Hyelin Choi

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Research Interest

Optimization & Optimal Control: Nonconvex Optimization; Stochastic Programming; Optimization under Uncertainty; Combinatorial optimization; Black-box Optimization
Reinforcement Learning: Algorithm Development; Convergence Analysis; Applications in Finance
Operations Research: Inventory and Supply Chain Optimization; Scheduling and Resource Allocation

Education

SungKyunKwan University (SKKU), Republic of Korea Mar. 2020 - Aug. 2023
B.S. in Mathematics, magna cum laude — Early Graduation (One Semester) GPA: 4.13/4.5 Major 4.17/4.5

SungKyunKwan University (SKKU), Republic of Korea Sep. 2023 - In progress
Master in Mathematics

Preprints

Preprint A Linear Convergence Result for the Jacobi-Proximal Alternating Direction Method of Multipliers (with Woocheol Choi), *Computational Optimization and Applications*, under revision 2025

- Contributed talk at 2025 KMS Spring Meeting, KAIST, April 2025
- Seminar talk at SKKU, April 2025

Research Experiences

A Linear Convergence Result for Jacobi–Proximal ADMM, SKKU Dec. 2023 – May 2025
Advisor: Woocheol Choi Suwon, South Korea

- Developed theoretical proofs establishing linear convergence of the Jacobi–Proximal ADMM
- Implemented numerical experiments to validate convergence results
- Took primary responsibility for drafting and revising the manuscript

Topological Data Analysis Project, SKKU Spring 2025
Persistent Homology for Financial Crisis Detection
Suwon, South Korea

- Implemented a persistent homology-based framework for early warning signals of financial crises in R
- Extended the analysis to the Korean stock market
- Conducted comparative evaluation with traditional approaches

Research Seminar on Machine Learning and Optimization in Finance, SKKU 2024 – 2025
Advisor: Woocheol Choi Suwon, South Korea

- Reviewed and presented recent research on machine learning approaches in finance, including reinforcement learning and generative models
- Studied theoretical foundations of stochastic and robust optimization, focusing on methods such as Sample Average Approximation and Wasserstein optimization

Reinforcement Learning Seminar, SKKU 2024 – 2025
Reinforcement Learning
Advisor: Woocheol Choi and Jeonggyu Huh Suwon, South Korea

- Conducted research and seminars on advanced Reinforcement Learning algorithms, with emphasis on theoretical convergence analysis and simulation

Generative Models and Reinforcement Learning for Financial Forecasting, SKKU 2025
Advisor: Woocheol Choi and Jeonggyu Huh Suwon, South Korea

- Built end-to-end modules for data preprocessing, QuantGANs training, synthetic path generation, and DDPG policy learning
- Applied the framework to forecast future U.S. stock prices

Regularized Direct Policy Optimization (RDPO) for LQR, SKKU 2025
Advisor: Woocheol Choi and Jeonggyu Huh Suwon, South Korea

- Implemented a reinforcement learning approach (RDPO) for solving linear quadratic control problems
- Validated the learned policy against classical optimal control solutions

Korea Institute for Advanced Study (KIAS) Summer 2024
CAC Summer School on Artificial Intelligence & Parallel Computing
Seoul, South Korea

- Completed intensive training on parallel computing (MPI), scientific computing, physics-informed neural networks (PINN), Bayesian inference, and diffusion models
- Developed and presented a project on solving the Merton Portfolio Problem using PINN, awarded 3rd place

Undergraduate Research Program, SKKU Jan. 2022 – Dec. 2022
Optimal Control
Advisor: Woocheol Choi Suwon, South Korea

- Studied theoretical foundations of optimal control, including Kalman filtering and model predictive control (MPC)
- Explored machine learning approaches (e.g., contrastive learning) and data-driven dynamical systems frameworks (e.g., Koopman operator theory) for applications in control

Undergraduate Research Program, SKKU Jul. 2022 – Aug. 2022
Convex Optimization
Advisor: Woocheol Choi Suwon, South Korea

- Analyzed the convergence of various optimization algorithms and implemented them in Python
- Delivered weekly seminar talks on advanced optimization algorithms based on selected research papers

Honors & Awards

Project Award Jun. 2024
3rd place, Korea Institute for Advanced Study (KIAS)

Graduate School Outstanding Scholarship Aug. 2023 - Jun. 2025
Sungkyunkwan University (SKKU)
Awarded to incoming graduate students with highest academic standing

BK21 Project Scholarship Aug. 2023 - Dec. 2024
Brain Korea 21 (Ministry of Education)
Research scholarship for top graduate students in the program

Student Success Scholarship (Combined BSc & MSc Track) Aug. 2023 – Dec. 2023
Sungkyunkwan University (SKKU)
Awarded to students admitted into the integrated bachelor's/master's program

Academic Scholarship Aug. 2021 – Dec. 2021
Sungkyunkwan University (SKKU)
Scholarships for students in the top 10 percent of the department

Academic Scholarship
Sungkyunkwan University (SKKU)
Scholarships for students in the top 30 percent of the department
- Aug. 2022 – Dec. 2022
- Mar. 2023 - Jun. 2023

National Scholarship Mar. 2020 - Jun. 2020

Talks

Contributed Talk	A Linear Convergence Result for the Jacobi-Proximal Alternating Direction Method of Multipliers (2025 KMS Spring Meeting, KAIST)|	2025
Expository Talk	A Linear Convergence Result for the Jacobi-Proximal Alternating Direction Method of Multipliers |	2025
Expository Talk	QuantGANs	2024
Expository Talk	Supervised Learning vs Reinforcement Learning |	2023
Expository Talk	Model Predictive Control |	2023

Teaching Experiences

Teaching Assistant	Calculus 1 (in English)	Mar. 2025,- Jun. 2025
Teaching Assistant	Probability (in English)	Sep. 2024 - Dec. 2024
Teaching Assistant	Calculus 1	Mar. 2024 - Jun. 2024
Teaching Assistant	Calculus 2	Sep. 2024 - Dec. 2024
Tutor	Graph Neural Networks— weekly tutoring sessions for SKKU undergraduates and external graduate students	Feb. 2024
Tutor	Linear Algebra— weekly sessions for SKKU undergraduates	Mar. 2023 - May 2023

Conferences & Workshops (Attended)

Conference	2025 KMS Spring Meeting, KAIST |	Apr. 24 - 26, 2025
Workshop	Workshop on Mathematical Finance at Jeju |	May. 31 – Jun. 3 2024
School	15th KIAS CAC Summer School on Artificial Intelligence & Parallel Computing, KIAS |	Jun. 24 – 28 2024
Conference	15th KSIAM Spring Conference, Alpensia, Pyeong Chang |	May. 19 – 21 2023

Relevant Coursework

Optimization & Optimal Control: Optimization Theory and Computation, Applied Numerical Analysis, Industrial Mathematics, Real Analysis 1

Machine Learning & AI: Scientific Computing and Deep Learning, Mathematical Principle and Programming of Deep Learning, Fundamentals of Machine Learning

Finance & Statistics: Financial Mathematics, Stochastic Processes, Applied Mathematics, Probability and Statistics, Partial Differential Equations, Applications of Partial Differential Equations

Topology & Geometry: Topological Data Analysis, Advanced Differential Geometry (Optimal Transport)

Computer Skills

Python
Related Experiences: Optimization, Reinforcement Learning, Machine Learning, Generative AI Models, Numerical Analysis, Scient
AI in Finance

R
Related Experiences: Topological Data Analysis (applications in Finance)

C/C++
Related Experiences: Coursework in Data Structures & Algorithms