

University of Michigan
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EDUCATION

- Ph.D. in Electrical Engineering, Syracuse University** March 2016
Thesis: “Resource management for distributed estimation via sparsity-promoting regularization”
(*All University Doctoral Prize*)
Advisors: [Pramod K. Varshney](#) and [Makan Fardad](#)
- M.S. in Electrical Engineering, Xi’an Jiaotong University** May 2011
Thesis: “Sensor registration for multi-target tracking”
Advisor: Chongzhao Han
- B.S. in Electrical Engineering, Xi’an Jiaotong University** May 2008

RESEARCH INTERESTS

Machine learning: Learning over graphs, online learning, neural networks, graphical model
Optimization: Distributed computation/optimization, convex/nonconvex optimization
Statistical signal processing: Estimation/detection, target tracking, graph signal processing

RESEARCH EXPERIENCE

Postdoctoral Research Fellow, University of Michigan April 2016 – present
Supervisor: [Alfred Hero](#)

- Distributed learning in dynamic environments
- Learning with multi-scale data in the human genome
- Topology inference from data over graphs
- 1 journals, 3 conferences

Research Assistant, Syracuse University Aug. 2011 – March 2016
Advisors: [Pramod K. Varshney](#) and [Makan Fardad](#)

Resource-aware learning system in dynamical networks

Collaborators: [Geert Leus](#) (TU Delft), [Engin Masazade](#) (Yeditepe Univ.) and [Aditya Vempaty](#) (IBM)

- Strike balance between inference accuracy and resource usage
- Adaptive resource management via design of sparsity-promoting learning systems
- Near-optimal solutions from low-complexity optimization algorithms
- 4 journals, 5 conferences

On optimal inter-node collaboration for message passing over graphs

Collaborator: [Swarnendu Kar](#) (Intel Corporation)

- Power-efficient communication schemes for cooperative monitoring
- Online power allocation with energy harvesting constraints
- Joint design of power allocation and storage control policies
- Up to 30% conservation of battery power (typical setups)
- 3 journals, 5 conferences

Energy allocation and storage control in sensor networks

Collaborator: [Yanzhi Wang](#) (Syracuse Univ.), [Vinod Sharma](#) (Indian Institute of Science)

- Joint design of optimal energy allocation and storage control policies
- Online energy allocation subject to energy harvesting constraints
- 2 conferences

Algorithm-hardware co-optimization of memristor-based solvers for large-scale convex optimization problemsCollaborator: [Yanzhi Wang](#) (Syracuse Univ.)

- Design optimization solver using memristor crossbar arrays
- Ultra-efficient hardware architecture for compressive sensing, linear and quadratic programming
- 2 conferences

Adaptive information processing for enhanced situational awarenessCollaborator: [Engin Masazade](#) (Yeditepe Univ.)

- Process a large amount of highly correlated sensor observations
- Design quantization and sampling strategies for field estimation
- 2 conferences

Detection with physical layer secrecy guaranteesCollaborators: [Bhavya Kailkhura](#) and V. S. Siddhardh Nadendla (Syracuse Univ.)

- Optimized detection system to enhance secrecy against eavesdropping attacks
- Collaborative compressive detection framework with secrecy guarantees
- 1 journal, 1 conference

Summer Intern, Huawei R&D USA, Bridgewater, NJ

June 2015–Aug. 2015

Mentor: Kai Yang; Director: Jin Yang

Learning based anomaly root cause analysis in wireless networks

- Data-driven anomaly demarcation and root cause analysis
- Innovated clustering and A/B testing based algorithms for anomaly demarcation
- Root cause analysis via denoising autoencoder
- Delivered R package and 1 patent

Research Assistant, Xi'an Jiaotong University

Aug. 2008–May 2011

Advisor: Chongzhao Han

Building information fusion system for target tracking

- Real-time target tracking at the presence of registration errors
- Designed portable battery-operated ground fusion center
- 1 conference

SCHOLASTIC ACHIEVEMENTS

- **Recipient of All University Doctoral Prize**, Syracuse University, 2016
- **Signal Processing Society Travel Grant Award** at IEEE ICASSP'15, Australia, 2015
- **Best Student Paper Nominee** (among the seven finalists) at Asilomar Conference on Signals, Systems, and Computers, CA, Pacific Grove, CA, 2013
- **Best Department Poster Award** at Nunan Poster Competition, Syracuse University, 2012
- **Outstanding Graduate Student**, Xi'an Jiaotong University, 2011
— *one of 3 recipients selected from 500 students in my grade*
- **Best Undergraduate Award**, Xi'an Jiaotong University, 2008
— *exempted from Chinese Graduate Entrance Examination*
- **First Class Award in China National Mathematics Olympiad**, 2004
— *exempted from Chinese College Entrance Examination*

