Libin Liu

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Education:

Ph.D. in Electrical and Computer Engineering Aug. 2015 — present
University of Southern California (USC) Advisor: Prof. Urbashi Mitra

B.E. in Electronic Engineering and Information Science Aug. 2011 — Jun. 2015
University of Science and Technology of China (USTC)

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: Expoitation 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 Insitute, 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 Jan. 2014 — Oct. 2014
Advisor: Prof. Wenyi Zhang

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

Honors & Awards:

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