Zehua Lai

Employment

Since 2023   **R. H. Bing Instructor of Mathematics**, *University of Texas at Austin*, Austin, TX

Education

2018–2023   **Ph.D. in Computational and Applied Mathematics**, *University of Chicago*, Chicago, IL

2014–2018   **B.A. in Mathematics, B.A. in Economics and Finance**, *Tsinghua University*, Beijing, China

Honors

2018   **Neubauer Family Distinguished Doctoral Fellowship**, *Chicago*, IL
`http://grad.uchicago.edu/fellowships/neubauer-fellows/`

2017   **Gold Medal, S.-T. Yau College Student Mathematics Contests**, *Beijing*, China, Chia-Chiao Lin Gold Medal in Computational and Applied Mathematics
`http://www.cms.zju.edu.cn/conference/ycmc/YCMC.html`

2014   **Tsinghua Freshman Fellowship**, *Beijing*, China

2013   **Gold Medal, China Mathematical Olympiad**, *Nanjing*, China, ranked 29th nationwide

Papers

2025   Z. Lai, L. Lim, "Pierce-Birkhoff conjecture is true for splines", (2025), `https://arxiv.org/abs/2507.07976`

2025   Z. Lai, L. Lim, T. Tang, "Stiefel optimization is NP-hard", (2025), `https://arxiv.org/abs/2507.02839`

2025   Z. Lai, L. Lim, K. Ye, "Euclidean distance degree in manifold optimization", (2025), `https://arxiv.org/abs/2502.10336`

2024   Z. Lai, L. Lim, Y. Liu, "Attention is a smoothed cubic spline," *preprint*, (2024), `https://www.arxiv.org/abs/2408.09624`

2024   Z. Lai, L. Lim, K. Ye, "Grassmannian optimization is NP-hard," *preprint (accepted by SIOPT)*, (2024), `https://arxiv.org/abs/2406.19377`

2024   Z. Lai, L. Lim, K. Ye, "Simple matrix expressions for the curvatures of Grassmannian," *preprint (accepted by FoCM)*, (2024), `https://arxiv.org/abs/2406.11821`

2024   M. Zhao, Z. Lai, L. Lim, "Stochastic Steffensen method," *Computational Optimization and Applications*, (2024), `https://doi.org/10.1007/s10589-024-00583-7`

2023   X. Chen, Z. Lai, H. Li, Y. Zhang, "Online statistical inference for stochastic optimization via Kiefer–Wolfowitz methods," *Journal of the American Statistical Association*, (2023), `https://doi.org/10.1080/01621459.2023.2296703`

2022   X. Chen, Z. Lai, H. Li, Y. Zhang, "Online statistical inference for contextual bandits via stochastic gradient descent," *preprint*, (2022), `http://laizehua.github.io/files/bandit.pdf`

2022   Z. Lai, L. Lim, K. Ye, "Simpler flag manifold optimization," *preprint*, (2022), `https://arxiv.org/abs/2212.00212`

2022   S. Friedland, Z. Lai, L. Lim, "Haagerup bound for quaternionic Grothendieck inequality," *preprint*, (2022), `https://arxiv.org/abs/2212.00208`

2020 Z. Lai, L.-H. Lim, K. Ye, "Simpler Grassmannian optimization," *preprint*, (2020), `http://arxiv.org/abs/2009.13502`

2020 Z. Lai, L.-H. Lim, "Recht–Ré noncommutative arithmetic-geometric mean conjecture is false," *Proceedings of the 37th International Conference on Machine Learning* (ICML), PMLR **119**, (2020), pp. 5608–5617

