Jiaxiang Li

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Appointments

Meta Platforms, Inc. — Sunnyvale, CA
AI Research Scientist — Aug 2025–Now
Working on large-scale training and optimization

University of Minnesota — Minneapolis, MN
Postdoctoral Associate, Department of Electrical and Computer Engineering — Jan 2024–Aug 2025
Mentor: Mingyi Hong and Shuzhong Zhang

Education

University of California, Davis — Davis, CA
Ph.D. in Applied Mathematics, GPA: 3.97/4.00 — Sept 2018–Dec 2023
Advisor: Shiqian Ma and Krishnakumar Balasubramanian

Zhejiang University — Hangzhou, China
B.S. in Mathematics, GPA: 3.88/4.00 — Sept 2014–July 2018

Research Interest

My research lies at the intersection of applied mathematics, optimization theory, and artificial intelligence, with a focus on developing principled algorithms that advance both **theoretical foundations** and **practical applications** in modern machine learning. Specifically, I work on:

- Algorithm design for gradient-based, gradient-free (zeroth-order), and primal–dual methods for large-scale nonconvex optimization, including problems on Riemannian manifolds.
- Convergence theory for deterministic and stochastic minimax and bilevel optimization, with applications to machine learning and operations research.
- Distributed, decentralized and federated optimization algorithms for training large-scale AI systems.
- Theoretical foundations of reinforcement learning, especially policy-based methods, and their role in aligning large language models (LLMs).
- Efficient pre-training and fine-tuning methods for LLMs, bridging optimization principles with practical deployment.

Fundings

Honors and Awards

- INFORMS Computing Society Prize — 2024
- INFORMS Optimization Conference Travel Award — 2024
- Graduate Student Fellowship at UC Davis — 2018–2019, 2022-2023

Publications and Preprints (* marks co-first author)

[1] X. Zhang, C. Li, S. Zeng, **J. Li**, Z. Wang, S. Lu, A. Garcia, and M. Hong, "Reinforcement Learning in Inference Time: A Perspective from Successive Policy Iterations", in *ICLR 2025 Workshop on Reasoning and Planning for Large Language Models*.

[2] A. Glentis*, **J. Li***, A. Han, and M. Hong, "A minimalist optimizer design for llm pretraining", *arXiv preprint arXiv:2506.16659*, 2025.

[3] A. Glentis*, **J. Li***, Q. Shang*, A. Han, I. Tsaknakis, Q. Wei, and M. Hong, "Scalable parameter and memory efficient pretraining for llm: Recent algorithmic advances and benchmarking", *arXiv preprint arXiv:2505.22922*, 2025.

[4] C. He, **J. Li**, B. Jiang, S. Ma, and S. Zhang, "On relatively smooth optimization over riemannian manifolds", *arXiv preprint arXiv:2508.03048 (Submitted to SIAM Journal on Optimization)*, 2025.

[5] X. Jiang, **J. Li**, M. Hong, and S. Zhang, "A correspondence-driven approach for bilevel decision-making with nonconvex lower-level problems", *arXiv preprint arXiv:2509.01148*, 2025.

[6] C. Li, S. Zeng, Z. Liao, **J. Li**, D. Kang, A. Garcia, and M. Hong, "Joint reward and policy learning with demonstrations and human feedback improves alignment", in *The Thirteenth International Conference on Learning Representations (ICLR, Spotlight)*, 2025.

[7] **J. Li** and S. Ma, "Riemannian bilevel optimization", *Journal of Machine Learning Research*, vol. 26, no. 18, pp. 1–44, 2025.

[8] H. Wang, Z. Pan, C. He, **J. Li**, and B. Jiang, "Federated learning on riemannian manifolds: A gradient-free projection-based approach", *arXiv preprint arXiv:2507.22855 (Submitted to IEEE Transactions on Automatic Control)*, 2025.

[9] S. Zeng, L. Viano, C. Li, **J. Li**, V. Cevher, M. Wulfmeier, S. Ermon, A. Garcia, and M. Hong, "Aligning large language models with human feedback: Mathematical foundations and algorithm design", *Authorea Preprints*, 2025.

[10] X. Zhang, C. Li, S. Zeng, **J. Li**, Z. Wang, K. Lin, S. Lu, A. Garcia, and M. Hong, "Aligning frozen llms by reinforcement learning: An iterative reweight-then-optimize approach", *arXiv preprint arXiv:2506.17828*, 2025.

[11] A. Han, **J. Li**, W. Huang, M. Hong, A. Takeda, P. Jawanpuria, and B. Mishra, "SLTrain: A sparse plus low-rank approach for parameter and memory efficient pretraining", in *Thirty-Eighth Annual Conference on Neural Information Processing Systems (NeurIPS)*, 2024.

