

AARTI SINGH

Phone: (412) 268-4266
Fax: (412) 268-3431
Email: aartisingh@cmu.edu
Web: www.cs.cmu.edu/~aarti

8207 Gates-Hillman Center
Carnegie Mellon University
5000 Forbes Avenue
Pittsburgh PA 15213

RESEARCH INTERESTS

Statistical Inference and Machine Learning, Signal and Image Processing, Wireless Communications and Sensor Networks, Networked Systems, Bioinformatics.

EDUCATION

Ph.D., Electrical Engineering

University of Wisconsin, Madison, USA.

Thesis: Nonparametric set estimation problems in statistical inference and learning.

Aug 2008

Advisor: Robert D. Nowak

M.S., Electrical Engineering

University of Wisconsin, Madison, USA.

Thesis: Experimental investigation of TWT nonlinearities and distortion suppression by signal injection.

Dec 2003

Advisor: John E. Schärer

B.E., Electronics and Communication Engineering

Netaji Subhas Institute of Technology, Delhi University, India.

Project: Adaptive noise cancellation and its applications.

June 2001

RESEARCH EXPERIENCE

Assistant Professor, Carnegie Mellon University (Aug 2009 - present)

Postdoctoral Research Associate, Princeton University (Oct 2008 – Aug 2009)

Mentor: Robert Calderbank

- Network anomaly detection based on statistical learning techniques for sparse, high-dimensional data.
- Sparsifying representations for probabilistic graphical models.

Graduate Research Assistant, University of Wisconsin - Madison (Sept 2003 – Aug 2008)

- Finite sample analysis of semi-supervised learning gains and the value of unlabeled data.
- Level set estimation under the Hausdorff metric that provides spatially uniform error control.
- Activation detection in fMRI using a multi-resolution approach based on level sets.
- Fluorescence lifetime imaging (FLIM) in multiphoton microscopy via semi-parametric density estimation.
- Adaptive sampling using mobile sensors for field estimation.
- Probabilistic delay assurances in highly partitioned delay tolerant networks (DTNs) by adaptive gossiping.
- Cross-layer (PHY/MAC) design for exploiting multiple antennas in a wireless adhoc network.

Graduate Summer School, Institute of Pure and Applied Mathematics (IPAM)

- Intelligent Extraction of Information from Graphs and High Dimensional Data, July 11 – 29, 2005.

Graduate Research Assistant, University of Wisconsin - Madison (June 2001 - Aug 2003)

- Linearization of Microwave amplifiers by using signal injection for nonlinear distortion suppression.

Research Trainee, Central Electronics Engineering Research Institute, India (Jun – Aug 2000, Jan 2001)

- Implementation and Comparative Study of Adaptive Filters in C++, LMS Algorithm and its variants.

- VHDL Implementation of Maximum Distance Separable Matrix used in Twofish Candidate for Advanced Encryption Standard (AES) Algorithm.

TEACHING EXPERIENCE

Teaching Assistant, University of Wisconsin - Madison

- Theory and Applications of Pattern Recognition (Grader, Spring 2005)
- Digital Image Processing (TA, Fall 2004)
Held discussion sessions and tutorials for about 30 undergraduate and graduate students.
- Circuits Lab (TA, Fall 2001 - Spring 2003)
Directed two sections of 20 undergraduate students each, designed grading policy, quizzes and exams.

PUBLICATIONS

Journal papers:

A. Singh, C. Scott and R. Nowak. Adaptive Hausdorff Estimation of Density Level Sets. *Annals of Statistics*, pp. 2760-2782, vol. 37, no. 5B, 2009.

A. Singh, J. E. Scharer, J. H. Booske and J. G. Wöhlbier. Second and Third-order Signal Injection for Nonlinear Distortion Suppression in a Traveling Wave Tube. *IEEE Transactions on Electron Devices*, Special Issue on Vacuum Electron Devices, pp. 709-717, vol. 52, no. 5, May 2005.

A. Singh, J. G. Wöhlbier, J. H. Booske and J. E. Scharer. Experimental Verification of the Mechanisms for Nonlinear Harmonic Growth and Suppression by Harmonic Injection in a Traveling Wave Tube. *Physical Review Letters*, vol. 92, no. 20, Article 205005, 2004.

S. Bhattacharjee, C. Marchewka, J. Welter, R. Kowalczyk, C. B. Wilsen, Y. Y. Lau, J. H. Booske, A. Singh, J. E. Scharer, R. M. Gilgenbach, M. J. Neumann, and M. W. Keyser, "Suppression of Third-order Intermodulation in a Klystron by Third-order Injection", *Physical Review Letters*, 90, Article 098303, 2003.

M. Wirth, A. Singh, J. Scharer and J. Booske, "Third-Order Intermodulation Reduction by Harmonic Injection in a TWT Amplifier", *IEEE Trans. on Electron Devices*, pp. 1082-84, vol. 49, No. 6, June 2002.

Peer-Reviewed Conference papers:

A. Goldberg, X. Zhu, A. Singh, Z. Xu and R. Nowak. Multi-Manifold Semi-Supervised Learning. *Artificial Intelligence and Statistics, AISTATS 2009*.

A. Singh, R. Nowak and X. Zhu. Unlabeled data: Now it helps, now it doesn't. *Neural Information Processing Systems, NIPS 2008*.

