Yihong Wu

24 Hillhouse Ave Room 203
Yale University
New Haven, CT 06511

Phone: (203) 436-9003
Email: yihong.wu@yale.edu
Homepage: http://www.stat.yale.edu/~yw562/

Research Interests

Theoretical and algorithmic aspects of high-dimensional statistics, information theory, optimal transportation

Education

Ph.D. in Electrical Engineering, Princeton University, Princeton NJ, September 2011

Thesis: Shannon Theory for Compressed Sensing
Minors: Mathematics, Operational Research and Financial Engineering
Advisor: Prof. Sergio Verdú

M.A. in Electrical Engineering, Princeton University, Princeton NJ, September 2008

B.E. in Electrical Engineering (with distinction), Tsinghua University, Beijing, China, July 2006

Honors & Awards

Simons-Berkeley Research Fellowship, 2015.

List of Teachers Ranked Excellent by Their Students, Fall 2014.

Strategic Research Initiatives Grant, University of Illinois, 2014.

Marconi Society Paul Baran Young Scholar Award, 2011.

Best student paper award, IEEE International Symposium on Information Theory (ISIT), 2011.

Wallace Memorial honorific fellowship, Princeton University, 2010 - 2011.

Work Experience

Yale University, New Haven, CT

Assistant professor, Department of Statistics, Jul 2016 – present.

Simons Institute for the Theory of Computing, University of California, Berkeley, CA

Research fellow, Jan 2015 – May 2015.

University of Illinois at Urbana-Champaign, Urbana, IL

Assistant professor, Department of Electrical and Computer Engineering, Jan 2013 – Jun 2016.

Research assistant professor, Coordinated Science Laboratary, Jan 2013 – Jun 2016.

Affiliated faculty, Department of Statistics, Jul 2014 – Jun 2016.

Statistics Department, The Wharton School, University of Pennsylvania, Philadelphia, PA

Postdoctoral fellow (Host: Prof. Tony T. Cai), Sep 2011 - Dec 2012.

Information and Quantum Systems Lab, HP Labs, Palo Alto, CA

Research associate intern, Jun 2010 - Sep 2010.

Teaching Experience

Instructor

STAT241: Probability theory with applications, Yale University, Fall 2016.

Short course on Information-theoretic methods in high-dimensional statistics, 2015 JTG/IEEE Information Theory Society Summer School on Signal Processing, Communications and Networks, IISc Bangalore, India, July 20-23, 2015.

ECE598: Information-theoretic methods in high-dimensional statistics, University of Illinois, Spring 2016.

ECE313: Probability with Engineering Applications, University of Illinois, Spring 2014, Fall 2015.

ECE563: Information Theory, University of Illinois, Fall 2013, Fall 2014.

Assistant Instructor

ELE525: Random Processes in Information Systems, Princeton, Fall 2008.

ELE486: Digital Communications and Networks, Princeton, Spring 2008.

ELE382: Distributed Algorithms and Optimization Methods, Princeton, Fall 2007.

Journal Publications

[J1] Yury Polyanskiy and Yihong Wu, "Wasserstein continuity of entropy and outer bounds for interference channels," *IEEE Transactions on Information Theory*, vol. 62, no. 7, pp. 3992–4002, Jul 2016, arXiv:1504.04419.

[J2] Bruce Hajek, Yihong Wu, and Jiaming Xu, "Achieving exact cluster recovery threshold via semidefinite programming: Extensions," *to appear in IEEE Transactions on Information Theory*, 2016, arxiv:1502.07738.

[J3] Bruce Hajek, Yihong Wu, and Jiaming Xu, "Achieving exact cluster recovery threshold via semidefinite programming," *IEEE Transactions on Information Theory*, vol. 62, no. 5, pp. 2788–2797, May 2016.

[J4] Yihong Wu and Pengkun Yang, "Minimax rates of entropy estimation on large alphabets via best polynomial approximation," *IEEE Transactions on Information Theory*, vol. 62, no. 6, pp. 3702–3720, 2016.