PUBLICATIONS

JOURNALS

- [1] **S. Liu**, P.-Y. Chen and A. O. Hero, “Accelerated Distributed Dual Averaging over Evolving Networks of Growing Connectivity”, *IEEE Trans. Signal Process.*, under review, 2017
- [2] P.-Y. Chen and **S. Liu**, “Bias-Variance Tradeoff of Graph Laplacian Smoothing Regularizer”, *IEEE Signal Process. Lett.*, under review, 2017
- [3] **S. Liu**, S. Kar, M. Fardad and P. K. Varshney, “Optimized Sensor Collaboration for Estimation of Temporally Correlated Parameters”, *IEEE Trans. Signal Process.*, vol. 64, no. 24, pp. 6613–6626, Dec., 2016
- [4] B. Kailkhura, **S. Liu**, T. Wimalajeewa and P. K. Varshney, “Measurement Matrix Design for Compressive Detection with Secrecy Guarantees”, *IEEE Wireless Commun. Lett.*, vol. 5, no. 4, pp. 420–423, Aug. 2016
- [5] **S. Liu**, S. P. Chepuri, M. Fardad, E. Masazade, G. Leus and P. K. Varshney, “Sensor Selection for Estimation with Correlated Measurement Noise”, *IEEE Trans. Signal Process.*, vol. 64, no. 13, pp. 3509–3522, July, 2016
- [6] **S. Liu**, S. Kar, M. Fardad and P. K. Varshney, “Joint Design of Optimal Sensor Selection and Collaboration Strategies for Distributed Estimation,” *IEEE ComSoc MMTC E-letter, Special Issue on “Energy efficiency management for distributed computation and applications in sensor network”*, March 2016
- [7] **S. Liu**, S. Kar, M. Fardad and P. K. Varshney, “Sparsity-Aware Sensor Collaboration for Linear Coherent Estimation”, *IEEE Trans. Signal Process.*, vol. 63, no. 10, pp. 2582–2596, May 2015
- [8] **S. Liu**, A. Vempaty, M. Fardad, E. Masazade and P. K. Varshney, “Energy-Aware Sensor Selection in Field Reconstruction,” *IEEE Signal Process. Lett.*, vol. 21, no. 12, pp. 1476–1480, Dec. 2014
- [9] X. Shen, **S. Liu** and P. K. Varshney, “Sensor Selection for Nonlinear Systems in Large Sensor Networks,” *IEEE Trans. Aerosp. Electron. Syst.*, vol. 50, no. 4, pp. 2664–2678, Oct. 2014
- [10] **S. Liu**, M. Fardad, E. Masazade and P. K. Varshney, “Optimal Periodic Sensor Scheduling in Large-Scale Dynamical Networks,” *IEEE Trans. Signal Process.*, vol. 62, no. 12, pp. 3055–3068, June 2014

PEER REVIEWED CONFERENCES

- [1] **S. Liu**, A. Ren, Y. Wang and P. K. Varshney, “Ultra-Fast Robust Compressive Sensing Based on Memristor Crossbars,” *IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP)*, 2017
- [2] **S. Liu**, P.-Y. Chen and A. O. Hero, “Distributed Optimization for Evolving Networks of Growing Connectivity,” *ICASSP*, 2017
- [3] **S. Liu**, S. P. Chepuri, G. Leus and A. O. Hero, “Distributed Sensor Selection for Field Estimation,” *ICASSP*, 2017
- [4] S. P. Chepuri, **S. Liu**, G. Leus and A. O. Hero, “Learning Sparse Graphs Under Smoothness Prior,” *ICASSP*, 2017
- [5] A. Ren, **S. Liu**, R. Cai, P. K. Varshney and Y. Wang, “Algorithm-Hardware Co-Optimization of Memristor Crossbar-Based Framework for Solving SOCP and Homogeneous QCQP Problems,” *The 22nd Asia and South Pacific Design Automation Conference (ASPDAC)*, 2016
- [6] **S. Liu**, N. Cao and P. K. Varshney, “Sensor Placement for Field Estimation via Poisson Disk Sampling,” *IEEE Global Conference on Signal and Information Processing (GlobalSIP)*, 2016
- [7] **S. Liu**, V. Sharma and P. K. Varshney, “Towards An Online Energy Allocation Policy for Distributed Estimation with Sensor Collaboration Using Energy Harvesting Sensors,” *GlobalSIP*, 2016

