






SULIN LIU

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Research Interests

My research interests are deep learning, probabilistic modeling and control theory. Through combining these tools, I am interested in developing methods and algorithms to accelerate modeling and design in machine learning and engineering. In particular, I mainly work on machine learning methods that utilize the structure of the problems for fast and scalable learning with guarantees. My current research focuses on scalable and robust automatic model identification with applications to AutoML and robust control. Before starting my PhD at Princeton, I have also worked on federated (distributed) learning and multi-task learning.

Education

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| 2017-pres. | Ph.D. in Electrical Engineering, Princeton University <ul style="list-style-type: none">- Advisors : Ryan P. Adams (CS), Peter J. Ramadge (EE)- GPA : 3.96/4.0 |
| 2011-2015 | B.Eng. in Electrical Engineering, National University of Singapore <ul style="list-style-type: none">- Major GPA : 4.94/5.0, Minor in Mathematics |
| 2014 | Exchange student, Georgia Institute of Technology <ul style="list-style-type: none">- GPA : 4.0/4.0, only 9 students selected university wide |

Research Experience

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| 2018-pres. | Research Assistant, Princeton University Advisors : Ryan P. Adams , Peter J. Ramadge <ul style="list-style-type: none">▶ Amortized model selection of Gaussian Process :<ul style="list-style-type: none">- Developed an amortized inference framework for GP model selection- Proposed a novel self-attention based neural network architecture that could trained on problems with different data cardinality and dimension- Demonstrated that a single trained neural model trained with synthetic data is able to perform GP model selection on different unseen real-world benchmarks with comparable quality but ~ 100 times faster than conventional approaches▶ Gaussian Process for system identification with stability guarantees :<ul style="list-style-type: none">- Identified a general class of stable GPs whose kernel's reproducing kernel Hilbert space (RKHS) corresponds to integrable functions- Proposed a probabilistic system identification method for linear dynamical systems with stability guarantees▶ Optimization for deep learning (side projects) :<ul style="list-style-type: none">- Studied second-order optimization method for better generalization in large batch training- Analyzed the noise component in stochastic gradient descent (SGD) from a low-rank perspective to help interpret its performance in deep learning |
| 2015-17 | Research Engineer, Nanyang Technological University, Singapore Advisor : Sinno Jialin Pan <ul style="list-style-type: none">▶ Distributed and federated learning, multi-task learning :<ul style="list-style-type: none">- Established the first distributed (federated) learning algorithm for relationship-based multi-task learning with convergence guarantees- Developed a distributed primal-dual optimization algorithm for empirical risk minimization- Developed a new multi-task learning method that adaptively group correlated tasks |
| 2015 | Undergraduate Thesis, National University of Singapore Advisor : Loong Fah Cheong |

- 2014 |
 - ▶ Proposed a new quadratic programming formulation of multi-view planar reconstruction
- 2014 | Research Intern, **Institute for Infocomm Research, Singapore**
 - ▶ Implemented a 3D face pose alignment algorithm for face images in the wild

Publications

- 2020 | **S. Liu**, X. Sun, P. J. Ramadge, R. P. Adams Task-Agnostic Amortized Inference of Gaussian Process Hyperparameters, *Advances in Neural Information Processing Systems (NeurIPS)*, preliminary version at ICML AutoML workshop, 2020. [Link](#).
- 2020 | H. Valavi, **S. Liu**, P. J. Ramadge Revisiting the Landscape of Matrix Factorization, in *International Conference on Artificial Intelligence and Statistics (AISTATS)*, 2020. [Link](#).
- 2018 | M. Zhao, B. An, Y. Yu, **S. Liu**, S. J. Pan Data Poisoning Attacks on Multi-Task Relationship Learning, in *AAAI Conference on Artificial Intelligence (AAAI)*, 2018. [Link](#).
- 2017 | **S. Liu**, S. J. Pan, Q. Ho Distributed Multi-task Relationship Learning, in *Conference on Knowledge Discovery and Data Mining (KDD)*, 2017. [Link](#).
- 2017 | Y. Yu*, **S. Liu***, S. J. Pan Communication-Efficient Distributed Primal-Dual Algorithm for Saddle Point Problems, in *Uncertainty in Artificial Intelligence (UAI)*, 2017. [Link](#).
- 2017 | **S. Liu**, S. J. Pan Adaptive Group Sparse Multi-task Learning via Trace Lasso, in *International Joint Conference on Artificial Intelligence (IJCAI)*, 2017. [Link](#).

Honors and Awards

- 2018 | Anthony Ephremides Fellowship
 - awarded to the top one first year Ph.D. student in the information science track
- 2017 | Princeton University Fellowship in Natural Sciences and Engineering
- 2014 | IEEE Eta Kappa Nu Honor Society
- 2014 | Faculty of Engineering Annual General Electric Book Prize
 - awarded to the top one student in the area of wireless communications
- 2013 | ST Electronics Book Prize
 - awarded to the top one student in Electrical Engineering in the second year
- 2011-15 | Singapore Ministry of Education SM3 Undergraduate Scholarship

Coursework

Machine Learning and Pattern Recognition
 New Directions in Theoretical Deep Learning
 Theoretical Machine Learning
 Statistical Optimization and Reinforcement Learning
 Optimization for Machine Learning

Linear and Nonlinear Optimization
 Large-Scale Optimization
 Statistical Theory and Methods
 High-Dimensional Probability
 Safety-Critical Robotic Systems

Programming Skills

- Proficient : Python (PyTorch), MATLAB, Java, \LaTeX
- Some experience : TensorFlow, C/C++, Bash, Julia, HTML, VHDL

Languages

- Chinese (Native)
- English (Professional)

Academic Service

Reviewer for *JMLR*, *NeurIPS*(2018-), *ICML*(2019-), *ICLR*(2019-), *AAAI*(2020-), *ACML*(2020-)

Teaching

Teaching assistant for *Machine Learning and Pattern Recognition*, *Mathematics for Numerical Computing and Machine Learning*, *Introduction to Data Science*, *Programming Methodology in C*.