Talks

July 2025	International Conference on Continuous Optimization, University of Southern California, Los Angeles, CA
July 2025	SIAM Conference on Applied Algebraic Geometry, University of Wisconsin-Madison, Madison, WI
June 2025	Householder Symposium XXII, Cornell University, Ithaca, NY
Feb 2025	Mathematics in Deep Learning Workshop, University of Texas, Austin, TX
Feb 2025	Conference on Data Analytics and Topology, Online
Jan 2025	AMS Special Session on Topological, Algebraic, and Geometric Methods for Safe, Robust, and Explainable Machine Learning, Joint Mathematics Meeting, Seattle, WA
Oct 2024	Math and Data Seminar, The Department of Mathematics, University of Missouri, Columbia, MO
Oct 2024	7th Annual Meeting of SIAM Conference Texas-Louisiana Section, Baylor University, Waco, TX
Oct 2024	Math Machine Learning seminar, Max Planck Institute for Mathematics in the Sciences/UCLA, Online
Aug 2024	Applied Algebra Seminar, The Department of Mathematics, University of Wisconsin, Madison, WI
Jun 2024	2024 Workshop: Matrices and Operators, The Department of Mathematics and Statistics, University of Nevada, Reno, NV
May 2024	Workshop on Statistical Machine Learning for High Dimensional Data, Institute for Mathematical Sciences, National University of Singapore
Sept 2023	Applied Mathematics Seminar, University of Texas, Austin, TX
July 2023	SIAM Conference on Applied Algebraic Geometry, Eindhoven University of Technology, Eindhoven, Netherlands
May 2023	Seminar, Academy of Mathematics and Systems Science, Chinese Academy of Sciences, Beijing, China
Jan 2023	Center for Computational and Applied Mathematics Seminar, Purdue University, West Lafayette, IN
July 2022	2nd Young Topologist Seminar, Beijing Institute of Mathematical Sciences and Applications, Beijing, China
Mar 2022	AMS Spring Central Sectional Meeting, Special Session on Mathematical Foundation of Data Science in Scientific Computing, Purdue University, West Lafayette, IN
Mar 2022	AMS Spring Central Sectional Meeting, Special Session on Numerical Linear Algebra, Purdue University, West Lafayette, IN
Jan 2022	Joint Mathematics Meetings, International Linear Algebra Society Special Session on Matrix Analysis and Applications, Seattle, WA
Nov 2021	4th Annual Meeting of SIAM Conference Texas-Louisiana Section, South Padre Island, TX
Apr 2021	Optimization and Data Science Seminar, University of California, San Diego, CA
Jan 2021	Sanya Workshop on Algebraic Geometry and Machine Learning, Tsinghua Sanya International Mathematics Forum, Sanya, China
Nov 2020	Algebraic Statistics Online Seminar
Jul 2020	37th International Conference on Machine Learning
Dec 2019	International Conference on Data Science, Fudan University, Shanghai, China

Sep 2019   Seminar, Academy of Mathematics and Systems Science, Chinese Academy of Sciences, Beijing, China

Sep 2019   AMS Fall Central Sectional Meeting, Special Session on Applications of Algebra and Geometry, University of Wisconsin-Madison, Madison, WI

Services

Organizer

Jun 2025   ILAS 2025 Conference, Minisymposium on *Advances in Matrix Manifold Optimization*, Jun 23–27, 2025

May 2021   SIAM Conference on Applied Linear Algebra Minisymposium on *Linear Algebra and Differential Geometry*, May 17–21, 2021

Jun 2019   RTG Summer Lectures on *Numerical Methods in Data Science* and *Deep Neural Networks*, http://www.stat.uchicago.edu/events/rtg/, June 17–21, 2019

Referee

Annals of Statistics

Applied Numerical Mathematics

Arnold Mathematical Journal

BIT Numerical Mathematics

Computational Geometry: Theory and Applications

Conference on Neural Information Processing Systems

Foundations of Computational Mathematics

IEEE Journal of Selected Topics in Signal Processing

Information and Inference: A Journal of the IMA

International Conference on Learning Representations

International Conference on Machine Learning

Journal of Machine Learning Research

Journal of Mathematical Physics

Journal of Scientific Computing

Journal of Symbolic Computation

Linear Algebra and its Applications

Linear and Multilinear Algebra

Mathematics of Operations Research

Mathematical Programming (2024 Meritorious Service Award)

Numerical Algorithms

Numerical Linear Algebra with Applications

Optimization Methods and Software

SIAM Journal on Optimization

Transactions on Mathematical Software

Vietnam Journal of Mathematics

Teaching

The University of Austin at Texas

Spring 2025   MATH 362M Introduction to Stochastic Processes, Instructor

Fall 2024   MATH 348 Numerical Analysis, Instructor

Spring 2024   MATH 362K Probability, Instructor

The University of Chicago

Spring 2022	STAT 28000 Optimization, Teaching Assistant
Autumn 2021	FINM 33180 Multivariate Data Analysis via Matrix Decompositions, Teaching Assistant
Winter 2021	STAT 28000 Optimization, Teaching Assistant
Autumn 2020	STAT 30900 Matrix Computations, Teaching Assistant
Spring 2020	STAT 28000 Optimization, Teaching Assistant
Winter 2020	STAT 31220 Partial Differential Equations, Teaching Assistant
Autumn 2019	STAT 30900 Matrix Computations, Teaching Assistant