[J5] Yury Polyanskiy and Yihong Wu, "Dissipation of information in channels with input constraints," *IEEE Transactions on Information Theory*, vol. 62, no. 1, pp. 35–55, Jan. 2016.

[J6] Zongming Ma and Yihong Wu, "Volume ratio, sparsity, and minimaxity under unitarily invariant norms," *IEEE Transactions on Information Theory*, vol. 61, no. 12, pp. 6939 – 6956, Dec 2015.

[J7] Zongming Ma and Yihong Wu, "Computational barriers in minimax submatrix detection," *The Annals of Statistics*, vol. 43, no. 3, pp. 1089–1116, 2015.

[J8] T. Tony Cai, Zongming Ma, and Yihong Wu, "Optimal estimation and rank detection for sparse spiked covariance matrices," *Probability Theory and Related Fields*, vol. 161, no. 3-4, pp. 781–815, Apr. 2015.

[J9] Yihong Wu, Shlomo Shamai (Shitz), and Sergio Verdú, "Information Dimension and the Degrees of Freedom of the Interference Channel," *IEEE Transactions on Information Theory*, vol. 61, no. 1, pp. 256 – 279, Jan 2015.

[J10] Yury Polyanskiy and Yihong Wu, "Peak-to-average power ratio of good codes for Gaussian channel," *IEEE Transactions on Information Theory*, vol. 60, no. 12, pp. 7655 – 7660, Sep. 2014.

[J11] T. Tony Cai, Zongming Ma, and Yihong Wu, "Sparse PCA: Optimal rates and adaptive estimation," *The Annals of Statistics*, vol. 41, no. 6, pp. 3074 – 3110, 2013.

[J12] T. Tony Cai and Yihong Wu, "Optimal detection of sparse mixtures against a given null distribution," *IEEE Transactions on Information Theory*, vol. 60, no. 4, pp. 2217 – 2232, Apr. 2014.

[J13] Yihong Wu and Sergio Verdú, "Optimal Phase Transitions in Compressed Sensing," *IEEE Transactions on Information Theory*, vol. 58, no. 10, pp. 6241 – 6263, Oct. 2012.

[J14] Yihong Wu and Sergio Verdú, "MMSE dimension," *IEEE Transactions on Information Theory*, vol. 57, no. 8, pp. 4857 – 4879, Aug. 2011.

[J15] Yihong Wu and Sergio Verdú, "Functional properties of MMSE and mutual information," *IEEE Transactions on Information Theory*, vol. 58, no. 3, pp. 1289 – 1301, Mar. 2012.

[J16] Dongning Guo, Yihong Wu, Shlomo Shamai(Shitz), and Sergio Verdú, "Estimation in Gaussian Noise: Properties of the Minimum Mean-square Error," *IEEE Transactions on Information Theory*, vol. 57, no. 4, pp. 1 – 15, May 2011.

[J17] Yihong Wu, Dongning Guo, and Sergio Verdú, "Derivative of Mutual Information at Zero SNR: the Gaussian Noise Case," *IEEE Transactions on Information Theory*, pp. 1–6, Jul. 2011.

[J18] Yihong Wu and Sergio Verdú, "Rényi Information Dimension: Fundamental Limits of Almost Lossless Analog Compression," *IEEE Transactions on Information Theory*, vol. 56, no. 8, pp. 3721 – 3748, Aug. 2010.

[J19] Kai Yang, Jianwei Huang, Yihong Wu, Xiaodong Wang, and Mung Chiang, "Distributed Robust Optimization (DRO) Part I: Framework and Example," *Optimization and Engineering*, vol. 15, no. 1, pp. 35–67, 2014.

[J20] Yiqun Wu, Lin Zhang, Yihong Wu, and Zhisheng Niu, "Motion Indicated Interest Dissemination with Directional Antennas for Wireless Sensor Networks with Mobile Sinks," *IEEE Transactions of Vehicular Technology*, vol. 58, no. 2, pp. 977 – 989, Feb. 2009.

