Ruizhe Zhang

CONTACT
INFORMATION

Simons Institute for the Theory of Computing
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RESEARCH
INTERESTS

Theoretical computer science, quantum computing, and machine learning.

EMPLOYMENT

University of California, Berkeley   Fall 2023 - present
Simons Quantum Postdoctoral Fellow
Host: Umesh Vazirani

EDUCATION

The University of Texas at Austin   August 2023
Ph.D. in Computer Science
Thesis: *Quantum Meets Optimization and Machine Learning*
Advisor: Dana Moshkovitz

Fudan University   May 2018
B.S. in Computer Science, *Honors Class*

ACADEMIC
EXPERIENCE

The University of Texas at Austin   Fall 2018 - Fall 2021
Position: Research Assistant
Supervisors: Dana Moshkovitz, Scott Aaronson

Zapata Computing, Inc.   Summer 2021, Summer 2022
Position: Quantum Research Intern
Supervisors: Peter Johnson, Guoming Wang

HONORS AND
AWARDS

University Graduate Continuing Fellowship, UT Austin Graduate School
Fudan University First Prize Scholarship, Wonders Information
The ACM-ICPC Asia Regional Contest Gold Medal, Shanghai Site
The ACM-ICPC Asia Regional Contest Gold Medal, Hefei Site

PUBLICATIONS

[1] Zhao Song, Baocheng Sun, Omri Weinstein, **Ruizhe Zhang**. Quartic Samples Suffice for Fourier Interpolation. To appear at *the 64rd Annual Symposium on Foundations of Computer Science (FOCS)*, 2023.

[2] **Ruizhe Zhang**, Xinzhi Zhang. Hyperbolic Extension of Kadison-Singer Type Results. In *Proceedings of the 50th EATCS International Colloquium on Automata, Languages, and Programming*(ICALP), 2023.

[3] Guoming Wang, Daniel Stilck França, **Ruizhe Zhang**, Shuchen Zhu, Peter D. Johnson. Quantum algorithm for ground state energy estimation using circuit depth with exponentially improved dependence on precision. In *Quantum Computing Theory in Practice* (QCTiP), 2023. (Contributed talk)

[4] Andrew Childs, Tongyang Li, Jin-Peng Liu, Chunhao Wang, **Ruizhe Zhang**. Quantum Algorithms for Sampling Log-Concave Distributions and Estimating Normalizing Constants. In *Proceedings of the 36th Conference on Neural Information Processing Systems* (NeurIPS), 2022. In *26th Annual Conference on Quantum Information Processing* (QIP), 2023. (Contributed talk)

[5] Tongyang Li, **Ruizhe Zhang**. Quantum Speedups of Optimizing Approximately Convex Functions with Applications to Logarithmic Regret Stochastic Convex Bandits. In *Proceedings of the 36th Conference on Neural Information Processing Systems* (NeurIPS), 2022.

[6] Yichuan Deng, Zhao Song, Omri Weinstein, **Ruizhe Zhang**. Fast Distance Oracles for Any Symmetric Norm. In *Proceedings of the 36th Conference on Neural Information Processing Systems* (NeurIPS), 2022.

[7] Baihe Huang, Shunhua Jiang, Zhao Song, Runzhou Tao, **Ruizhe Zhang**. Solving SDP Faster: A Robust IPM Framework and Efficient Implementation. In *Proceedings of the 63rd Annual Symposium on Foundations of Computer Science* (FOCS), 2022.

[8] **Ruizhe Zhang**, Guoming Wang, Peter Johnson. Computing Ground State Properties with Early Fault-Tolerant Quantum Computers. In *Quantum, Volume 6, Number 761*, 2022.

[9] Jason Gaitonde, Max Hopkins, Tali Kaufman, Shachar Lovett, **Ruizhe Zhang**. Eigenstripping, Spectral Decay, and Edge-Expansion on Posets. In *Proceedings of the 26th International Conference on Randomization and Computation* (RANDOM), 2022.

[10] Zhao Song, **Ruizhe Zhang**. Hyperbolic Concentration, Anti-concentration, and Discrepancy. In *Proceedings of the 26th International Conference on Randomization and Computation* (RANDOM), 2022.

[11] Sitan Chen, Zhao Song, Runzhou Tao, **Ruizhe Zhang**. Symmetric Sparse Boolean Matrix Factorization and Applications. In *Proceedings of the 13th Innovations in Theoretical Computer Science Conference* (ITCS), 2022.

[12] Nai-Hui Chia, Chi-Ning Chou, Jiayu Zhang, **Ruizhe Zhang**. Quantum Meets Minimum Circuit Size Problem. In *Proceedings of the 13th Innovations in Theoretical Computer Science Conference* (ITCS), 2022.

[13] Zhao Song, Shuo Yang, **Ruizhe Zhang**. Does Preprocessing Help Training Over-Parameterized Neural Networks? In *Proceedings of the 35th Conference on Neural Information Processing Systems* (NeurIPS), 2021.

