

DAVID I SHUMAN

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EDUCATION

2004 – 2010	University of Michigan Ph.D., Electrical Engineering: Systems M.S., Applied Mathematics M.S., Electrical Engineering: Systems <ul style="list-style-type: none">• GPA: 4.14/4.00• Major: Communications; Minor: Control• Thesis advisor: Prof. Mingyan Liu• Thesis title: “From sleeping to stockpiling: Energy conservation via stochastic scheduling in wireless networks”	<i>Ann Arbor, MI</i> (April 2010) (May 2009) (May 2006)
1997 – 2001	Stanford University M.S., Engineering-Economic Systems & Operations Research B.A., Economics, with a Minor in Computer Science <ul style="list-style-type: none">• GPA: 3.88/4.00 (M.S.); 3.74/4.00 (B.A.)• Elected to Phi Beta Kappa• Studied abroad at Oxford University, England, Spring 2000• Master’s project: “Dynamic allocation of R&D funding across a portfolio of electricity generation technologies while facing uncertain technical success,” in conjunction with the Electric Power Research Institute (EPRI)	<i>Stanford, CA</i>
1993 – 1997	Phillips Academy <ul style="list-style-type: none">• Elected to Cum Laude Society	<i>Andover, MA</i>

SUMMARY OF ACADEMIC INTERESTS

Research Interests:	<ul style="list-style-type: none">• Signal processing on graphs, including multiscale transforms, computational harmonic analysis, sparse approximation theory, dictionary learning, and polynomial approximations for fast, distributed processing• Stochastic control, including resource allocation and stochastic scheduling problems, energy-efficient design of wireless communication networks, inventory theory, and approximate dynamic programming
Teaching Interests:	<ul style="list-style-type: none">• Probability, stochastic processes, stochastic control, convex optimization, inventory control and queuing theory, signals and systems, spectral graph theory, calculus, linear algebra, and introductory analysis

RESEARCH EXPERIENCE

2010 – Current	Postdoctoral Researcher , Ecole Polytechnique Fédérale de Lausanne (EPFL) <ul style="list-style-type: none">• Advisors: Prof. Pierre Vanderghenst and Prof. Pascal Frossard• Research new techniques for processing data on graphs, including multiscale analysis methods and efficient distributed optimization techniques• Applications include data analysis for social and transportation networks, image processing, distributed signal processing in sensor and camera networks, statistical learning problems, and analysis of astrophysical data	<i>Lausanne, Switzerland</i>
2006 – 2010	Graduate Student Research Assistant , University of Michigan <ul style="list-style-type: none">• Conducted research on stochastic scheduling, estimation, and resource allocation problems in communications networks• Applications included wireless multimedia streaming, duty cycling and clock calibration of wireless sensor networks, and soil moisture smart sensor webs	<i>Ann Arbor, MI</i>

GRANTS AND AWARDS

2010	<ul style="list-style-type: none">• Co-authored a grant application for a project on signal processing on graphs which was awarded CHF 161,135 (approx. \$190,000) by the Swiss National Science Foundation
2010	<ul style="list-style-type: none">• Recipient of the Distinguished Achievement Award from the University of Michigan College of Engineering, awarded annually to one student in each department based on research, leadership, and academic performance
2000 – 2001	<ul style="list-style-type: none">• Semifinalist, Stanford Entrepreneur’s Challenge business plan competition

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TEACHING EXPERIENCE

- Fall 2011 and Fall 2012 **Co-Instructor**, Ecole Polytechnique Fédérale de Lausanne (EPFL) *Lausanne, Switzerland*
- EE-204 – Circuits and Systems I (with Prof. Volkan Cevher)
 - Approximately 125-150 students, primarily sophomores
 - Prepared and gave some lectures, led recitation and MATLAB sessions, revamped the syllabus, chose the homework problems, wrote the exams, and managed a team of six teaching assistants
- 2010 – Current **Mentor**, Signal Processing Laboratories, Ecole Polytechnique Fédérale de Lausanne (EPFL) *Lausanne, Switzerland*
- Co-supervised two master's theses, and mentored interns and graduate students
 - Taught selected topics in convex optimization and spectral graph theory in weekly lab meetings
- Fall 2007 **Graduate Student Instructor**, University of Michigan *Ann Arbor, MI*
- EECS 401 – Probabilistic Methods in Engineering
 - Led a weekly recitation session and held office hours for 37 students, primarily juniors and seniors
- Summer 1999 **Teaching Assistant**, Labor Economics class, Stanford Sophomore College *Stanford, CA*
- 1995 – 1999 **Volunteer Tutor** in English, Algebra, and Calculus *Andover, MA; Lawrence, MA; and East Palo Alto, CA*

