

MIT-IBM Watson AI Lab  
 IBM Research  
 Cambridge, MA 02142, USA

Mobile: (+1)-315-744-6778  
 Email: [sijia.liu@ibm.com](mailto:sijia.liu@ibm.com)  
 Website: <http://sliu17.mysite.syr.edu/>

## WORK EXPERIENCE

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**Research Staff Member, IBM Research AI, Cambridge, MA** Jan. 2018 – Present  
**Research Fellow, University of Michigan, Ann Arbor, MI** April 2016 – Dec. 2017  
 Supervisor: [Alfred Hero](#) and [Indika Rajapakse](#)  
**Data Science PhD Intern, Huawei R&D USA, Bridgewater, NJ** June 2015 – Aug. 2015  
 Mentor: Kai Yang, Director: Jin Yang  
**Research Asistant, Syracuse University, Syracuse, NY** Sept. 2011 – Mar. 2016  
 Advisors: [Pramod K. Varshney](#) and [Makan Fardad](#)

## EDUCATION

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**Ph.D. in Electrical and Computer Engineering, Syracuse University** Mar. 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  
**B.S. in Electrical Engineering, Xi’an Jiaotong University** May 2008

## RESEARCH INTERESTS

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**Optimization:** distributed optimization, gradient-free optimization, non-convex optimization  
**Machine learning:** online learning, graphical model, factor analysis, neural networks  
**Computational biology:** genome architecture and transcription, system biology, cell reprogramming  
**Data science:** time-series data analytics, graph and network analytics  
**Network science:** communication networks, biological networks, multi-layer networks  
**Signal processing:** estimation/detection, object tracking, filtering, information fusion

## RESEARCH EXPERIENCE

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**Postdoctoral Research Fellow, University of Michigan** April 2016 – present

### Distributed optimization and online learning

Collaborators: [Alfred Hero](#) (UofM), [Pin-Yu Chen](#) (IBM)

- Decentralized network topology estimation
- Accelerated distributed optimization over well-designed networks
- Online zeroth-order alternating direction method of multipliers

### Multilayer network analysis of genomic form and function

Collaborators: [Indika Rajapakse](#) (UofM), [Alfred Hero](#) (UofM), [Stephen Smale](#) (UCB)

- Devise algorithm for cellular reprogramming
- Understand genome architecture and function during cell fate decision
- Analyze allele-specific human genome during the cell cycle

**Graph signal processing**Collaborators: [Alfred Hero](#) (UofM), [Geert Leus](#) (TU Delft)

- Semiblind graph reconstruction using incomplete information
- Learning sparse graphs under smoothness prior

**Data Science PhD Intern, Huawei R&D USA, Bridgewater, NJ** June 2015 – Aug. 2015**Anomaly root cause analysis in communication networks**

- Data-driven anomaly demarcation and root cause analysis
- Root cause analysis via denoising autoencoder using neural networks
- An R package is delivered and yields 99% demarcation accuracy in testing data

**Research Assistant, Syracuse University** Sept. 2011 – Mar. 2016**Sparsity-aware optimization for resource management**Collaborators: [Pramod K. Varshney](#) (Syr.), [Makan Fardad](#) (Syr.)

- Strike balance between inference accuracy and resource usage
- Adaptive resource management via design of sparsity-promoting learning systems

**Sensor collaboration for message passing over networks**Collaborators: [Pramod K. Varshney](#) (Syr.), [Makan Fardad](#) (Syr.)

- Power-efficient communication schemes for sensor collaboration
- Online power allocation with energy harvesting constraints

**Memristor-based optimization and learning framework**Collaborators: [Pramod K. Varshney](#) (Syr.), [Makan Fardad](#) (Syr.), [Yanzhi Wang](#) (Syr.)

