

Hongpei Li

✉ ishongpeili@gmail.com | [Github](#) | [Homepage](#) | [Google Scholar](#)

EDUCATION

Shanghai University of Finance and Economics (SUFU) 2021/09 - 2025/06 (Expected)
Bachelor of Engineering in Data Science and Big Data Technology
Pilot Class of Research Institute for Interdisciplinary Science Shanghai, China
GPA 3.77/4.0 Average Score 89.44/100 Major GPA 3.87 Major Average Score 91.48/100

Main Courses:

- Mathematics: Discrete Mathematics, Linear Algebra, Mathematical Analysis, Probability, Mathematical Statistics, Stochastic Process, Numerical Computation Method, Game Theory, Dynamic Programming, High-Dimensional Data Analysis, Data-Driven Decision Making, Operations Management, Linear & Nonlinear Programming, Advanced Operations Research
- Computer Science: Python, C++, Data Structure, Data Mining, Machine Learning, Deep Learning, Advanced Program Design and Experiment, Algorithmic Design & Analysis
- Economics: Microeconomics, Macroeconomics, Economic Management of Computer Application, Econometrics, Money and Banking

RESEARCH INTERESTS

My research interests include Optimization, Artificial Intelligence and the Interdisciplinary of Operations Research and Machine Learning. My previous works dive into **developing algorithms and models for hard optimization problems**, such as learning-based optimization and GPU-accelerated optimization.

PUBLICATIONS

- Restarted Primal-Dual Hybrid Conjugate Gradient Method for Large-Scale Quadratic Programming*** (Submitted to **INFORMS Journal on Computing**)
Y. Huang, W. Zhang, **H. Li**, D. Ge, H. Liu, and Y. Ye. (2024). *arXiv preprint* ([\[Paper\]](#))([\[Datasets\]](#))([\[Python\]](#))([\[Julia\]](#))
- Solving Integrated Process Planning and Scheduling Problem via Graph Neural Network Based Deep Reinforcement Learning*** (to be submitted soon)
H. Li, H. Zhang, Z. He, Y. Jia, B. Jiang, X. Huang, and D. Ge. (2024). *arXiv preprint* ([\[Paper\]](#))([\[Code\]](#))

RESEARCH EXPERIENCE

Diffusion Models for Linear Programming Sep.2024 - Present
Adviser: [Prof. Mengdi Wang](#), [Prof. Yinyu Ye](#) Princeton University, Stanford University

- A comprehensive framework for solving linear programs using diffusion models.
- Significantly decrease (**more than 70%**) the number of iterations required to solve linear programs over a variety of datasets.

Warm-Starting PDHCG using Learning-based Methods Aug. 2024 - present
Adviser: [Prof. Huikang Liu](#) Shanghai Jiao Tong University, Cardinal Optimizer

- A framework for warm-starting PDHCG using learning-based methods, which is well-implemented to support efficient batch processing inference and sampling.
- A novel neural network inspired by the role of iteration in PDHCG algorithm.
- Competitive performance on a variety of standard datasets.

Deep Reinforcement Learning (DRL) for Scheduling Problems Mar.2024 - Aug.2024
Adviser: [Prof. Dongdong Ge](#) [Prof. Bo Jiang](#) Shanghai Jiao Tong University, SUFE, Cardinal Optimizer

- Well-implemented simulation environment of the integrated process planning and scheduling problem, supporting GPU-accelerated and batch processing training and inference. This environment allows for utilizing various algorithms efficiently.
- A novel **graph representation** of the problem based on MDP formulation and well-designed **dense reward function**. Also, some strategies are proposed to **reduce meaningless exploration**.
- The proposed method can make decisions within a few seconds and outperform traditional dispatching methods, as well as obtain an improvement of **11.35%** compared with OR-Tools SAT-CP Solver and the Gurobi MILP Solver with a 7200-second time limit on large instances. compared with optimizers. Offering a new perspective for solving the integrated process planning and scheduling problem.

Primal-Dual Hybrid Conjugate Gradient Method (PDHCG) Apr.2024 - Oct.2024
Adviser: [Prof. Yinyu Ye](#) [Prof. Dongdong Ge](#) [Prof. Huikang Liu](#) Stanford University, Shanghai Jiao Tong University

- Solid theoretical analysis, showing that the convergence of PDHCG has **much greater resilience to ill-conditionin** than previous First-Order Methods (e.g., rAPDHG, SCS).
- 5 times faster than the restarted accelerated primal-dual hybrid gradient (rAPDHG) method in large-scale problems and about 100 times faster than other existing methods (e.g., SCS, COPT).
- Implement GPU version and low-rank acceleration independently, obtaining more than 10 times faster than the CPU version and GPU full-matrix version respectively.