ACADEMIC SERVICE

- 2012 • Co-organized a special session on localization, diversity, and uncertainty in signal representations at the European Signal Processing Conference, and am co-editing a special issue of Advances in Computational Mathematics on the same subject
- 2011 • Organized a three-day workshop for the European project UNLocX (uncertainty principles versus localization properties), which was attended by team members from six universities and multiple companies
- 2007 – Current • Reviewer for journals such as the IEEE/ACM Transactions on Networking, the IEEE Communications Letters, the IEEE Transactions on Communications, the Proceedings of the IEEE, the IEEE Transactions on Mobile Computing, and the IEEE Transactions on Vehicular Technology
- 2007 – Current • Reviewer for conferences such as the IEEE International Conference on Communications, the IEEE International Symposium on Information Theory, and the IEEE Statistical Signal Processing Workshop

CORPORATE WORK EXPERIENCE

- 2001 – 2004 **Senior Analyst**, Monitor Group *New York, NY; London, England; and Cambridge, MA*
(Intern in 2000) Worked for the investment banking division of a global strategy consulting firm
- Structured and developed valuation models and financial analyses
 - Researched in-depth company information, industry trends, and emerging technologies
 - Designed and analyzed strategic options available to client companies
 - Interacted with senior clients (e.g. CEO, CFO, Head of Strategy), lawyers, and financial advisors
- Sample mergers and acquisitions advisory and strategy consulting projects:
- Advised a blue-chip private equity firm on a ~\$100m acquisition of a European telecommunication services business
 - Helped a leading global consumer electronics company develop the structure, scope, and business plan for a new interactive television entity
 - Advised a fiber-optics technology company on acquisition and licensing opportunities in the aerospace sector
- Summer 1999 **Information Technology Intern**, Federal Home Loan Bank *Boston, MA*
- Configured and installed new computers; maintained user support line
- Summer 1997 **Network Engineer Intern**, Raytheon Corporation *Sudbury, MA*
- Collaborated with a team of 14 engineers on an overhaul of the network infrastructure

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PUBLICATIONS AND PRESENTATIONS