Preprints & Technical reports

[P1] Ashok Vardhan Makkuva and Yihong Wu, "On addditive-combinatorial affine inequalities for Shannon entropy and differential entropy," *preprint arXiv:1601.07498*, Jan 2016.

[P2] Alon Orlitsky, Ananda Theertha Suresh, and Yihong Wu, "Estimating the number of unseen species: How far can one foresee?" *preprint arXiv:1511.07428*, Nov 2015.

[P3] B. Hajek, Y. Wu, and J. Xu, "Recovering a hidden community beyond the spectral limit in $O(|E|\log^*|V|)$ time," *preprint arXiv:1510.02786*, Oct 2015.

[P4] B. Hajek, Y. Wu, and J. Xu, "Information limits for recovering a hidden community," *preprint arXiv:1509.07859*, Sep 2015.

[P5] F. Calmon, Y. Polyanskiy, and Y. Wu, "Strong data processing inequalities for input-constrained additive noise channels," *arXiv*, Dec. 2015, arXiv:1512.06429.

[P6] Yury Polyanskiy and Yihong Wu, "Strong data-processing inequalities for channels and Bayesian networks," *preprint arXiv:1508.06025*, Aug. 2015.

[P7] Yihong Wu and Pengkun Yang, "Chebyshev polynomials, moment matching, and optimal estimation of the unseen," *arXiv:1504.01227*, 2015.

[P8] Yury Polyanskiy and Yihong Wu, "Lecture Notes on Information Theory," Feb 2014. [Online]. Available: http://www.ifp.illinois.edu/~yihongwu/teaching/itlectures.pdf

[P9] Yihong Wu, "A simple proof of (a slighly improved) Gaussian HWI inequality and extensions," *preprint*, Dec 2015.

[P10] Kiryung Lee, Yihong Wu, and Yoram Bresler, "Near optimal compressed sensing of sparse rank-one matrices via sparse power factorization," *Preprint arXiv:1312.0525*, 2013.

[P11] Yihong Wu, "Entropy and Dimension Inequalities for Integer-Linear Combinations," *preprint*, Nov. 2013.

[P12] Yihong Wu, Erik Ordentlich, and Marcelo J. Weinberger, "Energy-driven Data Compression," Information and Quantum Systems Lab, HP Labs, Tech. Rep., 2010.

Conference Publications

[C1] Bruce Hajek, Yihong Wu, and Jiaming Xu, "Semidefinite programs for exact recovery of a hidden community," in *Proceedings of Conference on Learning Theory (COLT)*, New York, NY, Jun 2016, arXiv:1602.06410.

[C2] B. Hajek, Y. Wu, and J. Xu, "Information limits for recovering a hidden community," in *2016 IEEE International Symposium on Information Theory*, Barcelona, Spain, Jul 2016.

[C3] Yury Polyanskiy and Yihong Wu, "Converse bounds via coupling for interference channels and proof of Costa's conjecture," in *2016 IEEE International Symposium on Information Theory*, Barcelona, Spain, Jul 2016.

[C4] Ashok Vardhan Makkuva and Yihong Wu, "On addditive-combinatorial affine inequalities for Shannon entropy and differential entropy," in *2016 IEEE International Symposium on Information Theory*, Barcelona, Spain, Jul 2016.

[C5] Bruce Hajek, Yihong Wu, and Jiaming Xu, "Achieving exact cluster recovery threshold via semidefinite programming under the stochastic block model," in *Proceedings of Asilomar Conference on Signals, Systems, and Computers*, Pacific Grove, California, Nov. 2015, (invited).

[C6] Yuejie Chi and Yihong Wu, "Change-point estimation of high-dimensional streaming data via sketching," in *Proceedings of Asilomar Conference on Signals, Systems, and Computers*, Pacific Grove, California, Nov. 2015.

[C7] Bruce Hajek, Yihong Wu, and Jiaming Xu, "Exact recovery threshold in the binary censored block model," in *Proceedings of 2015 IEEE Information Theory Workshop*, Jeju, Korea, Oct. 2015, (invited).