- Algorithm-hardware co-optimization for mathematical programming
- Sparse learning using memristor crossbars

**SCHOLASTIC ACHIEVEMENTS**

- **Winner of Best Student Paper Award**, the 42nd IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP), 2017
- **Recipient of All University Doctoral Prize**, Syracuse University, 2016
- **Signal Processing Society Travel Grant Award** at IEEE ICASSP, 2015
- **Best Student Paper Nominee** (among the seven finalists) at Asilomar Conference on Signals, Systems, and Computers, CA, Pacific Grove, CA, 2013
- **Winner of Best Poster Award** at Nunan Poster Competition, Syracuse University, 2012
- **Outstanding Graduate Student**, Xi'an Jiaotong University, 2011

**SELECTED PUBLICATIONS**

## JOURNALS/EQUAL-QUALITY PUBLICATIONS

*Optimization for machine learning*

- [1] X. Chen, **S. Liu**, R. Sun, and M. Hong. "On the Convergence of A Class of Adam-Type Algorithms for Non-Convex Optimization." arXiv preprint arXiv:1808.02941, 2018
- [2] **S. Liu**, B. Kailkhura, P.-Y. Chen, P. Ting, S. Chang and L. Amini, "Zeroth-Order Stochastic Variance Reduction for Nonconvex Optimization". arXiv preprint arXiv:1805.10367, 2018

- [3] **S. Liu**, J. Chen, P.-Y. Chen and A. O. Hero, “Zeroth-Order Online Alternating Direction Method of Multipliers: Convergence Analysis and Applications,” *International Conference on Artificial Intelligence and Statistics (AISTATS)*, 2018
- [4] **S. Liu**, Y. Wang, M. Fardad and P. K. Varshney, “A Memristor-Based Optimization Framework for Artificial Intelligence Applications,” *IEEE Circuits and Systems Magazine*, 2018
- [5] **S. Liu**, P.-Y. Chen and A. O. Hero, “Accelerated Distributed Optimization for Evolving Networks of Growing Connectivity,” *IEEE Trans. Signal Process.*, 2018

### ***Deep learning and adversarial machine learning***

- [6] K. Xu\*, **S. Liu**\*, P. Zhao\*, P.-Y. Chen, H. Zhang, D. Erdogmus, Y. Wang, and X. Lin, “Structured Adversarial Attack: Towards General Implementation and Better Interpretability.” arXiv preprint arXiv:1808.01664, 2018 (\* Equal contributions)
- [7] P. Zhao, **S. Liu**, Y. Wang, and X. Lin. “An ADMM-Based Universal Framework for Adversarial Attacks on Deep Neural Networks.” arXiv preprint arXiv:1804.03193, 2018

### ***Computational biology***

- [8] H. Chen\*, **S. Liu**\*, L. Seaman, C. Najaria, W. Wu, A. O. Hero, M. Wicha and I. Rajapakse, “Parental allele-specific genome architecture and transcription during the cell cycle,” *Nature Communications*, under review, 2017 (\* co-first authors) <https://www.biorxiv.org/content/early/2017/10/11/201715>
- [9] **S. Liu**, H. Chen, S. Ronquist, L. Seaman, N. Ceglia, W. Meixner, L. A. Muir, P.-Y. Chen, G. Higgins, P. Baldi, S. Smale, A. O. Hero and I. Rajapakse, “Genome Architecture Leads a Bifurcation in Cell Identity,” *iScience*,

### ***Graph signal processing***

- [10] B. Oselio, **S. Liu** and Alfred O. Hero, “Multi-layer Social Networks”, book chapter in *Cooperative and Graph Signal Processing: Principles and Applications*, Elsevier, 2018
- [11] P.-Y. Chen and **S. Liu**, “Bias-Variance Tradeoff of Graph Laplacian Smoothing Regularizer”, *IEEE Signal Process. Lett.*, 2017