- Journal Papers:
- D. I Shuman, S. K. Narang, P. Frossard, A. Ortega, and P. Vandergheynst, "Signal processing on graphs: Extending high-dimensional data analysis to networks and other irregular domains," accepted for publication in *IEEE Signal Processing Magazine*, to appear in May 2013.
 - D. I Shuman, P. Vandergheynst, and P. Frossard, "Distributed signal processing via Chebyshev polynomial approximation," submitted to *IEEE Transactions on Signal Processing*, November 2011.
 - D. I Shuman, M. Liu, and O. Wu, "Energy-efficient transmission scheduling with strict underflow constraints," *IEEE Transactions on Information Theory*, vol. 57, no. 3, pp. 1344-1367, March 2011.
 - M. Moghaddam, D. Entekhabi, Y. Goykhman, K. Li, M. Liu, A. Mahajan, A. Nayyar, D. Shuman, and D. Teneketzis, "A wireless soil moisture smart sensor web using physics-based optimal control: Concept and initial demonstrations," *IEEE Journal of Special Topics in Applied Earth Observations and Remote Sensing*, vol. 3, no. 4, pp. 522-535, December 2010.
 - D. I Shuman, A. Nayyar, A. Mahajan, Y. Goykhman, K. Li, M. Liu, D. Teneketzis, M. Moghaddam, and D. Entekhabi, "Measurement scheduling for soil moisture sensing: From physical models to optimal control," *Proceedings of the IEEE, Special Issue on Sensor Network Applications*, vol. 98, no. 11, pp. 1917-1933, November 2009.
- In Preparation:
- D. I Shuman, B. Ricaud, and P. Vandergheynst, "Localized vertex-frequency analysis of signals on graphs."
 - D. I Shuman, M. J. Faraji, and P. Vandergheynst, "A Laplacian pyramid for signals on graphs."
- Book Chapter:
- D. I Shuman and M. Liu, "Opportunistic scheduling with deadline constraints in wireless networks," in *Performance Models and Risk Management in Communication Systems*, edited by N. Gulpinar, P. Harrison, and B. Rustem, pp. 127-155, Springer, 2010.
- Conference Papers:
- D. I Shuman, B. Ricaud, and P. Vandergheynst, "A windowed graph Fourier transform," in *Proceedings of the Statistical Signal Processing Workshop (SSP)*, Ann Arbor, Michigan, August 2012.
 - D. I Shuman, P. Vandergheynst, and P. Frossard, "Chebyshev polynomial approximation for distributed signal processing," in *Proceedings of the International Conference on Distributed Computing in Sensor Systems (DCOSS)*, Barcelona, Spain, June 2011.
 - D. I Shuman, M. J. Faraji, and P. Vandergheynst, "Semi-supervised learning with spectral graph wavelets," in *Proceedings of the International Conference on Sampling Theory and Applications (SampTA)*, Singapore, May 2011.
 - D. I Shuman and M. Liu, "Dynamic clock calibration via temperature measurement," in *Proceedings of the IEEE Conference on Decision and Control (CDC)*, Shanghai, China, December 2009, pp. 2082-2087.
 - M. Moghaddam, D. Entekhabi, Y. Goykhman, M. Liu, A. Mahajan, A. Nayyar, D. Shuman, D. Teneketzis, "A soil moisture smart sensor web using data assimilation and optimal control: formulation and first laboratory demonstration," in *Proceedings of the IEEE International Geoscience and Remote Sensing Symposium*, Boston, MA, July 2008, vol. 5, pp. 140-143.
 - M. Moghaddam, D. Entekhabi, L. Farhadi, Y. Goykhman, M. Liu, A. Mahajan, A. Nayyar, D. Shuman, D. Teneketzis, "Initial analyses and demonstration of a soil moisture smart sensor web," in *Proceedings of the Earth Science Technology Conference (ESTC)*, East Adelphi, MD, June 2008.
 - D. Shuman and M. Liu, "Energy-efficient transmission scheduling for wireless media streaming with strict underflow constraints," in *Proceedings of the International Symposium on Modeling and Optimization in Mobile, Ad Hoc, and Wireless Networks (WiOpt)*, Berlin, Germany, March-April 2008, pp. 354-359.
 - D. Shuman and M. Liu, "Optimal sleep scheduling for a wireless sensor network node," in *Proceedings of the Asilomar Conference on Signals, Systems, and Computers*, Pacific Grove, CA, October 2006, pp. 1337-1341.

The publications and presentations listed above are available at my home page:

<http://documents.epfl.ch/users/s/sh/shuman/www/>

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PUBLICATIONS AND PRESENTATIONS (cont.)

- Other Conference Presentations and Invited Talks
- D. Shuman, B. Ricaud, and P. Vandergheynst, “A windowed graph Fourier transform,” presented at the International Traveling Workshop for Interacting Sparse Models and Technology (iTWIST), Marseille, France, May 2012.
 - P. Vandergheynst and D. Shuman, “Wavelets on graphs, an introduction,” invited talk at Université de Provence, Marseille, France, November 2011.
 - D. Shuman, M. Liu, and O. Wu, “Inventory control of multiple items under stochastic prices and budget constraints,” presented at the *INFORMS Annual Meeting*, San Diego, CA, October 2009.
 - D. Shuman and M. Liu, “From sleeping to stockpiling: Energy conservation via scheduling in wireless networks,” presented at the *Information Theory and Applications Workshop (ITA)*, La Jolla, CA, February 2009.

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