[C8] Maxim Raginsky, Alexander Rakhlin, Matthew Tsao, and Yihong Wu, "Information-theoretic analysis of stability and bias of learning algorithms," in *Proceedings of 2016 IEEE Information Theory Workshop*, Cambrige, UK, Sep 2016, (invited).

[C9] Bruce Hajek, Yihong Wu, and Jiaming Xu, "Computational lower bounds for community detection on random graphs," *Conference on Learning Theory (COLT)*, Jul. 2015, arxiv:1406.6625.

[C10] Yihong Wu and Pengkun Yang, "Optimal entropy estimation on large alphabets via best polynomial approximation," in *Proceedings of 2015 IEEE International Symposium on Information Theory*, Hong Kong, China, Jun. 2015.

[C11] Bruce Hajek, Yihong Wu, and Jiaming Xu, "Achieving exact cluster recovery threshold via semidefinite programming," in *Proceedings of 2015 IEEE International Symposium on Information Theory*, Hong Kong, China, Jun. 2015, (semi-plenary).

[C12] F. Calmon, Y. Polyanskiy, and Y. Wu, "Strong data processing inequalities in power-constrained Gaussian channels," in *Proceedings of 2015 IEEE International Symposium on Information Theory*, Hong Kong, China, Jun. 2015.

[C13] Zongming Ma and Yihong Wu, "Volume ratio, sparsity, and minimaxity under unitarily invariant norms," in *Proceedings of 2013 IEEE International Symposium on Information Theory*, Istanbul, Turkey, Jul. 2013.

[C14] A. Andoni, H. L. Nguyen, Y. Polyanskiy, and Y. Wu, "Tight lower bound for linear sketches of moments," in *Proceedings of 40th Internat. Coll. Automata, Languages, and Programming (ICALP-2013)*, Riga, Latvia, Jul. 2013.

[C15] Erik Ordentlich, Marcelo Weinberger, and Yihong Wu, "Piecewise constant prediction," in *Proceedings of 2012 IEEE International Symposium on Information Theory*, Boston, MA, USA, Jul. 2012.

[C16] Yihong Wu and Sergio Verdú, "Optimal phase transitions in compressed sensing with noisy measurements," in *Proceedings of 2012 IEEE International Symposium on Information Theory*, Boston, MA, USA, Jul. 2012.

[C17] Yihong Wu, Erik Ordentlich, and Marcelo J. Weinberger, "Energy-driven Lossless Data Compression: Rate-variability Tradeoff," in *Proceedings of 2011 IEEE International Symposium on Information Theory*, Saint Petersburg, Russia, Aug. 2011.

[C18] Yihong Wu and Sergio Verdú, "Witsenhausen's Counterexample: a View from Optimal Transport Theory," in *Proceedings of 50th IEEE Conference on Decision and Control*, Orlando, FL, Dec. 2011.

[C19] Yihong Wu, Shlomo Shamai (Shitz), and Sergio Verdú, "Degrees of Freedom of Interference Channel: a General Formula," in *Proceedings of 2011 IEEE International Symposium on Information Theory*, Saint Petersburg, Russia, Aug 2011, (best student paper award).

[C20] Yihong Wu and Sergio Verdú, "The Impact of Constellation Cardinality on Gaussian Channel Capacity," in *Forty-Eighth Annual Allerton Conference on Communication, Control, and Computing*, Monticello, IL, Sep 2010, (invited).

[C21] Yihong Wu and Sergio Verdú, "MMSE Dimension," in *Proceedings of 2010 IEEE International Symposium on Information Theory*, Austin, TX, Jun 2010, (best student paper award finalist).

[C22] Yihong Wu and Sergio Verdú, "Functional Properties of MMSE," in *Proceedings of 2010 IEEE International Symposium on Information Theory*, Austin, TX, Jun. 2010.

[C23] Yihong Wu and Sergio Verdú, "Fundamental Limits of Almost Lossless Analog Compression," in *Proceedings of 2009 IEEE International Symposium on Information Theory*, Seoul, Korea, Jun. 2009.