### ***Optimization in signal processing and communications***

- [12] S. Zhang, **S. Liu**, V. Sharma and P. K. Varshney, “Optimal Sensor Collaboration for Parameter Tracking Using Energy Harvesting Sensors,” *IEEE Trans. Signal Process.*, 2018
- [13] **S. Liu**, S. Kar, M. Fardad and P. K. Varshney, “Optimized Sensor Collaboration for Estimation of Temporally Correlated Parameters”, *IEEE Trans. Signal Process.*, 2016
- [14] **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.*, 2016
- [15] **S. Liu**, S. Kar, M. Fardad and P. K. Varshney, “Joint Design of Optimal Sensor Selection and Collaboration Strategies for Distributed Estimation,” *IEEE Communications Society MMTTC Communications - Frontiers*, 2016
- [16] B. Kailkhura, **S. Liu**, T. Wimalajeewa and P. K. Varshney, “Measurement Matrix Design for Compressive Detection with Secrecy Guarantees”, *IEEE Wireless Commun. Lett.*, 2016
- [17] **S. Liu**, S. Kar, M. Fardad and P. K. Varshney, “Sparsity-Aware Sensor Collaboration for Linear Coherent Estimation”, *IEEE Trans. Signal Process.*, 2015
- [18] **S. Liu**, A. Vempaty, M. Fardad, E. Masazade and P. K. Varshney, “Energy-Aware Sensor Selection in Field Reconstruction,” *IEEE Signal Process. Lett.*, 2014
- [19] X. Shen, **S. Liu** and P. K. Varshney, “Sensor Selection for Nonlinear Systems in Large Sensor Networks,” *IEEE Trans. Aerosp. Electron. Syst.*, 2014

- [20] S. Liu, M. Fardad, E. Masazade and P. K. Varshney, "Optimal Periodic Sensor Scheduling in Large-Scale Dynamical Networks," *IEEE Trans. Signal Process.*, 2014

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## PATENT

- [P1] 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.

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## TEACHING EXPERIENCE

- Guest Lecturer for *Adaptive Learning (ELE 853)*, Syracuse University, Fall 2015
- Guest Lecturer for *Advanced Numerical Methods II (MAT 781)*, Syracuse University, Fall 2014
- Guest Lecturer for *Optimal Control Systems (ELE 712)*, Syracuse University, Fall 2013
- Guest Lecturer for *Detection and Estimation (ELE 851)*, Syracuse University, Fall 2012
- Teaching Assistant for *Multi-Source Information Fusion*, Xi'an Jiaotong University, Fall 2010

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## SERVICE & PROFESSIONAL ACTIVITIES

- **General Co-Chair** of IEEE GlobalSIP Workshop on *Signal Processing for Adversarial Machine Learning*, 2018
- **Guest editor**, IEEE Internet of Things (IoT) Journal special issue on *AI Enabled Cognitive Communications and Networking for IoT*, 2018
- **Co-chair** of *ICME Workshop on Machine Learning and Artificial Intelligence for Multimedia Creation*, 2018
- **Vice-chair** of *IEEE ComSoc SIG on AI Embedded Cognitive Networks*, 2017-present
- **TPC member** for *GlobalSIP on Distributed Optimization and Resource Management over Networks*, 2017
- **Referee for journals**: *IEEE Transactions on Information Theory*, *IEEE Transactions on Signal Processing*, *IEEE Transactions on Wireless Communications*, *IEEE Transactions on Automatic Control*, *Information Fusion*, *IFAC Journal of Automatica*, *IEEE Sensors Journal*, *Springer Journals on Wireless Networks*, *Elsevier Journals on Digital Communications and Networks*
- **Referee for conferences**: *INFOCOM*, *ISIT*, *ICASSP*, *CDC*, *ACC*, *Fusion*, *GlobalSIP*, *VTC*

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## MISCELLANEOUS ACTIVITIES

- Judge for UofM Engineering Graduate Symposium, University of Michigan, Nov. 2017
- CNY Rocket Team Challenge volunteer, Syracuse University, June 2015
- International Student Orientation Volunteer, Syracuse University, Sept. 2014
- Judge for Ying Tri Region Science & Engineering Fair, March 2014

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## VISA TYPE

- F1 OPT extension