

Zhijian Lai (赖志坚)

Born: Feb 11, 1995 (Wenzhou, Zhejiang)
Email: lai_zhijian@pku.edu.cn **Tel:** (+86) 190-5016-2715
Web: galvinlai.github.io
Addr: 5 Yiheyuan Road, Haidian, Beijing, China



RESEARCH INTERESTS

My research focuses on **Riemannian optimization** and **quantum computing**, as well as the intersection between optimization theory and quantum computing, especially quantum search algorithms, variational quantum algorithms, parameter-shift estimation, and constrained/nonsmooth matrix manifold optimization.

ACADEMIC EXPERIENCE

Peking University Postdoc, Beijing International Center for Mathematical Research Advisor: Prof. Zaiwen Wen	Apr. 2024 – Present Beijing, China
University of Tsukuba M.S. & Ph.D. in Policy and Planning Sciences Advisor: Prof. Akiko Yoshise	Apr. 2019 – Mar. 2024 Tsukuba, Japan
Dongbei University of Finance and Economics B.Mgmt. in Logistics Management	Sep. 2013 – Jun. 2017 Dalian, China

AWARDS & GRANTS

Young Scientists Fund (Class C), National Natural Science Foundation of China Project: Manifold Optimization Theory and Algorithms in Quantum Information Science; Grant No. 1250141	2026 – 2028
Boya Postdoctoral Fellowship, Peking University	2024 – 2026
Spring Doctoral Fellowship, Japan Science and Technology Agency Selected as Class 1 Student; JPY 2.9 million/year	2021 – 2024

RESEARCH PAPERS

Ranking labels: CAS T = Chinese Academy of Sciences journal tier; JCR Q = Journal Citation Reports quartile; CMS T = Chinese Mathematical Society high-quality journal tier; CCF = China Computer Federation conference rank.

Publications and Accepted Papers

- Zhijian Lai**, Dong An, Jiang Hu and Zaiwen Wen, “A Grover-compatible manifold optimization algorithm for quantum search”, accepted by *SIAM Journal on Scientific Computing*, 2026. [[CAS T1](#), [JCR Q1](#), [CMS T1](#)]
- Zhijian Lai**, Jiang Hu, Taehee Ko, Jiayuan Wu and Dong An, “Interpolation-based coordinate descent method for parameterized quantum circuits”, *Communications Physics*, 2026. [[CAS T1](#), [JCR Q1](#), [Nature Portfolio](#)]
- Zhijian Lai**, Jiang Hu, Dong An and Zaiwen Wen, “Extended parameter shift rules with minimal derivative variance for parameterized quantum circuits”, *Physical Review Applied*, 2026. [[CAS T2](#), [JCR Q2](#)]
- 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 (CIKM)*, 2024. [[CCF-B](#)]
- Zhijian Lai** and Akiko Yoshise, “Riemannian interior point methods for constrained optimization on manifolds”, *Journal of Optimization Theory and Applications*, 2024. [[CAS T3](#), [JCR Q2](#), [CMS T2](#)]
- Zhijian Lai** and Akiko Yoshise, “Completely positive factorization by a Riemannian smoothing method”, *Computational Optimization and Applications*, 2022. [[CAS T3](#), [JCR Q1](#), [CMS T2](#)]

Preprints

- Hantao Nie, **Zhijian Lai**, Dong An, “Pauli-structured preconditioning for quantum linear system solvers”, [arXiv:2606.01733](#), preprint, 2026.

8. **Zhijian Lai**, Dong An, Jiang Hu and Zaiwen Wen, “Achieving double-logarithmic precision dependence in optimization-based quantum unstructured search”, [arXiv:2603.26039](#), preprint, 2026.
9. **Zhijian Lai**, Hantao Nie, Jiayuan Wu and Dong An, “Quantum circuit design from a retraction-based Riemannian optimization framework”, [arXiv:2602.20605](#), preprint, 2026.
10. Chenyi Li, **Zhijian Lai**, Dong An, Jiang Hu and Zaiwen Wen, “Advancing mathematical research via human–AI interactive theorem proving”, [arXiv:2512.09443](#), preprint, 2025.
11. Yuan Zhang, Jiang Hu, **Zhijian Lai**, Lin Lin and Zaiwen Wen, “Retraction-free optimization over the Stiefel manifold for the LoRA fine-tuning”, preprint, 2024.

PRESENTATIONS

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|---|-----------------|
| • 2026 International Conference on Optimization: Techniques and Applications (ICOTA 2026) | Shanghai, 2026 |
| • 29th Annual Quantum Information Processing Conference (QIP 2026) | Riga, 2026 |
| • 4th CCF Quantum Computing Conference (CQCC 2025) | Chengdu, 2025 |
| • 25th International Symposium on Mathematical Programming (ISMP 2024) | Montréal, 2024 |
| • 10th International Congress on Industrial and Applied Mathematics (ICIAM 2023) | Tokyo, 2023 |
| • 2023 SIAM Conference on Optimization (SIAM OP23) | Seattle, 2023 |
| • 2021 SIAM Conference on Optimization (SIAM OP21) | Hong Kong, 2021 |

TEACHING

Instructor at Peking University

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| • 00130202, Advanced Mathematics B II (Undergraduate Core Course)
118 students; over 500 pages of lecture notes: gitee.com/galvin-lai/Advanced-Mathematics-Class-B2-07 | Spring 2025 |
| • 00130201, Advanced Mathematics B I (Undergraduate Core Course)
130 students; over 480 pages of lecture notes: gitee.com/galvin-lai/Advanced-Mathematics-Class-B-07 | Fall 2024 |

Teaching Assistant at University of Tsukuba

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| • 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

- Quantum
- Physical Review Applied
- Journal of Scientific Computing
- Journal of Global Optimization
- CSIAM Transactions on Applied Mathematics (CSIAM-AM)
- 25th Asian Quantum Information Science Conference (AQIS 2025)
- Japan Journal of Industrial and Applied Mathematics

Member of

- Operations Research Society of China (ORSC)
- Operations Research Society of Japan (ORSJ)
- China Society for Industrial and Applied Mathematics (CSIAM)
- China Computer Federation (CCF)