

# Zhijian Lai

## Contact Information

Office:

Beijing International Center for Mathematical Research Peking University

Peking University

Beijing 100871, People's Republic of China

Email: [galvin.lai@outlook.com](mailto:galvin.lai@outlook.com)

Homepage: <https://galvinlai.github.io>

## Education

2021 – 2024

**University of Tsukuba** – Tsukuba, Japan

Ph.D. in Policy and Planning Sciences

Supervisor: [Prof. Akiko Yoshise](#)

Thesis: “*Riemannian optimization algorithms for applications and their theoretical properties*”

2019 – 2021

**University of Tsukuba** – Tsukuba, 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

2024

**Zhijian Lai**, Akiko Yoshise. “Riemannian Interior Point Methods for Constrained Optimization on Manifolds”. *Journal of Optimization Theory and Applications* **201**, 433–469 (2024).

2022

**Zhijian Lai**, Akiko Yoshise. “Completely Positive Factorization by a Riemannian Smoothing Method”. *Computational Optimization and Applications* **83**, 933–966 (2022).

## Reprints

2023

Xin Yang, Heng Chang, Erxue Min, **Zhijian Lai**. “Hyperbolic Contrastive Learning for Cross-Domain Recommendation”. <https://openreview.net/pdf?id=wPWIAKaxFA>

## Research Experience

2021 – 2024

**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*”

## 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, Institute 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 Institute of Statistical Mathematics Summer Travel Grant
- 2021 – 2024 Research fellowship of Support for **Pioneering Research Initiated by the Next Generation** (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)

2021 – Present

**Professional Service****Society Membership**

Operations Research Society of China

Operations Research Society of Japan

Society for Industrial and Applied Mathematics

Institute for Operations Research and the Management Sciences

**Journal Reviewer**

Journal of Scientific Computing

**Technical Skills****Computer Skills**Proficient in: Matlab, L<sup>A</sup>T<sub>E</sub>X, 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

Phone: +81-29-853-5557, Email: yoshise@sk.tsukuba.ac.jp

**Prof. Ying Miao**

Faculty of Engineering, Information and Systems, University of Tsukuba

Phone: +81-29-853-5009, Email: miao@sk.tsukuba.ac.jp

**Asst. Prof. Qian Wu**

Faculty of Science and Engineering, Hosei University

Phone: +81-42-387-6205, Email: qian.wu.87@hosei.ac.jp