Zhijian Lai

Contact Information

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Education

2021 – Present **University of Tsukuba** – Ibaraki, Japan
Ph.D. in Policy and Planning Sciences (expected Mar. 2024)
Supervisor: Prof. Akiko Yoshise
Thesis: "*Riemannian optimization algorithms for applications and their theoretical properties*"

2019 – 2021 **University of Tsukuba** – Ibaraki, Japan
M.S. in Policy and Planning Sciences
Supervisor: Prof. Akiko Yoshise
Thesis: "*A new method for completely positive matrix factorization*"

2013 – 2017 **Dongbei University of Finance and Economics** – Dalian, China
B.Mgmt. Major: Logistics Management

Research Interests

Nonsmooth Optimization, Riemannian Optimization, Geodesic Convex Optimization, Bilevel Optimization, Multi-objective Optimization, Quantum Interior Point Methods, Machine Learning, Deep Reinforcement Learning

Publications & Reprints

2022 **Zhijian Lai**, Akiko Yoshise. "Riemannian Interior Point Methods for Constrained Optimization on Manifolds". *arxiv.org/abs/2203.09762* (under review).

2022 **Zhijian Lai**, Akiko Yoshise. "Completely Positive Factorization by a Riemannian Smoothing Method". *Comput. Optim. Appl.* **83**, 933–966 (2022).

Working Papers

2023 Xin Yang, **Zhijian Lai**, Qian Wu, Maiko Shigeno. "CLAP: A Contrastive Learning Structure for App-usage Prediction".

2023 Xin Yang, **Zhijian Lai**, Qian Wu, Maiko Shigeno. "Hyperbolic Graph Contrastive Learning for Recommender System".

Research Experience

2021 – Present **Research Assistant to Prof. Akiko Yoshise, University of Tsukuba**
Research Project: "*Theory and Implementation of General Algorithms for Constrained Optimization Problems on Riemannian Manifolds*"
Research Project: "*Development of New Data Collaboration Methods Based on Optimization Theory on Riemannian Manifolds*"

2022 **Facilitation Training Programs, University of Tsukuba**
Research Project: "*Big data analysis and marketing strategy formulation*"
Data: Device information of Android users, as well as limited demographic information such as the gender and age of users, provided by Fuller, Inc..
Teaming up with others, we are focusing on the problem of predicting app-usage prediction problem using graph neural network.

Conference Talks

Aug. 2023 10th International Congress on Industrial and Applied Mathematics (ICIAM), Tokyo, Japan.
"*Riemannian Interior Point Methods for Constrained Optimization on Manifolds*".

June 2023 SIAM Conference on Optimization (OP23), Seattle, US.
"*Interior Point Methods for Nonlinear Optimization on Riemannian Manifolds*".

May 2023 Operations Research Society of Japan, Research Division: Theory and Algorithms of Optimization, Tsukuba, Japan.
"*Riemannian Interior Point Methods for Constrained Optimization on Manifolds*".

Mar. 2023 The 2023 Spring National Conference of Operations Research Society of Japan, Tokyo, Japan.
"*Riemannian Interior Point Methods for Constrained Optimization on Manifolds*".

Dec. 2022 International Workshop on Continuous Optimization, Tokyo, Japan.
"*Riemannian Interior Point Methods for Constrained Optimization on Manifolds*".

Sep. 2022 The 2022 Autumn National Conference of Operations Research Society of Japan, Niigata, Japan.
"*On the Global Convergence of Riemannian Interior Point Method*".

Sep. 2022 The Japan Society for Industrial and Applied Mathematics 2022 Annual Meeting, Sapporo, Japan.
"*On the Global Convergence of Riemannian Interior Point Method*".

Mar. 2022 The 2022 Spring National Conference of Operations Research Society of Japan, Gunma, Japan.
"*Superlinear and Quadratic Convergence of Riemannian Interior Point Methods*".

July 2021 SIAM Conference on Optimization (OP21), Hong Kong.
"*Completely Positive Factorization via Orthogonality Constrained Problem*".

Aug. 2021 Meeting 2021 of Kyoto University Research Institute for Mathematical Sciences, Kyoto, Japan.
"*Application of Smoothing Methods for Completely Positive Matrices via Orthogonality Constrained Problem*".