Machine Learning for MIP Optimizer Configuration

Dec.2023 - Oct.2024

Prof. Dongdong Ge, Prof. Qi Deng, Prof. Wentin Tu, Dr. Qi Huangfu

Shanghai Jiao Tong University, SUFE, Cardinal Optimizer

- Extract comprehensive handcrafted features from the detailed internal logs of Cardinal Optimizer (COPT), which are proprietary and not publicly disclosed, to equip users with sufficient data for model training.
- Provide several standard machine learning models, including Random Forest and Graph Neural Networks, standard evaluation metrics and various labeled benchmark datasets for optimizer configuration.

Personal Projects

Lhongpei

- **DRL for Campus Auto-Delivery Vehicle** Developed an innovative framework integrating Deep Reinforcement Learning (DRL) and Mixed-Integer Programming (MIP) for campus auto-delivery vehicles, aimed at optimizing resource allocation and route efficiency.
 - **Part 1:** Formulated the allocation problem as a MIP model, leveraging the COPT optimizer to achieve optimal resource distribution.
 - **Part 2:** Employed DRL models to determine the shortest delivery paths, accounting for environmental disturbances on campus. developed a DRL agent, trained in a simulated environment with a similar disturbance distribution, enables real-time dynamic path adjustments, offering adaptive and efficient routing solutions to users.

Awarded the Shanghai Municipal Bronze Award in the Internet+ University Student Innovation and Entrepreneurship Competition(43/34000)

- **Learning To Optimize: Recurrent Neural Network-Based Quasi-Newton Method**
 - Use Recurrent Neural Networks (RNNs), such as LSTM and GRU, to learn a preconditioner inspired by the Quasi-Newton method.
 - Show faster convergence compared with the traditional Quasi-Newton method and gradient descent method after training on datasets with similar distributions.
- **Restaurant Recommendation**
 - Use a variety of recommendation algorithms, including collaborative filtering (item-based, user-based), matrix competition to recommend restaurants to users based on their preferences and historical data.

EMPLOYMENT HELD

TA of Advanced Operations Research

Feb.2024 - Jun.2024

Professor: Bo Jiang, Jianjun Gao

Research Institute for Interdisciplinary Science@SUFE

Responsibility: online tutorial, weekly tutorial, assisting students with related questions and grading of the homework and exams.

Syllabus: This course mainly focuses on the fields of Operations Research, including Optimization Theory, Integer Programming, Revenue Management, Constrained & Unconstrained Optimization, Robust Optimization.

TA of OOAD (Object-Oriented Analysis and Design)

Sep.2023 - Jan.2024

Professor: Bundit Laekhanukit

Institute for Theoretical Computer Science (ITCS) @SUFE

Responsibility: online tutorial, weely tutorial, assisting students with related questions and guiding the students to complete projects using Kotlin.

Syllabus: This course mainly focuses on understanding the principles of object-oriented programming and design.

VOLUNTEER

Peer Tutor in Programming Design Foundations

Sep.2022 - Dec.2022

I volunteered as a peer tutor to assist students struggling with the computer programming course. This course focuses on the basic concepts of programming, including foundations of C/C++ and basic algorithm problems selected from Luogu, a Chinese online judge and algorithm competition platform similar to Codeforces.

University Students' Union

Sep.2021 - Sep.2022

My main responsibility in the Students' Union is to advertising clubs and activities to students using posters and social media. I leveraged my skills in painting and using Photoshop and Illustrator to design posters and banners. I also response to connect clubs.

TECHNICAL SKILLS AND HOBBIES

- **Programming Languages:** Python, C/C++, Julia, MATLAB, R, Kotlin
- **Frameworks and Tools:**
 - **Machine Learning:** PyTorch, PyTorch Geometric (PyG), PyTorch Lightning, Scikit-learn, Gym, Isaac Gym
 - **Operations Research:** COPT, Gurobi, SCIP, HIGHS, OR-Tools, JuMP, CVX
 - **Document Formatting:** LaTeX, Markdown, Typst
 - **Others:** NumPy, Pandas, CUDA, CPython, JuliaCall, PythonCall, Shell, SSH, Git, YAML, JSON, Office, Phothoshop.
- **Hobbies:** Drawing, Biking, Skiing, Photography, Puzzle, Assembled Model, Coffee