

Maxim Raginsky

Curriculum Vitæ

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U.S. Citizen

Research Interests

Information processing and decision-making in uncertain environments under resource and complexity constraints ♦ information theory ♦ statistical learning ♦ game theory and control ♦ signal processing.

Education

- 2000 - 2002 Northwestern University: Ph.D. in Electrical Engineering, June 2002
Dissertation: *Dynamical Aspects of Information Storage in Quantum-Mechanical Systems*
Advisor: Horace Yuen
- 1999 - 2000 Northwestern University: M.S. in Electrical Engineering, June 2000
Thesis: *Quantum Noise Control in Fiber-Optic Lines*
Advisor: Prem Kumar
- 1996 - 2000 Northwestern University: B.S. *magna cum laude* in Electrical Engineering, June 2000

Employment

- 2007 - Present Research Scientist, Network and Imaging Science Laboratory
Department of Electrical and Computer Engineering
Duke University, Durham NC
- 2004 - 2007 Beckman Foundation Postdoctoral Fellow
Beckman Institute for Advanced Science and Technology
University of Illinois, Urbana IL
- 2002 - 2004 Postdoctoral Researcher
Center for Photonic Communication and Computing
Northwestern University, Evanston IL
- 2000 - 2002 Graduate Research Assistant
Department of Electrical and Computer Engineering
Northwestern University, Evanston IL

Teaching Experience

At Duke University

- Fall 2008: BME 171, Signals and Systems

At Northwestern University

- Fall 2001: ECE 590, Graduate Seminar (Quantum Detection and Estimation Theory) — instructor

- Winter 2001: ECE 407, Quantum Optics — teaching associate
- Winter 2000: ECE 302, Probabilistic Systems and Random Signals — teaching assistant
- Winter 2000: ECE 225, Fundamentals of Electronics — teaching assistant

Students supervised

Avon Loy Fernandes, M.S. 2008 (Electrical and Computer Engineering, UIUC; co-supervised with Prof. Todd P. Coleman). *Low-Complexity Architectures for Nonparametric Distributed Learning Using Wireless Sensor Networks*. Now at Microsoft Corp.

Awards

2004 - 2007 Beckman Foundation Postdoctoral Fellowship, University of Illinois

1999 - 2000 Walter P. Murphy Graduate Fellowship, Northwestern University

Publications

Journal papers

- M. Raginsky, Z. Harmany, R. Marcia, and R. Willett, “Compressed sensing performance bounds under Poisson noise,” submitted, 2009
- K. Krishnamurthy, M. Raginsky and R. Willett, “Multiscale photon-limited hyperspectral image reconstruction,” submitted, 2009
- S. Lazebnik and M. Raginsky, “Supervised learning of quantizer codebooks by information loss minimization,” *IEEE Transactions on Pattern Analysis and Machine Intelligence*, vol. 31, no. 7, pp. 1294–1309, 2009
- M. Raginsky, “Joint universal lossy coding and identification of stationary mixing sources with general alphabets,” *IEEE Transactions on Information Theory*, vol. 55, no. 5, pp. 1945–1960, 2009
- A.L. Fernandes, M. Raginsky and T.P. Coleman, “A low-complexity universal scheme for rate-constrained distributed regression using a wireless sensor network,” *IEEE Transactions on Signal Processing*, vol. 57, no. 5, pp. 1731–1744, 2009
- M. Raginsky, “Joint fixed-rate universal lossy coding and identification of continuous-alphabet memoryless sources,” *IEEE Transactions on Information Theory*, vol. 54, no. 7, pp. 3059–3077, 2008
- M. Raginsky and T.J. Anastasio, “Cooperation in self-organizing map networks enhances information transmission from input to output in the presence of input background activity,” *Biological Cybernetics*, vol. 98, pp. 195–211, 2007
- V.P. Belavkin, G.M. D’Ariano and M. Raginsky, “Operational distance and fidelity for quantum channels,” *Journal of Mathematical Physics*, vol. 46, art.no. 062106, 2004
- M. Raginsky, “Scaling and renormalization in fault-tolerant quantum computers,” *Quantum Information Processing*, vol. 2, pp. 249–258, 2003
- M. Raginsky, “Radon-Nikodym derivatives of quantum operations,” *Journal of Mathematical Physics*, vol. 44, pp. 5003–5020, 2003
- M. Raginsky, “Entropy production rates of bistochastic strictly contractive quantum channels on a matrix algebra,” *Journal of Physics A: Mathematical and General* vol. 35, pp. L585–L590, 2002