[C24] Kai Yang, Yihong Wu, Jianwei Huang, Xiaodong Wang, and Sergio Verdú, "Distributed Robust Optimization for Communication Networks," in *Proceedings of IEEE INFOCOM*, Phoenix, AZ, Apr. 2009.

[C25] Yihong Wu, Xiaobo Chen, Lin Zhang, and Zhisheng Niu, "Interest Dissemination with Directional Antenna for Wireless Sensor Networks with Mobile Sinks," in *Proceedings of ACM SenSys*, Boulder, CO, Nov. 2006.

Professional acitivities

University services:

Graduate recruitment, Fellowship and Colloquium committee, Dept. ECE, University of Illinois, Jan. 2013 - Present

ICWS/Communication seminar organizer, Coordinated Science Laboratory, University of Illinois, Aug. 2013 - Present

Conference services:

TPC member: ISIT 2015, 2016; COLT 2016.

"Statistics and Computation," invited session at the Information Theory Workshop, 2015, 2016.

"Statistics for high-dimensional data," invited session at the Allerton Conference on Communication, Control and Computing, 2013 - 2015.

Referees:

Journals: The Annals of Statistics, Applied and Computational Harmonic Analysis, Automatica, Bernoulli, Entropy, IEEE Transactions on Information Theory, IEEE Transactions on Signal Processing, IEEE Transactions on Wireless Communications, SIAM Journal on Imaging Sciences, Theory of Computing.

Conferences: Conference on Learning Theory (COLT), IEEE International Symposium on Information Theory (ISIT), IEEE Information Theory Workshop (ITW), IEEE Annual Conference on Decision and Control (CDC), Annual Conference on Neural Information Processing Systems (NIPS), International Workshop on Randomization and Computation (RANDOM), ACM-SIAM Symposium on Discrete Algorithms (SODA).

Selected talks

"Community Detection in Networks: SDP relaxations and Computational Gaps"

IMA Workshop "Graphical Models, Statistical Inference, and Algorithms (GRAMSIA)," University of Minnesota, Minneapolis, MN, May 2015.

STCS Seminar, School of Technology and Computer Science, Tata Institute of Fundamental Research, Mumbai, India, Jul 2015.

"Chebyshev polynomials, moment matching and optimal estimation of the unseen"

New Researchers Conference on High-Dimensional Statistics, Peking University, Beijing, China, Jun 2015.

Workshop on Information Theory, Learning and Big Data, Simons Institute, Berkeley, CA, Mar 2015.

Probability Seminar, Dept. of Statistics, UC Berkeley, Berkeley, CA, Mar 2015.

Dept. of Electrical Engineering, Indian Institute of Technology Bombay, Powai, Mumbai, India, Jul 2015.

"Optimal estimation of entropy and other properties via best polynomial approximation", LIDS Seminar, MIT, Cambridge, MA, Dec 2014.

"Estimating High-dimensional Matrices: Convex Geometry and Computational Barriers",

2013 Workshop On Coding and Information Theory (WCI 2013), The University of Hong Kong, Hong Kong, China, Dec 2013.

CSL communications seminar, University of Illinois, Urbana, IL, Sep 2013.

Statistics seminar, Dept. of Statistics, Yale University, New Haven, CT, Oct 2013.

ISL Colloquium, Stanford University, Palo Alto, CA, May 2014.

EECS Seminar, UC Berkeley, Berkeley, CA, May 2014.

EECS Seminar, Northwestern University, Evanston, IL, Oct 2014.

"Sparse Principal Component Analysis: Optimal Rates and Adaptive Estimation"

Statistics Seminar, Dept. of Statistics, University of Illinois, Urbana, IL, Oct, 2013.

LIDS, MIT, Cambridge, MA, August 2013.

International Conference on Frontiers of Statistics, Beijing, China, Jun, 2013.

ECE Colloquium, Dept. of ECE, University of Illinois, Urbana, IL, Apr 2013.

"Optimal Estimation and Rank Detection for Sparse Spiked Covariance Matrices", IMS-China International Conference on Statistics and Probability, Chengdu, China, Jul 2013