Hierarchical sampling for active learning. In *Twenty-Fifth International Conference on Machine Learning*, 2008.
- Sanjoy Dasgupta, Daniel Hsu, and Claire Monteleoni. A general agnostic active learning algorithm. In *Advances in Neural Information Processing Systems 20*, 2007.
- Sanjoy Dasgupta and Daniel Hsu. On-line estimation with the multivariate Gaussian distribution. In *Twentieth Annual Conference on Learning Theory*, 2007.
- Sanjoy Dasgupta, Daniel Hsu, and Nakul Verma. A concentration theorem for projections. In *Twenty-Second Conference on Uncertainty in Artificial Intelligence*, 2006.

Funding

NSF award CCF-1740833 (09/2017–08/2020, \$1,500,000), *TRIPODS: From Foundations to Practice of Data Science and Back* (co-PI with Wright, Du, Blei, and Andoni), 2017.

NSF award IIS-1563785 (09/2016–08/2020, \$1,196,617), *III: Medium: Adaptive Information Extraction from Social Media for Actionable Inferences in Public Health* (co-PI with Gravano), 2016.

NSF award DMREF-1534910 (10/2015–9/2018, \$982,786.00), *DMREF: Deblurring our View of Atomic Arrangements in Complex Materials for Advanced Technologies* (co-PI with Billinge and Du), 2015.

Yahoo Academic Career Enhancement (ACE) Award, 2014.

Institute for Data Sciences and Engineering Research Opportunities and Approaches to Data Science Grant, *Learning the Nature of Dark Energy from Weak Gravitational Lensing with Computer Vision and Machine Learning* (co-PI with Haiman, Peek, and Nayar), 2014.

Awards and Honors

National Academy of Sciences Kavli Fellow, 2017.

Alfred P. Sloan Research Fellow in Computer Science, 2016.

IEEE Intelligent Systems “AI’s 10 to Watch”, 2016.

Yahoo Academic Career Enhancement Award, 2014.

U.C. San Diego Departmental Dissertation Award, 2010.

Honorable Mention for Outstanding Student Paper Award at NIPS, 2009.

Los Alamos National Laboratory Research Fellowship, 2006–2008.

U.C. San Diego Graduate Fellowship, 2004–2005.

NASA Space Grant Summer Fellowship, 2004.

Member of Tau Beta Pi, 2004.

NSF Graduate Research Fellowship Honorable Mention, 2004.

Guidant Bioengineering Summer Research Fellowship, 2002.

U.C. Berkeley EECS Honors Degree Program, 2002–2004.

Member of Eta Kappa Nu, 2001.

Edward Frank Kraft Scholarship, 2001.

U.C. Berkeley Regents’ Scholarship, 2000–2004.

U.C. Berkeley National Merit Scholarship, 2000–2004.

Invited Talks

TRIPODS/DIMACS Workshop on Optimization in Machine Learning, Lehigh University, August 2018.

Simons Institute for the Theory of Computing, University of California, Berkeley, June 2018.

Workshop on Modern Challenges of Learning Theory, Centre de Recherches Mathematiques, University of Montreal, April 2018.

Joint Statistics/CSE Seminar, Ohio State University, November 2017.

Machine Learning Seminar, New York University, October 2017.

1st Japanese-American-German Kavli Frontiers of Science Symposium, National Academy of Sciences, Bad Neuenahr, Germany, September 2017.

Theory Lunch Seminar, Princeton University, May 2017.

Stochastics and Statistics Seminar, Massachusetts Institute of Technology, April 2017.

Simons Institute for the Theory of Computing, University of California, Berkeley, January 2017.

Machine Learning Seminar, University of Illinois, Urbana-Champaign, October 2016.

The Gatsby Computational Neuroscience Unit, University College London, July 2016.

Janelia Research Campus, Ashburn, VA, June 2016.

DIMACS Theoretical Computer Science Seminar, Rutgers University, Piscataway, NJ, April 2016.

Wilks Statistics Seminar, Princeton University, Princeton, NJ, April 2016.

Bloomberg Labs, New York, NY, March 2016.

Conference on Information Sciences and Systems, Princeton, NJ, March 2016.

Information Theory and Applications Workshop, La Jolla, CA, February 2016.

PrivacyCon (Federal Trade Commission), Washington, DC, January 2016.

New York University Machine Learning Seminar, November 2015.

Program in Algorithmic and Combinatorial Thinking, Princeton University, June 2015.

D.E. Shaw, New York, NY, April 2015.

Two Sigma research seminar, January 2015.

Columbia University Student Statistics Seminar, New York, NY, November 2014.

Wisconsin Institute of Discovery, University of Wisconsin–Madison, October 2014.

Wireless Networking & Communications Group Seminar, University of Texas at Austin, September 2014.

Yahoo! Labs, New York, September 2014.

AAAI Conference on Artificial Intelligence (Tutorial) 2014, Québec City, Québec, July 2014.

Workshop on Mathematical Foundations of Learning Theory, Barcelona, June 2014.

Workshop on Overcoming the Intractability Bottleneck in Unsupervised Machine Learning (co-located with 46th Annual Symposium on the Theory of Computing), New York, NY, May 2014.

New York University Machine Learning Seminar, April 2014.

