Yinbin Han

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EDUCATION

University of Southern California Aug 2021 – Present
Ph.D. Student, Industrial and Systems Engineering
Advisor: Meisam Razaviyayn, Renyuan Xu

Chinese University of Hong Kong, Shenzhen Sep 2017 – Jun 2021
B.S. in Mathematics

University of California, Berkeley Jan 2020 – May 2020
Exchange Student

RESEARCH INTERESTS

- Applied Probability and Stochastic Modeling
- Nonconvex Optimization and Stochastic Optimization
- Reinforcement Learning and Data-driven Decision Making
- Mathematical Finance and Stochastic Control
- Score-based Generative Models

PROJECTS

Score Approximation, Optimization and Generalization Mar 2023 - Present
Advisor: Meisam Razaviyayn, Renyuan Xu *USC*

- Investigated denoising score matching via training neural networks to learn the score function. Overcame challenges of unbounded input, vector-valued output, and an additional time variable.
- Leveraged the properties of the Ornstein-Uhlenbeck process to approximate the score function using reproducing kernel Hilbert space (RKHS) induced by the neural tangent kernel (NTK).
- Linked neural network training to kernel regression for overparameterized neural networks to show the convergence of gradient descent.
- Analyzed the generalization properties of gradient descent in training neural networks with an early stopping rule.

Policy Gradient Converges to the Globally Optimal Policy for Nearly Linear-Quadratic Regulators Jan 2022 - Mar 2023
Advisor: Meisam Razaviyayn, Renyuan Xu *USC*

- Studied an optimal control problem with quadratic cost and nonlinear dynamics consisting of a linear part and a nonlinear kernel basis governed by a policy which is the sum of a linear and a nonlinear component.
- Investigated the optimization landscape of the cost function. Proved a local strong convexity property of the cost function in the neighborhood of a carefully chosen initialization. Showed that the globally optimal solution must be attained near the initialization when the nonlinear component is small.
- Proposed a zeroth-order policy gradient algorithm with a carefully designed initialization scheme. Proved the linear convergence rate of the algorithm and analyzed the sample complexity.

Optimal Switching Policy for Batch Servers Sep 2020 – Nov 2022
Advisor: Zizhuo Wang *CUHKSZ*

- Studied an optimal switching problem for batch servers: for two arrival stochastic processes and two batch servers, given the current arrivals, decide whether to switch the two servers in order to maximize the total expected number of customers by the end of the time horizon.
- Proved the optimality condition, derived an explicit formula of the optimal value function, and designed an optimal threshold-based switching policy.
- Examined the monotonicity of optimal switching time thresholds with respect to the parameters, including the time horizon, arrival rates, and server capacities.
- Established an upper and a lower bound of the long-run benefits with switching flexibility and provided the $\Theta(\sqrt{T})$ asymptotic tight bound under the proposed regime.
- Organized numerical experiments to evaluate the performance of the optimal switching policy. Illustrated the monotonicity of time thresholds in parameters and validated the asymptotic bound.

Deep Optimal Stopping May 2020 – Sep 2020
Research Assistant (Part-time) *Remote*

- Developed a deep neural network to approximate the value function in a discrete-time optimal stopping problem; applied the method to Bermudan option pricing
- Compared the simulation results to a theoretical outcome from the Black-Scholes Model for European option pricing to validate the correctness
- Replicated the deep learning for optimal stopping algorithm; analyzed convergence and performance of the neural network; concluded the prior work's limitations: strong assumptions and large sample complexity
- Established a mathematical model via dynamic programming principle for optimal stock selling/buying decisions in the bull/bear switching market and made every single decision through deep optimal stopping

Reinforcement Learning Based Ride Sharing Feb 2019 – Aug 2019
Research Assistant (Part-time) *Remote*

- Applied deep reinforcement learning (DRL) algorithm to find the optimal consecutive batch-matching time interval for online ride-hailing platforms.
- Replicated the experiment results from prior works; verified the correctness of the algorithms and analyzed the performance of previous methods.
- Established a traffic network in PyTorch; generated passenger-driver data through a mixed Gaussian model. Organized the numerical experiments to verify the feasibility of our method. Improved the number of matched orders by over **5%** through DRL methods.

WORKING PAPERS

1. **Yinbin Han**, Meisam Razaviyayn, and Renyuan Xu. "Policy Gradient Converges to the Globally Optimal Policy for Nearly Linear-Quadratic Regulators." Submitted to *SIAM Journal on Control and Optimization*, 2023.
    - Short version accepted by *NeurIPS workshop Optimization for Machine Learning*, 2022.
2. **Yinbin Han** and Zizhuo Wang. "Optimal Switching Policy for Batch Servers." Revision, *Operations Research Letters*, 2022.

INVITED TALKS

- NeurIPS 2022 Workshop OPT2022, New Orleans — Dec 2022
- INFORMS Annual Meeting, Indianapolis — Nov 2022

REVIEWERS

- Conferences: ICML, NeurIPS, AISTATS, UAI

TEACHING EXPERIENCE

CUHKSZ, Undergraduate Student Teaching Fellow

- Ordinary Differential Equations — Spring 2021
- General Biology — Summer 2019

AWARDS & HONORS

- National Scholarship of China — 2020
- Academic Performance Scholarship, CUHKSZ — 2018, 2019, 2020
- Dean's List, CUHKSZ — 2018, 2019, 2020

TECHNICAL SKILLS

Programming Languages:

- Proficient in Python, Numpy, Pandas, R, and MATLAB
- Familiar with Java, C/C++, MySQL
- Experience with Hadoop, Spark, and CUDA