- [8] **S. Liu**, Y. Wang, M. Fardad and P. K. Varshney, “Optimal Energy Allocation and Storage Control for Distributed Estimation with Sensor Collaboration,” *The 50th Annual Conference on Information Sciences and Systems (CISS)*, 2016
- [9] **S. Liu**, S. Kar, M. Fardad and P. K. Varshney, “On Optimal Sensor Collaboration for Distributed Estimation with Individual Power Constraints,” *The 49th Asilomar Conf. on Signals, Systems and Computers (Asilomar)*, Nov. 2015
- [10] V. S. S. Nadendla, **S. Liu** and P. K. Varshney, “On Enhancing Secrecy in Centralized Detection using Transmit-Beamforming with Artificial Noise,” *The 53rd Annual Allerton Conf. Comm., Control, and Comp. (Allerton)*, Oct. 2015
- [11] **S. Liu**, F. Chen, A. Vempaty, M. Fardad, L. Shen and P. K. Varshney, “Sparsity-Promoting Sensor Management for Estimation: An Energy Balance Point of View,” *The 18th International Conference on Information Fusion (FUSION)*, July 2015
- [12] **S. Liu**, E. Masazade, M. Fardad and P. K. Varshney, “Sensor Selection with Correlated Measurements for Target Tracking in Wireless Sensor Networks”, *ICASSP*, April 2015 (**IEEE SPS Travel Grant Award**)
- [13] **S. Liu**, M. Fardad, S. Kar and P. K. Varshney, “On Optimal Sensor Collaboration Topologies for Linear Coherent Estimation,” *IEEE International Symposium on Information Theory (ISIT)*, June 2014
- [14] **S. Liu**, E. Masazade, M. Fardad and P. K. Varshney, “Sparsity-Aware Field Estimation via Ordinary Kriging,” *ICASSP*, May 2014
- [15] **S. Liu**, M. Fardad, E. Masazade and P. K. Varshney, “On Optimal Periodic Sensor Scheduling for Field Estimation in Wireless Sensor Networks,” *GlobalSIP*, Dec. 2013
- [16] **S. Liu**, E. Masazade, X. Shen and P. K. Varshney, “Adaptive Non-Myopic Quantizer Design for Target Tracking in Wireless Sensor Networks,” *Asilomar*, Nov. 2013 (**Best Student Paper Nominee**)
- [17] **S. Liu**, E. Masazade, and P. K. Varshney, “Temporally Staggered Sensing for Field Estimation with Quantized Data in Wireless Sensor Networks, *IEEE Workshop on Statistical Signal Processing (SSP)*, Aug. 2012

PATENT APPLICATIONS

- [1] K. Yang and **S. Liu**, “System and Method for Analyzing A Root Cause of Anomalous Behavior Using Hypothesis Testing,” U.S. Patent Application #14/991685, filed Dec. 2015.

INVITED TALKS & PRESENTATIONS

- [1] *Sparsity and Sparsity-Inducing Optimization*, Lecture for Sparse Learning, Syracuse University, March 2016
- [2] *Optimal Energy Allocation and Storage Control for Distributed Estimation with Sensor Collaboration*, EECS Student Colloquium, Syracuse University, Feb. 2016
- [3] *Bilinearity and Difference of Convex Functions: Resource Management*, at Sensor Fusion Laboratory, Syracuse University, Jan. 2015
- [4] *Semidefinite Program, Bilinear Program and Convex-Concave Procedure*, at Sensor Fusion Laboratory, Syracuse University, Oct. 2014
- [5] *Sparsity-Promoting Techniques in Sensor Management*, Symposium for Cognitive Wireless Systems & Networks, Syracuse University, March 2014
- [6] *Temporally Staggered Sensing for Field Estimation*, Nunan Poster Competition, Syracuse University, March 2012

TEACHING AND MENTORING EXPERIENCE

- Guest Lecturer for *Adaptive Learning (ELE 853)*, Syracuse University, Fall 2015
- Guest Lecturer for *Advanced Numerical Methods II (MAT 781)*, Syracuse University, Fall 2013
- Guest Lecturer for *Optimal Control Systems (ELE 712)*, Syracuse University, Fall 2012
- Omar Khalil, University of Michigan EECS, MS student
- Ao Ren, Syracuse University EECS, MS student
- Shan Zhang, Syracuse University EECS, PhD student

MISCELLANEOUS ACTIVITIES

- Graduate international orientation volunteer, Syracuse University, Sept. 2014
- CNY Rocket Team Challenge volunteer, Syracuse University, June 2015
- Ying Tri Region Science & Engineering Fair judge, March 2014

SERVICE & PROFESSIONAL ACTIVITIES

- **Member:** IEEE, IEEE Signal Processing Society, IEEE Communications Society, IEEE Information Theory Society, IEEE Control Systems Society
- **Reviewer:** IEEE Transactions on Information Theory, IEEE Transactions on Signal Processing, IEEE Transactions on Wireless Communications, IEEE Transactions on Automatic Control, IFAC Journal of Automatica, IEEE Sensors Journal, Springer Journals on Wireless Networks, Elsevier Journals on Digital Communications and Networks, INFOCOM, ISIT, ICASSP, CDC, ACC, Fusion, GlobalSIP, VTC

REFERENCES

- **Alfred Hero**
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