Haoya Li

lihaoya@stanford.edu | (650) 665-1546

Department of Mathematics, Stanford University

87 Hulme Ct, Stanford, CA, 94305

EDUCATION BACKGROUND

Stanford University *2019 -*

Department of Mathematics, Ph.D. candidate

Expected Graduation: April 2024

- Overall GPA: **4.27**/4.00
- Real Analysis: A+, Theory of Probability I: A+, Convex Optimization I: A+, Advanced Reading and Research: A+

Peking University *2015 - 2019*

School of Mathematical Sciences, Bachelor of Science

- Overall GPA: **3.81**/4.00, Rank: **1**/39, Member of the Elite Undergraduate Training Program in Applied Math
- Mathematical Statistics: 99, Partial Differential Equations: 99, Numerical Optimization: 96, Data Structure: 96

RESEARCH INTERESTS

Machine Learning, Reinforcement Learning, Numerical PDEs, Quantum Computing, Quantum Control, Signal Processing, Optimization

RESEARCH EXPERIENCES

Research assistant, Stanford *Sep 2019 -*

- Developed new data-driven algorithms to solve high dimensional committor equations, elliptic PDEs, and eigenvalue problems with neural networks
- Developed a fast algorithm for solving Mean Field Game (MFG) Equations
- Devise reinforcement learning solvers for quantum control problems
- Devise novel quantum block-encoding algorithms with low gate complexity
- Devise novel quantum phase estimation algorithms for early-fault-tolerant computers

Quantitative researcher intern, Two Sigma *Jun 2023 - Aug 2023*

- Work as an intern at the optimization and market impact team

Applied scientist, Amazon *Jun 2022 - Sep 2022*

- Thoroughly review off-line reinforcement learning literature
- Extract an RL model from the raw data
- Implement off-line RL algorithms and improve upon current methods
- Investigate the problem of action uncertainty in off-line RL

Applied scientist, Amazon *Jun 2021 - Sep 2021*

- Developed a quasi-Newton method for the policy gradient algorithm with entropy regularization
- Prove the second-order convergence and implement tests on industrial-scale examples
- Developed a quadratically convexified primal-dual formulation for entropy-regularized MDPs
- Proposed an interpolating natural gradient algorithm and prove the global convergence by the Lyapunov method

PUBLICATIONS

- Quantum Multiple Eigenvalue Gaussian filtered Search: an efficient and versatile quantum phase estimation method
  Zhiyan Ding, Haoya Li, Lin Lin, Hongkang Ni, Lexing Ying, Ruizhe Zhang, Submitted
- Quantum Hamiltonian Learning for the Fermi-Hubbard Model
  Hongkang Ni, Haoya Li, Lexing Ying, Submitted
- Heisenberg-limited Hamiltonian learning for interacting bosons
  Haoya Li, Yu Tong, Tuvia Gefen, Hongkang Ni, Lexing Ying, Submitted

- On low-depth quantum algorithms for robust multiple-phase estimation
  Haoya Li, Hongkang Ni, Lexing Ying, Physical Review A
- A note on spike localization for line spectrum estimation
  Haoya Li, Hongkang Ni, Lexing Ying, Applied and Computational Harmonic Analysis
- On low-depth algorithms for quantum phase estimation
  Hongkang Ni, Haoya Li, Lexing Ying, Quantum
- On efficient quantum block encoding of pseudo-differential operators
  Haoya Li, Hongkang Ni, Lexing Ying, Quantum
- Monte Carlo tree search based hybrid optimization of variational quantum circuits
  Jiahao Yao, Haoya Li, Marin Bukov, Lin Lin, Lexing Ying, MSML 2022
- Accelerating primal-dual methods for regularized Markov decision processes
  Haoya Li, Hsiang-fu Yu, Lexing Ying, Inderjit Dhillon, To appear in SIAM Journal on Optimization (SIOPT)
- Approximate Newton policy gradient algorithms
  Haoya Li, Samarth Gupta, Hsiang-fu Yu, Lexing Ying, Inderjit Dhillon, SIAM Journal on Scientific Computing
- A semigroup method for high dimensional elliptic PDEs and eigenvalue problems based on neural networks
  Haoya Li, Lexing Ying, Journal of Computational Physics
- A semigroup method for high dimensional committor functions based on neural network
  Haoya Li, Yuehaw Khoo, Yinuo Ren, Lexing Ying, MSML 2021
- A simple multiscale method for mean field games
  Haoya Li, Yuwei Fan, Lexing Ying, Journal of Computational Physics

AWARDS AND HONORS

- Outstanding reviewer (top 10%) at ICML 2022 and invited as session chair 2022
- **1st Prize** in National University Physics Competition & National University Math Competition 2016, 2017
- National Scholarship 2018
- Honorary Graduate of the Elite Undergraduate Training Program in Applied Math 2019
- Outstanding Graduate of Peking University 2019

TEACHING EXPERIENCES

- Math 104: Applied Matrix Theory *Fall 2019, Spring 2020, Winter 2021*
- Math 51: Linear Algebra and Differential Calculus of Several Variables *Spring 2021*
- Math 172: Lebesgue Integration and Fourier Analysis *Fall 2021*
- Math 21: Calculus *Winter 2022*
- Math 53: Ordinary Differential Equations with Linear Algebra *Fall 2022*
- Math 131P: Partial Differential Equations *Winter 2023*

PROFESSIONAL SERVICE

- **Journal reviewer:** Quantum, SIAM Journal on Optimization, Applied and Computational Harmonic Analysis, Journal of Scientific Computing, Research in the Mathematical Sciences, IEEE Transactions on Circuits and Systems I: Regular Papers
- **Conference reviewer:** QIP, ICML, MSML

PROGRAMMING AND EXTRACURRICULAR ACTIVITIES

- Programming: C/C++, Python, Pyspark, Tensorflow, MATLAB, MPI, OpenMP, CUDA
- Captain and coach of the Softball Team of the School of Mathematical Sciences 2016 - 2019
- Member of Peking University Baseball team 2019
- Inclusive Mentorship in Data Science 2022