- M. Raginsky, “Almost any quantum spin system with short-range interactions can support toric codes,” *Physics Letters A*, vol. 294, pp. 153–157, 2002
- M. Raginsky, “Strictly contractive quantum channels and physically realizable quantum computers,” *Physical Review A*, vol. 65, art.no. 032306, 2002
- M. Raginsky, “A fidelity measure for quantum channels,” *Physics Letters A*, vol. 290, pp. 11–18, 2001
- M. Raginsky and P. Kumar, “Generation and manipulation of squeezed states of light in optical networks for quantum communication and computation,” *Journal of Optics B: Quantum and Semi-classical Optics*, vol. 3, pp. L1–L4, 2001

Conference papers

- M. Raginsky and S. Lazebnik, “Locality-sensitive binary codes from shift-invariant kernels,” *Proceedings of the 2009 Conference on Neural Information Processing Systems* (Vancouver, Canada, December 2009), to appear
- S. Jafarpour, R. Willett, M. Raginsky and R. Calderbank, “Performance bounds for expander-based compressed sensing with Poisson noise,” *Proceedings of the 2009 Asilomar Conference on Signals, Systems, and Computers* (Pacific Grove, CA, November 2009), to appear (invited)
- M. Raginsky and A. Rakhlin, “Information complexity of black-box convex optimization: a new look via feedback information theory,” *Proceedings of the Forty-Seventh Annual Allerton Conference on Communication, Control, and Computing* (Monticello, IL, September 2009), to appear (invited)
- M. Raginsky and T.P. Coleman, “Mutual information and posterior estimates in channels of exponential family type,” *Proceedings of the 2009 IEEE Workshop on Information Theory* (Taromina, Italy, October 2009)
- M. Raginsky, “Achievability results for statistical learning under communication constraints,” *Proceedings of the 2009 IEEE International Symposium on Information Theory* (Seoul, South Korea, June–July 2009); an extended version appeared as an invited paper in *Proceedings of the 2009 Workshop on Information Theory and Applications* (San Diego, CA, February 2009)
- R. Willett and M. Raginsky, “Performance bounds on compressed sensing with Poisson noise,” *Proceedings of the 2009 IEEE International Symposium on Information Theory* (Seoul, South Korea, June–July 2009)
- M. Raginsky, R. Marcia, J. Silva and R. Willett, “Sequential probability assignment via online convex programming using exponential families,” *Proceedings of the 2009 IEEE International Symposium on Information Theory* (Seoul, South Korea, June–July 2009)
- S. Lazebnik and M. Raginsky, “An empirical Bayes approach to contextual region classification,” *Proceedings of the 2009 IEEE Conference on Computer Vision and Pattern Recognition* (Miami Beach, FL, June 2009)
- M. Raginsky, S. Lazebnik, R. Willett and J. Silva, “Near-minimax recursive density estimation on the binary hypercube,” *Proceedings of the 2008 Conference on Neural Information Processing Systems* (Vancouver, Canada, December 2008)
- M. Raginsky, “On the information capacity of Gaussian channels under small peak power constraints,” *Proceedings of the Forty-Sixth Annual Allerton Conference on Communication, Control, and Computing* (Monticello, IL, September 2008), pp. 286–293
- M. Raginsky, “Universal Wyner–Ziv coding of discrete memoryless sources with known side information statistics,” *Proceedings of the 2008 IEEE International Symposium on Information Theory* (Toronto, Canada, July 2008), pp. 2167–2171

- A.L. Fernandes, M. Raginsky and T.P. Coleman, “A low-complexity universal scheme for rate-constrained distributed regression using a wireless sensor network,” *Proceedings of the 2008 IEEE International Conference on Acoustics, Speech, and Signal Processing* (Las Vegas, NV, March 30–April 4, 2008), pp. 2269–2272
- M. Raginsky, “Learning from compressed observations,” *Proceedings of the 2008 IEEE Workshop on Information Theory* (Lake Tahoe, CA, September 2007), pp. 420–425
- M. Raginsky, “Joint universal lossy coding and identification of stationary mixing sources,” *Proceedings of the 2007 IEEE International Symposium on Information Theory* (Nice, France, June 2007), pp. 1961–1965
- S. Lazebnik and M. Raginsky, “Learning nearest-neighbor quantizers from labeled data by information loss minimization,” *Proceedings of the Eleventh International Conference on Artificial Intelligence and Statistics* (San Juan, Puerto Rico, March 2007)
- M. Raginsky, “Joint universal lossy coding and identification of i.i.d. vector sources,” *Proceedings of the 2006 IEEE International Symposium on Information Theory* (Seattle, July 2006), pp. 577–581
- M. Raginsky and S. Lazebnik, “Estimation of intrinsic dimensionality using high-rate vector quantization,” *Proceedings of the 2005 Conference on Neural Information Processing Systems* (Vancouver, Canada, December 2005), pp. 1105–1112
- M. Raginsky, “A complexity-regularized quantization approach to nonlinear dimensionality reduction,” *Proceedings of the 2005 IEEE International Symposium on Information Theory* (Adelaide, Australia, September 2005), pp. 352–356
- M. Raginsky, “Quantum system identification,” *Proceedings of International Conference on Physics and Control (PhysCon 2003)*, A.L. Fradkov and A.N. Churilov, eds., St. Petersburg, Russia; vol. 3, pp. 792–796
- M. Raginsky, “Entropy-energy balance in noisy quantum computers,” *Proceedings of the Sixth International Conference on Quantum Communication, Measurement, and Computing (QCMC’02)*, J.H. Shapiro and O. Hirota, eds. (Rinton Press, New Jersey, 2003), pp. 445–448

