

Zitao Song

Ph.D. Researcher in Machine Learning, Optimization, and Efficient AI

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Summary

Machine learning researcher developing scalable and theoretically grounded optimization methods for large models and scientific discovery. First author of papers at ICML, ICLR, and Nature Communications, with research spanning LLM pretraining, matrix optimization, nonsmooth optimization, probabilistic generative models, and reinforcement learning.

Education

Purdue University

Ph.D. in Computer Science; Lynn Fellow

West Lafayette, IN

Expected May 2029

The Chinese University of Hong Kong, Shenzhen

M.S. in Data Science; GPA: 3.77/4.00, top 5%

Shenzhen, China

Nov. 2023

University of Liverpool, XJTLU Campus

B.S. in Applied Mathematics; GPA: 3.98/4.00, top 5%

Suzhou, China

Jun. 2021

Selected Publications

- **Z. Song**, C. S. Bai, Z. Zhang, B. Bullins, and D. F. Gleich. “Decoupling Variance and Scale-Invariant Updates in Adaptive Gradient Descent for Unified Vector and Matrix Optimization.” *ICML*, 2026. [paper] [code]
- **Z. Song**, C. Yang, C. Wang, B. An, and S. Li. “Latent Logic Tree Extraction for Event Sequence Explanation from LLMs.” *ICML*, 2024. [paper]
- **Z. Song**, W. Ren, and S. Li. “Amortized Network Intervention to Steer the Excitatory Point Processes.” *ICLR*, 2024. [paper]
- **Z. Song**, D. Huang, B. Song, et al. “Attention-Based Multi-Label Neural Networks for Integrated Prediction and Interpretation of Twelve Widely Occurring RNA Modifications.” *Nature Communications*, 2021.

Preprints

- **Z. Song**, C. S. Bai, Z. Zhang, B. Bullins, and D. F. Gleich. “Can Entry-Wise Clipping Give Spectral Control of Stochastic Gradients?” arXiv:2605.27733, 2026. [paper]

Awards

Lynn Fellowship , Purdue University	2024–2025
M.Sc. Excellence Academic Scholarship , CUHK-Shenzhen (top 5%)	2021–2023
Suzhou Outstanding Academic Paper Prize , First Prize	2022
Academic Excellence Award , XJTLU (top 5%)	2017–2020

Research Experience

Purdue University

West Lafayette, IN

Graduate Research Assistant, advised by Prof. David F. Gleich

Aug. 2024 – Present

- Developed **DeVA**, bridging variance adaptation and matrix spectral optimization; outperformed Muon and SOAP while reducing language-model training tokens by approximately **6.6%** (**ICML 2026**).
- Developed entry-wise gradient clipping for spectral control under heavy-tailed noise, saving approximately **7%** of NanoGPT training tokens; research also spans efficient matrix reduction and compression for LLMs.

Nanyang Technological University

Singapore

Research Associate, Agent Mediated Intelligence Group

Aug. 2023 – Jun. 2024

- Designed Monte Carlo tree search and local-search methods for constrained scientific discovery; contributed ML trading strategies to the open-source TradeMaster platform.

Shenzhen Research Institute of Big Data

Shenzhen, China

Research Assistant, advised by Prof. Shuang Li

Jun. 2022 – Jun. 2023

- Developed generative and reinforcement-learning methods to intervene on and explain temporal point processes in healthcare data, leading to first-author papers at **ICLR 2024** and **ICML 2024**.
- Built GFlowNet and score-based methods for causal graph generation from multivariate time series and translated LLM explanations into interpretable latent logic trees.

Xi'an Jiaotong-Liverpool University

Suzhou, China

Research Assistant

Sep. 2020 – Jun. 2022

- Implemented TD3, D3PG, SAC, and hierarchical reinforcement learning for portfolio optimization; evaluated strategies against S&P 500 and CSI 300 benchmarks.
- Co-developed an attention-based multi-label model for joint prediction and interpretation of 12 RNA modifications; published as first author in **Nature Communications**.

Academic Service

Reviewing

ICML; TMLR	2026
ICLR	2024–2026
NeurIPS	2025

Teaching

Teaching Assistant, CS 515 Numerical Linear Algebra, Purdue University	Fall 2025
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Academic Talks & Presentations

Poster Presentation, Midwest Machine Learning Symposium (MMLS)	2026
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