

Education:

Ph.D. in Electrical and Computer Engineering
University of Southern California (USC)

Aug. 2015 — present
Advisor: Prof. Urbashi Mitra

B.E. in Electronic Engineering and Information Science
University of Science and Technology of China (USTC)

Aug. 2011 — Jun. 2015

Publications:

Journal Papers

1. L. Liu and U. Mitra, “On Sampled Reinforcement Learning in Wireless Networks: Exploitation of Policy Structures”, *IEEE Transactions on Communications*, accepted.
2. L. Liu, A. Chattopadhyay and U. Mitra, “On Solving Large Scale MDPs: Exploitation of Policy Structures and Spectral Properties”, *IEEE Transactions on Communications*, vol. 67, no. 6, pp. 4151-4165, 2019.
3. L. Liu, Y. Zhong, W. Zhang and M. Haenggi, “On the impact of Cooperation on Local Delay and Energy Efficiency in Poisson Networks”, *IEEE Wireless Communications Letters*, vol. 4, no. 3, pp. 241-244, 2015.

Conference Articles

1. L. Liu, and U. Mitra, “Policy Sampling and Interpolation for Wireless Networks: A Graph Signal Processing Approach”, *IEEE International Global Communications Conference (GLOBECOM)*, IEEE, 2019. Accepted.
2. L. Liu, A. Chattopadhyay and U. Mitra, “Exploiting Policy Structure for Solving MDPs with Large State Space”, *52nd Annual Conference on Information Sciences and Systems (CISS)*, IEEE, Mar, 2018.
3. L. Liu, A. Chattopadhyay and U. Mitra, “On Exploiting Spectral Properties for Solving MDP with Large State Space”, *55th Annual Allerton Conference on Communication, Control and Computing*, pp. 1213-1219, IEEE, Oct, 2017.

Research/Project Experience:

Communication Science Institute, USC

Aug. 2015 — present

Advisor: Prof. Urbashi Mitra

- *Application of Deep Learning for Policy Optimization (currently working on)*
 - The application of various policy gradient techniques (using neural networks) for reinforcement learning problem in wireless networks.
 - Efficient deep learning algorithm design with the structural information of the optimal policy.
- *Application of Graph Signal Processing to Reinforcement Learning*
 - Proposed policy sampling and reconstruction algorithms for structured optimal policy in reinforcement learning problems. The proposed algorithms achieve both complexity reduction and similar performance as the classical reinforcement learning algorithm.
 - Derived analytical bounds for the proposed algorithms.
 - Further proposed policy refinement algorithms, which achieve better policy reconstruction with minor increase in complexity.
- *Efficient Representation and Policy Optimization for Markov Decision Processes Problems with Large State Space*
 - Derived the one optimal subspace design method for reduced dimensional Markov Decision Processes, perfect reconstruction of value functions and optimal policy is guaranteed.

- Proposed various subspace design methods for reduced dimensional Markov Decision Processes using graph signal processing techniques. One particular method achieved both complexity reduction and perfect reconstruction of the optimal policy.
- Exploited policy structure to accelerate policy iteration.

Communication Science Insitute, USC

Aug. 2019 — Dec. 2019

- *Teaching Assistant*: EE562 Random Processes in Engineering

Adaptive Spectrum and Signal Alignment, Incorporated (ASSIA)

May. 2019 — Aug. 2019

Technical Manager: Jisung Oh

- *Improvement of Broadband Network Speed Measurement*
 - Software implementation of broadband and Wi-Fi speed test
 - Optimization on codes for improved performance
 - Conducted comparison with the current flooding algorithm and showed robustness and better performance of the developed algorithm under heavy network traffic scenario.
- *Multi-AP (Wi-Fi Mesh) Network*
 - Investigation and understanding of WFA (Wi-Fi Alliance) Mesh Standard

Department of Electronic Engineering and Information Science, USTC

- *Impact of Coordinated Transmission on Delay and Energy Efficiency in Wireless Networks*:

Advisor: Prof. Wenyi Zhang

Jan. 2014 — Oct. 2014

- Derived formulas for delay and energy efficiency in non-coordinated transmission and coordinated transmission.
- Conducted numerical comparisons and analyzed their engineering significance.
- Demonstrated that networks can strongly benefit from coordinated transmission.

Courses and Skills:

• Graduate Courses

- Introduction to Computer Networks ◦ Digital Communication and Coding Systems
- Probability for Electrical and Computer Engineers ◦ Fundamental Concepts of Analysis
- Information Theory and Compression ◦ Random Processes in Engineering
- Applied Matrix Analysis ◦ Stochastic Processes ◦ Analysis of Algorithms
- Computational Solution of Optimization Problems ◦ Stochastic Network Optimization
- Wavelets and Graphs for Signal Processing and Machine Learning
- Dynamic Programming and Markov Decision Processes

• Software skills and Packages

- **Programming and Toolbox**
 - * C * Matlab * Python * SDR simulink Matlab * SQL
- **Others**
 - * L^AT_EX * VHDL

Honors & Awards:

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| 1, Electronic Institute Scholarship (USTC) | 2014 |
| 2, Outstanding Undergraduate Scholarship (Gold Prize, 3%, USTC) | 2013 and 2012 |
| 3, Outstanding Freshman Scholarship (USTC) | 2011 |

References:

- Prof. Urbashi Mitra (Ph.D advisor)
Ming Hsieh Department of Electrical and Computer Engineering, University of Southern California, USA.
Email: ubli@usc.edu
- Prof. Antonio Ortega (Project collaborator)
Ming Hsieh Department of Electrical and Computer Engineering, University of Southern California, USA.
Email: antonio.ortega@gmail.com
- Prof. Wenyi Zhang (Undergraduate advisor)
Department of Electronic Engineering and Information Science, University of Science and Technology of China, China.
Email: wenyizha@ustc.edu.cn