[12] X. Jiang, **J. Li**, M. Hong, and S. Zhang, "Barrier function for bilevel optimization with coupled lower-level constraints: Formulation, approximation and algorithms", *arXiv preprint arXiv:2410.10670 (Major revision in Mathematical Programming)*, 2024.

[13] **J. Li**, K. Balasubramanian, and S. Ma, "Zeroth-order Riemannian averaging stochastic approximation algorithms", *SIAM Journal on Optimization*, vol. 34, no. 4, pp. 3314–3341, 2024.

[14] **J. Li**, X. Chen, S. Ma, and M. Hong, "Problem-Parameter-Free Decentralized Nonconvex Stochastic Optimization", *Pacific Journal on Optimization (Accepted), arXiv:2402.08821*, 2024.

[15] **J. Li**, S. Ma, and T. Srivastava, "A riemannian alternating direction method of multipliers", *Mathematics of Operations Research*, 2024.

[16] **J. Li**, S. Zeng, H.-T. Wai, C. Li, A. Garcia, and M. Hong, "Getting More Juice Out of the SFT Data: Reward Learning from Human Demonstration Improves SFT for LLM Alignment", in *Thirty-Eighth Annual Conference on Neural Information Processing Systems (NeurIPS)*, 2024.

[17] X. Zhang, S. Zeng, **J. Li**, K. Lin, and M. Hong, "Policy optimization can be memory-efficient: LLM Alignment Through Successive Policy Re-weighting (SPR)", in *NeurIPS 2024 Workshop on Fine-Tuning in Modern Machine Learning: Principles and Scalability*, 2024.

[18] Y. Zhang*, P. Li*, J. Hong*, **J. Li***, Y. Zhang, W. Zheng, P.-Y. Chen, J. D. Lee, W. Yin, M. Hong, Z. Wang, S. Liu, and T. Chen, "Revisiting Zeroth-Order Optimization for Memory-Efficient LLM Fine-Tuning: A Benchmark", in *Proceedings of the 41st International Conference on Machine Learning (ICML)*, vol. 235, PMLR, 2024, pp. 59 173–59 190.

[19] **J. Li**, K. Balasubramanian, and S. Ma, "Stochastic Zeroth-order Riemannian Derivative Estimation and Optimization", *Mathematics of Operations Research*, vol. 48, no. 2, pp. 1183–1211, 2023.

[20] **J. Li** and S. Ma, "Federated Learning on Riemannian Manifolds", *Appl. Set-Valued Anal. Optim. 5 (2023), 213-232*, 2023.

Teaching

- **Lecturer** at University of Minnesota
  - EE5239 Introduction to Nonlinear Optimization (Jointly teaching with Prof. Mingyi Hong)
- **Teaching Assistant** at UC Davis
  - MAT 127 Real Analysis
  - MAT 168 Optimization
  - MAT 170 Math in Data Science
  - MAT 21 ABCD Calculus Series
  - MAT 17 ABC Calculus for Biology Series

Talks

- ICCOPT, session speaker — July 2025
  Topic: A Riemannian ADMM
- INFORMS Annual meeting, session speaker — October 2024
  Topic: A Riemannian ADMM
- INFORMS Optimization Society Conference, session speaker — March 2024
  Topic: Zeroth order moving average methods on manifolds
- INFORMS Optimization Society Conference, session speaker — March 2022
  Topic: Zeroth order optimization on Riemannian manifolds
- Modeling and Optimization: Theory and Applications (MOPTA), session speaker — August 2021
  Topic: Zeroth order optimization on Riemannian manifolds
- SIAM Conference on Optimization, session speaker — July 2021
  Topic: Zeroth order optimization on Riemannian manifolds

Academic services

- Journal Reviewer
  INFORMS Journal on Computing, Information and Inference: A Journal of the IMA, Journal of Machine Learning Research, Computational Optimization and Applications, Journal of Scientific Computing, Journal of Global Optimization
- Conference Reviewer
  AISTATS (2021, 2022, 2023), ICML (2022, 2024, 2025), NeurIPS (2023, 2024, 2025), ICLR (2023, 2024), AAAI (2024)

Internship Experience

Amazon.com, Inc. — Seattle, WA
Applied Scientist Intern — June 2023–Sept 2023

- Amazon Prime Science ML Team
- Built customer-prime service engagement history aggregation model with 1.2% offline evaluation gain
- Developed data pipeline for engagement history features using Pyspark and AWS services
- Built customer-prime service engagement trajectory model using seq2seq modeling and Attention networks

Meta Platforms, Inc. — Menlo Park, CA
Software Engineer Intern, Machine Learning — June 2022–Sept 2022

- Ads Core Machine Learning ENG Team
- Built reinforcement learning based Slate-Q long-term value optimization for Ads recommender in Facebook
- Designed large-scale data pipeline and managed data from industry-level databases using SQL and Hadoop Hive
- Initiated and conduct large-scale deep Q-networks training in PyTorch