Mar. 2021 The 2021 Spring National Conference of Operations Research Society of Japan, Tokyo, Japan.
"*Completely Positive Factorization via Orthogonality Constrained Problem*".

Aug. 2020 Meeting 2020 of Kyoto University Research Institute for Mathematical Sciences, Kyoto, Japan.
"*A New Approach to the Recognition Problem of Completely Positive Matrices*".

Posters

Aug. 2023 Summer School on Continuous Optimization and Related Fields, Institue of Statistical Mathematics, Tokyo, Japan.
"*Riemannian Interior Point Methods for Constrained Optimization on Manifolds*".

Mar. 2023 2022 SPRING Fellowship Research Meeting, Tsukuba, Japan.
"*Riemannian Interior Point Methods for Manifold Optimization*".

Mar. 2022 2021 SPRING Fellowship Research Meeting, Tsukuba, Japan.
"*Riemannian Optimization and Its Applications*".

Softwares

2022 **RIPM**, a primal-dual interior point methods solver for nonlinear optimization problems on Riemannian manifolds. Code: https://github.com/GALVINLAI/RIPM

2021 **RieSmooth**, a general Riemannian smoothing solver for nonsmooth Riemannian optimization problems. Code: https://github.com/GALVINLAI/RieSmooth

Grant and Fellowship

Aug. 2023 The Institue of Statistical Mathematics Summer Travel Grant

2021 – Present Research fellowship of **S**upport for **P**ioneering **R**esearch **I**nitiated by the **N**ext **G**eneration (SPRING), funded by Japan Science and Technology Agency.
Research Topic: "*The development of optimization theory of Riemannian manifolds and cones and its application to mathematical information engineering*".
Fellowship Qualified Students (Class 1): Annual amount of 20,503 US dollars.

Teaching Experience

2021 – 2023 **University of Tsukuba, College of Policy and Planning Sciences**
Teaching Assistant
– FH61141, Society and Optimization, 2023 Fall
– FH35012, Problem Identification and Resolution, 2022 Fall
– FH61141, Society and Optimization, 2022 Fall
– 0AL5100, Supply Chain Management, 2021 Fall

2019 – 2021 **University of Tsukuba, Graduate School of Science and Technology**
Mathematics Tutoring for Graduate Admission Examination of Master's Program in Policy and Planning Sciences
– "Linear Algebra" subject for summer admission exams, Aug. 2021
– "Calculus" subject for winter admission exams, Dec. 2019
– "Calculus" subject for summer admission exams, Aug. 2019
Each lasted for six weeks, totaling 12 hours of instruction. During the COVID-19 pandemic, I uploaded the course videos to the Bilibili platform to help those students in need.

2019 – 2021 **University of Tsukuba, University-High School Collaboration Project: Optimizing Issues in the Community.**
This project is supported by the Japan Science and Technology Agency. Its aim is to enable high school students to identify problems within their living environment and propose solutions using optimization models (e.g., MILP) and solvers (e.g., Xpress, Gurobi).
From 2019 to 2021, I served as a TA, during which time my responsibilities included guiding a group and overseeing the following topics:
– Developing a self-study schedule program to maximize efficiency. (2021)
– Selecting evacuation shelters during disasters. (2020)
– Leveling out the number of people using the school cafeterias. (2019)
– Ease congestion by determining stops on the Tobu Isezaki Line. (2019)

Professional Memberships

2021 – Present Operations Research Society of China
Operations Research Society of Japan
Society for Industrial and Applied Mathematics
Institute for Operations Research and the Management Sciences

Technical Skills

Computer Skills
Proficient in: Matlab, LaTeX, Mathematica.
Familiar with: Python, GuRoBi, Xpress, NetLogo.
Languages
Chinese (Native), English (Fluent), Japanese (Advanced): JLPT N1.

Graduate Coursework

Discrete Mathematics (A)
Mathematical Optimization Theory (A)
Information Security (A)
Mathematics for Policy and Planning Sciences (A+)
Social Simulation (A+)
Statistical Analysis (A)
Seminar: Quantum Computing and Optimization (A)
Seminar: Semi-definite Positive Programming (A+)

Additional Education

2017 – 2019 ARC Tokyo Japanese Language School – Tokyo, Japan
Graduate School Preparation Class

References

Prof. Akiko Yoshise
Provost, Faculty of Engineering, Information and Systems, University of Tsukuba
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