Zhijian Lai

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RESEARCH INTERESTS

My research focuses on Riemannian optimization, quantum computation, and quantum optimization, aiming to develop efficient algorithms that bridge geometric optimization theory with quantum computing.

ACADEMIC EXPERIENCE

Peking University   Beijing, China
Postdoc in Beijing International Center for Mathematical Research, Advisor: Prof. Zaiwen Wen   May 2024 – Present

University of Tsukuba   Tsukuba, Japan
M.S. & Ph.D. in Policy and Planning Sciences, Advisor: Prof. Akiko Yoshise   Apr. 2019 – Mar. 2024

Dongbei University of Finance and Economics   Dalian, China
B.Mgmt. in Logistics Management   Sep. 2013 – Jun. 2017

RESEARCH PAPERS

1. **Zhijian Lai** and Akiko Yoshise, "Completely Positive Factorization by a Riemannian Smoothing Method", Computational Optimization and Applications (2022).

2. **Zhijian Lai** and Akiko Yoshise, "Riemannian Interior Point Methods for Constrained Optimization on Manifolds", Journal of Optimization Theory and Applications (2024).

3. Xin Yang, Heng Chang, **Zhijian Lai**, Jinze Yang, Xingrun Li, Yu Lu, Shuaiqiang Wang, Dawei Yin and Erxue Min, "Hyperbolic Contrastive Learning for Cross-Domain Recommendation", Proceedings of the 33rd ACM International Conference on Information and Knowledge Management (2024).

4. Yuan Zhang, Jiang Hu, **Zhijian Lai**, Lin Lin and Zaiwen Wen, "Retraction-Free Optimization over the Stiefel Manifold for the LoRA Fine-Tuning" (2025).

5. **Zhijian Lai**, Jiang Hu, Taehee Ko, Jiayuan Wu and Dong An, "Interpolation-based Coordinate Descent Method for Parameterized Quantum Circuits", arXiv:2503.04620 (2025).

6. **Zhijian Lai**, Jiang Hu, Dong An and Zaiwen Wen, "Extended Parameter Shift Rules with Minimal Derivative Variance for Parameterized Quantum Circuits", arXiv:2508.08802 (2025).

7. **Zhijian Lai**, Hantao Nie, Jiang Hu, Dong An and Zaiwen Wen, "A Riemannian Optimization Framework for Quantum Circuit Design", manuscript (2025).

8. **Zhijian Lai**, Jiang Hu, Dong An and Zaiwen Wen, "A Grover-compatible Manifold Optimization Method for Quantum Search", manuscript (2025).

9. Chenyi Li, **Zhijian Lai**, Jiang Hu, Dong An and Zaiwen Wen, "Advancing Mathematical Research via Human–AI Interactive Theorem Proving", manuscript (2025).

PRESENTATIONS

- Riemannian Interior Point Methods for Constrained Optimization on Manifolds
  25th International Symposium on Mathematical Programming (ISMP 2024) Montréal, Canada, 2024

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

- Interior Point Methods for Nonlinear Optimization on Riemannian Manifolds
  SIAM Conference on Optimization (SIAM OP23) Seattle, USA, 2023

- Completely Positive Factorization via Orthogonality Constrained Problem
  SIAM Conference on Optimization (SIAM OP21) Hong Kong, China, 2021

HONORS AND AWARDS

- **Young Scientists Fund (C Class), National Natural Science Foundation of China (NSFC)** 2025
- Boya Postdoctoral Fellowship, Peking University 2024–Present
- SPRING Research Fellowship, Japan Science and Technology Agency (JSPS) 2021–2024

TEACHING

Instructor at Peking University

- 00130202, Advanced Mathematics B-2 Spring 2025
  Course website & lecture notes: gitee.com/galvin-lai/Advanced-Mathematics-Class-B2-07

- 00130201, Advanced Mathematics B-1 Fall 2024
  Course website & lecture notes: gitee.com/galvin-lai/Advanced-Mathematics-Class-B-07

Teaching Assistant at University of Tsukuba

- FH35012, Problem Identification and Resolution, by Prof. Akiko Yoshise Fall 2022
- FH61141, Society and Optimization, by Prof. Akiko Yoshise et al. Fall 2022, 2023
- 0AL5100, Supply Chain Management, by Prof. Hisashi Kurata Fall 2021

PROFESSIONAL SERVICES

Reviewer for

- Journal of Scientific Computing (JSC)
- Electronic Research Archive (ERA)
- Japan Journal of Industrial and Applied Mathematics (JIAM)
- Quantum Engineering
- 25th Asian Quantum Information Science Conference (AQIS 2025)
- Physical Review Applied (PRApplied)

SKILLS

- Programming: Python, Matlab
- Software: LaTeX, git
- Open Source Project: LatexFormatting — a utility tool for formatting LaTeX code generated by ChatGPT.

LANGUAGES

- Chinese
- English
- Japanese: JLPT N1