Theses and technical reports

- M. Raginsky and R. Willett, “Sequential anomaly detection in the presence of noise and limited feedback,” Duke University Technical Report ECE-2009-01, 2009
- M. Raginsky, “A phase transition and stochastic domination in Pippenger’s probabilistic failure model for Boolean networks with unreliable gates,” arXiv.org e-print math.PR/0311045, 2003
- *Dynamical Aspects of Information Storage in Quantum-Mechanical Systems*, Ph.D. dissertation, Northwestern University, 2002
- *Quantum Noise Control in Fiber-Optic Lines*, M.S. thesis, Northwestern University, 2000

Presentations

Research seminars

- *Information complexity of black-box convex optimization: a new look via feedback information theory*
 - Duke University, Algorithms Seminar, November 2009 (planned)
 - Queen’s University, Mathematics Colloquium, October 2009
- *Information theory meets statistical learning: how to extract patterns from data using just a few bits*

- Queen’s University, October 2009
- University of Illinois at Urbana–Champaign, CSL Seminar, May 2009
- Northwestern University, Communications Group Seminar, May 2009
- *Shannon meets Vapnik–Chervonenkis: some interactions between information theory and statistical learning*
 - Princeton University, ISS Seminar, March 2008
- *Statistical learning under communication constraints*
 - UNC Chapel Hill, Statistics Colloquium, March 2008
 - University of Michigan Ann Arbor, CSPL Seminar, November 2007
- *A low-complexity universal scheme for rate-constrained distributed regression using a wireless sensor network*
 - Duke University, ECE Colloquium, October 2007
 - University of Illinois at Chicago, ECE Seminar, September 2007
 - North Carolina State University, Distinguished Seminar Series, August 2007
- *Joint universal lossy coding and identification of stationary mixing sources*
 - University of Illinois at Urbana-Champaign, CSL Seminar, January 2007
 - Yale University, Statistics Seminar, November 2006
- *From quantum channels to neural networks: information processing in stochastic multicomponent systems*
 - University of Wisconsin-Madison, March 2006
- *Dimensionality estimation and reduction: a unified approach using vector quantization*
 - University of Chicago, Toyota Technological Institute, February 2006
- *Estimation of intrinsic dimensionality using high-rate vector quantization*
 - Microsoft Research, December 2005
- *Minimax fidelity for quantum channels: theory and some applications*
 - University of California at Berkeley, Berkeley Quantum Seminar, May 2005

Invited conference and workshop talks

- *Achievability results for learning under communication constraints*
 - Information Theory and Applications Workshop, UCSD, February 2009
- *Operational distances between quantum channels, with applications to quantum information theory and cryptography*
 - Mini-Symposium on Quantum Communication, Computation and Information Theory, ETH, Zürich, September 2006
- *Quantum operations, Radon–Nikodym and all that*
 - A Meeting on C^* -Algebras and Quantum Information Theory, Los Angeles, CA, June 2004
- *Comparison Theorems for Quantum Operations*

- Workshop on Quantum Information Processing and Quantum Communications, Università di Pavia, Italy, May 2004
- *Scaling and renormalization in fault-tolerant quantum computers*
 - Simons Conference on Quantum and Reversible Computation, SUNY Stony Brook, May 2003

Professional Service and Memberships

- Journal refereeing:
 - IEEE Transactions on Information Theory
 - IEEE Journal on Selected Areas in Communication
 - IEEE Transactions on Signal Processing
 - Entropy
 - Physical Review Letters
 - Physical Review A
 - Physics Letters
- Conference refereeing:
 - 2007 Conference on Artificial Intelligence and Statistics
 - 2007, 2009 IEEE International Symposia on Information Theory
 - 2008 IEEE Information Theory Workshop
 - 2008 European Conference on Computer Vision
 - 2009 Conference on Learning Theory
 - 2009 Conference on Neural Information Processing Systems
- Co-organizer: “New Developments in the Use of Feedback in Communications and Decision-Making Environments,” invited session at the 2009 Allerton Conference on Communications, Control and Computing – with T.P. Coleman (UIUC) and O. Shayevitz (UCSD)
- Panels: NSF CISE, 2008
- Member of IEEE (Information Theory Society) since 1999