Information Theory and Applications Workshop, San Diego, CA, February 2014.

Columbia University Student Statistics Seminar, New York, NY, September 2013.

International Conference on Machine Learning (Tutorial) 2013, Atlanta, GA, June 2013.

Second Joint Symposium on Natural Language Processing and Machine Learning, Atlanta, GA, June 2013.

Department of Computer Science, University of California, Los Angeles, April 2013.

Department of Computer Science, Cornell University, April 2013.

Department of Computer Science, Columbia University, April 2013.

Department of Computer Science, Yale University, April 2013.

Department of Computer Science, University of Toronto, April 2013.

School of Computer Science, University of Waterloo, April 2013.

Department of Computer Science, Princeton University, March 2013.

Department of Computer and Information Science, University of Pennsylvania, March 2013.

Department of Computer Science, University of Maryland, College Park, March 2013.

Department of Electrical and Computer Engineering, Boston University, March 2013.

Department of Computer Science and Engineering, Washington University in St. Louis, March 2013.

Department of Electrical Engineering and Computer Science, Massachusetts Institute of Technology, March 2013.

Microsoft Research, Mountain View, CA, March 2013.

Department of Computer Science, University of Illinois at Urbana-Champaign, March 2013.

Department of Computer Science, University of Chicago, February 2013.

Machine Learning Department, Carnegie Mellon University, February 2013.

Department of Statistics, Rutgers University, February 2013.

Department of Computer Science, Johns Hopkins University, February 2013.

Information Theory and Applications Workshop, San Diego, CA, February 2013.

The Gatsby Computational Neuroscience Unit, University College London, February 2013.

School of Computer and Communication Sciences, École Polytechnique Fédérale de Lausanne, February 2013.

NIPS 2012 Workshop on Modern Nonparametric Methods in Machine Learning, Tahoe, NV, December 2012.

NICTA Machine Learning Seminar, Canberra, Australia, April 2012.

Department of Statistics, Rutgers University, Piscataway, NJ, November 2011.

Microsoft Research, Redmond, WA, October 2011.

Department of Computer Science and Technology, Nanjing University, Nanjing, China, August 2011.

School of Computer Science, Fudan University, Shanghai, China, August 2011.

ID Analytics, San Diego, CA, May 2010.

IBM Research, Yorktown Heights, NY, October 2009.

Service

Board of Directors

Association for Computational Learning (ACL), 2017–2020.

Conference Organization

Program chair (with Alina Beygelzimer), Conference on Learning Theory (COLT), 2019.

Publicity chair, International Conference on Artificial Intelligence and Statistics (AISTATS), 2019.

Local arrangements chair (with Satyen Kale), Conference on Learning Theory (COLT), 2016.

Seminar Organization

Computer Science Distinguished Lecture Series, Columbia University, Fall 2018.

Foundations of Data Science Seminar Series, Columbia University, Fall 2015.

Workshop Organization

Workshop on Method of Moments and Spectral Learning, co-located with International Conference on Machine Learning (ICML), 2014.

DIMACS/CCICADA Workshop on Systems and Analytics of Big Data, 2014.

Workshop on Spectral Learning, co-located with International Conference on Machine Learning (ICML), 2013.

Workshop on Spectral Learning, co-located with Conference on Neural Information Processing Systems (NIPS), 2013.

Journal Associate Editor

ACM Transactions on Algorithms, January 2017 to present.

Journal Reviewing

Algorithmica

Annals of Statistics

Artificial Intelligence Journal

Data Mining and Knowledge Discovery

Electronic Journal of Statistics

IEEE Transactions on Information Theory
IEEE Transactions on Pattern Analysis and Machine Intelligence
Journal of the Association for Computing Machinery
Journal of Machine Learning Research
Machine Learning Journal
Neural Computation
Transactions of the Association for Computational Linguistics

Conference Senior Program Committee / Area Chair

Conference on Learning Theory (COLT), 2011, 2013, 2015, 2016, 2017, 2018.
International Conference on Machine Learning (ICML), 2012, 2013, 2015, 2016, 2017.
Conference on Neural Information Processing Systems (NIPS), 2012, 2013, 2017.
International Conference on Artificial Intelligence and Statistics (AISTATS), 2016, 2017, 2019.
International Conference on Algorithmic Learning Theory (ALT), 2017, 2018, 2019.

Conference Program Committee / Reviewing

AAAI Conference on Artificial Intelligence (AAAI)
International Conference on Artificial Intelligence and Statistics (AISTATS)
International Conference on Machine Learning (ICML)
Conference on Neural Information Processing Systems (NIPS)
Conference on Uncertainty in Artificial Intelligence (UAI)

External Reviewing

Conference on Algorithmic Learning Theory (ALT)
Conference on Learning Theory (COLT)
European Conference on Machine Learning and Principles and Practice of Knowledge Discovery in Databases (ECML/PKDD)
IEEE Symposium on Foundations of Computer Science (FOCS)
ACM-SIAM Symposium on Discrete Algorithms (SODA)
ACM Symposium on Theory of Computing (STOC)

Funding Proposal Reviewing

National Science Foundation, 2014, 2018.
Swiss National Science Foundation (external), 2013.
German-Israeli Foundation for Scientific Research and Development (external), 2010.