A. Singh, C. Scott and R. Nowak. Adaptive Hausdorff Estimation of Density Level Sets. *Conference on Learning Theory, COLT 2008*.

Z. Harmany, R. Willett, A. Singh and R. Nowak. Controlling the error in fMRI: Hypothesis testing or Set estimation? *IEEE International Symposium on Biomedical Imaging, ISBI 2008*.

P. Ramanathan and A. Singh. Delay-differentiated Gossiping in Delay Tolerant Networks. *IEEE International Conference on Communications, ICC 2008*.

A. Singh, R. Nowak and P. Ramanathan. Active Learning for Adaptive Mobile Sensing Networks. *ACM/IEEE International Conference on Information Processing in Sensor Networks, IPSN 2006*.

M. Rabbat, J. Haupt, A. Singh and R. Nowak. Decentralized Compression and Predistribution via Randomized Gossiping. *ACM/IEEE International Conference on Information Processing in Sensor Networks, IPSN 2006*.

A. Singh, P. Ramanathan and B. D. Van Veen. Spatial Reuse through Adaptive Interference Cancellation in Multi-Antenna Wireless Ad Hoc Networks. *IEEE Global Telecommunications Conference, GLOBECOM 2005*.

Book Section:

A. Singh, J. Scharer and J. Booske. Active Techniques in How to Achieve Linear Amplification. *Modern Microwave and Millimeter-Wave Power Electronics*, John Wiley and IEEE Press, April 2005.

Conference papers (Peer-Reviewed abstracts):

A. Singh, J. E. Scharer, J. G. Wöhlbier and J. H. Booske. Sensitivity of Harmonic Injection and its Spatial Evolution for Nonlinear Distortion Suppression in a TWT. *IEEE International Vacuum Electronics Conference, IVEC 2004*.

A. Singh, J. G. Wöhlbier, J. E. Scharer and J. H. Booske. Injection Schemes for TWT Linearization. *IEEE International Vacuum Electronics Conference, IVEC 2003*.

J. G. Wöhlbier, M. C. Converse, J. Plouin, A. Rawal, A. Singh, J. H. Booske, "LATTE/MUSE numerical suite: An Open Source Teaching and Research Code for Traveling Wave Tube Amplifiers", *IEEE International Conference on Plasma Science, ICOPS 2003*.

J. G. Wohlbiere, J. H. Booske, I. Dobson, A. Singh, J. E. Scharer, "A New look at the Nonlinear Physics of Traveling Wave Tubes", *American Physical Society Annual Meeting, Division of Plasma Physics, APS-DPP 2003*.

A. Singh, J. E. Scharer, M. Wirth, S. Bhattacharjee and J. H. Booske. Intermodulation Suppression in a Broad Band TWT. *IEEE International Vacuum Electronics Conference, IVEC 2002*.

M. Converse, A. Singh, J. Scharer, M. Wirth, S. Bhattacharjee, J. Booske, C. Armstrong, "Hot Phase Velocity Measurements and Modeling for a Broad Band TWT", *International Vacuum Electronics Conference, IVEC 2002*.

A. Singh, J. Scharer, M. Wirth, S. Bhattacharjee, J. Booske, "Investigations of various Techniques for Intermodulation Suppression in a TWT Amplifier", *American Physical Society Annual Meeting, Division of Plasma Physics, APS-DPP 2002*.

M. A. Wirth, J. E. Scharer, J. H. Booske, M. C. Converse, A. Singh, J. G. Wohlbiere, C. Armstrong, "Investigations of Non-Linear Spectral Growth in a Broadband Traveling Wave Tube Amplifier", *American Physical Society Annual Meeting, APS 2001*.

PROFESSIONAL ACTIVITIES

Technical Paper Reviewer

- IEEE Transactions on Signal Processing
- ACM Transactions on Sensor Networks
- Elsevier Journal of Multivariate Analysis
- Annals of Statistics
- Neural Information Processing Systems Conference, NIPS 2008, 2009
- Conference on Learning Theory, COLT 2009
- IEEE International Wireless Communications and Mobile Computing Conference, IWCMC 2009

Committee Member, IMS Committee on New Researchers

Coordinator of volunteers for IEEE Statistical Signal Processing Workshop, Madison WI, Aug 2007.

Volunteer for ECE open house, UW-Madison, 2007, 2008 – facilitated enrollment of potential top graduate students.

Volunteer for organizing New Educators' Orientation Workshop, UW-Madison, 2002, 2003 – shared experiences and mentored new teaching assistants.

AWARDS AND HONORS

Harold A. Peterson Best Dissertation Award, ECE Department, UW-Madison, 2009.

Invited Fellow, Institute of Pure and Applied Mathematics IPAM, Fall 2008 (offered but declined).

Travel award, IPAM Short Program: Mathematical Challenges and Opportunities in Sensor Networking, January 8 - 12, 2007, Graduate Summer School: Intelligent Extraction of Information from Graphs and High Dimensional Data, July 11 – 29, 2005.

“Grand Integrator of Madison”, University of Wisconsin Integration Bee 2005 – First place in University level Mathematics competition.

Merit Scholarships – 1st rank, Electronics and Communications Engineering Department, Netaji Subhas Institute of Technology, Delhi University, 1997-98.

National Science Aptitude and Talent Search, India – Grade A.