






# SULIN LIU

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## Research Interests

My recent interests are probabilistic modeling, probabilistic numerics, deep learning. More specifically, I work on 1) : methods that utilize uncertainty quantification in probabilistic machine learning models for robust decision making, and 2) methods that accelerate probabilistic inference with deep learning. Previously, I have worked on federated/distributed optimization and multi-task learning.

## Education

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|------------|--|
| 2017-pres. | Ph.D. in Machine Learning, Electrical and Computer Engineering, <b>Princeton University</b><br>- Advisors : <a href="#">Ryan P. Adams</a> (CS), <a href="#">Peter J. Ramadge</a> (ECE), GPA : 3.96/4.0 |
| 2011-2015  | B.Eng. in Electrical Engineering, <b>National University of Singapore</b><br>- GPA : 4.84/5.0, Major GPA : 4.94/5.0, Minor in Mathematics  |
| 2014       | Exchange student, <b>Georgia Institute of Technology</b><br>- GPA : 4.0/4.0, only 9 students selected university wide  |

## Work Experience

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|------------------|--|
| 2021<br>May-Aug. | Research Intern, <b>Facebook Research</b><br>Mentors : <a href="#">Ben Letham</a> , <a href="#">Eytan Bakshy</a><br>▶ Worked on Bayesian optimization in the Adaptive Experimentation group, <a href="#">Core Data Science</a><br>- Developed sparse/interpretable policy search methods for multi-objective BO, paper submitted<br>- Collabed with product team and successfully deployed the methods in FB products  |
| 2015-17          | Research Engineer, <b>Nanyang Technological University, Singapore</b><br>Advisor : <a href="#">Sinno Jialin Pan</a><br>▶ Distributed/federated optimization, multi-task learning (MTL) :<br>- Developed the first distributed/federated learning algorithm for relationship-based MTL with convergence analysis<br>- Developed a novel distributed primal-dual optimization algorithm<br>- Developed a MTL method that learns to adaptively group correlated tasks |

## Research Experience

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|------------|--|
| 2018-pres. | Research Assistant, <b>Princeton University</b><br>Advisors : <a href="#">Ryan P. Adams</a> , <a href="#">Peter J. Ramadge</a><br>▶ Learning to optimize Gaussian Process hyperparameters :<br>- Developed an amortized inference framework for GP model selection<br>- Proposed a novel self-attention based neural network architecture that preserves permutation equivariance/invariance for learning on datasets<br>- Demonstrated that a single neural model trained with only synthetic data is able to perform GP model selection on different unseen real-world tasks with comparable quality, but $\sim 100$ times faster than conventional approaches<br>▶ Learning probabilistic safety certificates for safety-critical control<br>- Proposed a probabilistic modeling framework for the uncertainty in control barrier function dynamics<br>- Derived a probabilistic safety-projection controller that can take advantage of the uncertainty predictions from GP via a novel convex optimization reformulation<br>▶ Probabilistic modeling for system identification with stability guarantees :<br>- Identified a general class of stable GPs whose reproducing kernel Hilbert space corresponds to integrable functions for modeling system impulse responses |
| 2015       | Undergraduate Thesis, <b>National University of Singapore</b><br>Advisor : <a href="#">Loong Fah Cheong</a><br>▶ Proposed a new quadratic-programming-based formulation for multi-view planar reconstruction   |

## Publications

- 2021 | **S. Liu\***(equal contr.), Q. Feng\*, D. Eriksson, B. Letham, E. Bakshy  
Sparse Bayesian Optimization, under submission, 2022. [Paper](#).
- 2021 | **S. Liu\***(equal contr. random order), A. R. Kumar\*, J. F. Fisac, R. P. Adams, P. J. Ramadge  
ProBF : Probabilistic Safety Certificates with Barrier Functions, in *NeurIPS "Safe and Robust Control of Uncertain Systems" Workshop*, 2021. [Paper](#). [Code](#).
- 2020 | **S. Liu**, X. Sun, P. J. Ramadge, R. P. Adams  
Task-Agnostic Amortized Inference of Gaussian Process Hyperparameters, in *Advances in Neural Information Processing Systems (NeurIPS)*, 2020. [Paper](#). [Code](#).
- 2020 | H. Valavi, **S. Liu**, P. J. Ramadge  
Revisiting the Landscape of Matrix Factorization, in *International Conference on Artificial Intelligence and Statistics (AISTATS)*, 2020. [Paper](#).
- 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. [Paper](#).
- 2017 | **S. Liu**, S. J. Pan, Q. Ho  
Distributed Multi-task Relationship Learning, in *Conference on Knowledge Discovery and Data Mining (KDD)*, 2017. [Paper](#).
- 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. [Paper](#).
- 2017 | **S. Liu**, S. J. Pan  
Adaptive Group Sparse Multi-task Learning via Trace Lasso, in *International Joint Conference on Artificial Intelligence (IJCAI)*, 2017. [Paper](#).

## Honors and Awards

- 2018 | Anthony Ephremides Fellowship - awarded to the top 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 Book Prize - awarded to student with the best performance in the area of wireless communications
- 2013 | ST Electronics Book Prize - awarded to the top sophomore in Electrical Engineering
- 2011-15 | Singapore Ministry of Education Undergraduate Scholarship

## Graduate Coursework

- **ML** : Machine Learning and Pattern Recognition, Theoretical Machine Learning, Theoretical Deep Learning,
- **Stats** : Statistical Theory and Methods, High-Dimensional Probability, Statistical Optimization and Reinforcement Learning,
- **Opt** : Linear and Nonlinear Optimization, Optimization for Machine Learning, Large-Scale Optimization,
- **Control** : Safety-Critical Robotic Systems

## Programming Skills

- **Proficient** : Python (PyTorch, Numpy, Pandas), MATLAB, Java,  $\text{\LaTeX}$ , Git, Slurm, Bash/Zsh
- **Familiar** : TensorFlow, R, C/C++, Parameter Server, Julia, HTML/CSS, VHDL

## Teaching and Service

**Teaching** : SML 310 Research Projects in Data Science (co-teaching), ELE 535 Machine Learning and Pattern Recognition (head TA), COS 424 Fundamentals of Machine Learning, COS 302 Mathematics for Machine Learning, SML 201 Intro to Data Science

**Reviewer** : JMLR, TPAMI, NeurIPS(2018-, 2019 Top Reviewer), ICML(2019-), ICLR(2019-), AAAI(2020-), ACML(2020-), KDD(2021), SDM(2021)