[14] Yuxuan Zhang, **Ruizhe Zhang**, Andrew C. Potter. QED driven QAOA for network-flow optimization. In *Quantum, Volume 5, Number 510*, 2021.

[15] Scott Aaronson, Jiahui Liu, Qipeng Liu, Mark Zhandry, **Ruizhe Zhang**. New Approaches for Quantum Copy-Protection. In *Proceedings of the 41st Annual International Cryptology Conference* (CRYPTO), 2021.

[16] Scott Aaronson, Nai-Hui Chia, Han-Hsuan Lin, Chunhao Wang, **Ruizhe Zhang**. On the Quantum Complexity of Closest Pair and Related Problems. In *Proceedings of the 35th Computational Complexity Conference* (CCC), 2020.

PREPRINTS

[1] Yeqi Gao, Zhao Song, Xin Yang, **Ruizhe Zhang**. Fast quantum algorithm for attention computation. *arXiv preprint arXiv:2307.08045*, 2023.

[2] Lianke Qin, Zhao Song, **Ruizhe Zhang**. A General Algorithm for Solving Rank-one Matrix Sensing. *arXiv preprint arXiv:2303.12298*, 2023.

[3] Hongru Yang, Ziyu Jiang, **Ruizhe Zhang**, Zhangyang Wang, Yingbin Liang. Convergence and Generalization of Wide Neural Networks with Large Bias. *arXiv preprint arXiv:2301.00327*, 2023.

[4] Josh Alman, Jiehao Liang, Zhao Song, **Ruizhe Zhang**, Danyang Zhuo. Bypass exponential time preprocessing: Fast neural network training via weight-data correlation preprocessing. *arXiv preprint arXiv:2211.14227*, 2022.

[5] Baihe Huang, Shunhua Jiang, Zhao Song, Runzhou Tao, **Ruizhe Zhang**. A Faster Quantum Algorithm for Semidefinite Programming via Robust IPM Framework. *arXiv preprint arXiv:2207.11154*, 2022.

[6] Zhao Song, Baocheng Sun, Omri Weinstein, **Ruizhe Zhang**. Sparse Fourier Transform over Lattices: A Unified Approach to Signal Reconstruction. *arXiv preprint arXiv:2205.00658*, 2022.

[7] Baihe Huang, Zhao Song, Omri Weinstein, Hengjie Zhang, **Ruizhe Zhang**. A Dynamic Fast Gaussian Transform. *arXiv preprint arXiv:2202.12329*, 2022.

[8] Zhao Song, Lichen Zhang, **Ruizhe Zhang**. Training Multi-Layer Over-Parametrized Neural Network in Subquadratic Time. *arXiv preprint arXiv:2112.07628*, 2021.

[9] Baihe Huang, Zhao Song, Runzhou Tao, **Ruizhe Zhang**, Danyang Zhuo. InstaHide's Sample Complexity When Mixing Two Private Images. *arXiv preprint arXiv:2011.11877*, 2020.

Talks

Quantum Algorithm for Ground State Energy Estimation Using Circuit Depth With Exponentially Improved Dependence on Precision
    – Contributed talk at APS March Meeting 2023   Mar, 2023

Quantum Speedups of Continuous Sampling and Optimization Problems
    – Invited talk at George Mason University Theory Seminar   Apr, 2023
    – Invited talk at MIT Quantum Information Processing Seminar   Jan, 2023

Solving SDP Faster: A Robust IPM Framework and Efficient Implementation
    – Invited talk at UT Austin Theory Seminar   Apr, 2023
    – The 63rd Annual Symposium on Foundations of Computer Science (FOCS 2022) Nov, 2022

Ground State Energy and Property Estimation with Low Quantum Circuit Depth
    – Invited talk at QUARK Lab at Peking University   Oct, 2022

Hyperbolic Concentration, Anti-concentration, and Discrepancy
    – The 26th International Conference on Randomization and Computation (RANDOM 2022)   Sept, 2022

On the Quantum Fine-Grained Complexity of Closest Pair and Related Problems
    – Invited talk at University of Washington Theory Seminar   May, 2022

Computing Ground State Properties with Early Fault-Tolerant Quantum Computers
    – Contributed talk at APS March Meeting 2022   Mar, 2022

Symmetric Sparse Boolean Matrix Factorization and Applications
    – The 13th Innovations in Theoretical Computer Science Conference (ITCS 2022)   Feb, 2022

Quantum Speedup for Annealing and Sampling
    – Invited talk at Simons Institute reading group   Dec, 2021

Quantum Meets the Minimum Circuit Size Problem
  – Second Kyoto Workshop on Quantum Information, Computation, and Foundation (QICF 2021)   Sept, 2021

On the Quantum Complexity of Closest Pair and Related Problems
  – Computational Complexity Conference (CCC 2020)   Sept, 2020
  – The 15th Conference on the Theory of Quantum Computation, Communication and Cryptography (TQC 2020)   Aug, 2020

MENTORING   Baocheng Sun (Master's student at Weizmann Institute of Science)

TEACHING   At UT Austin
  – TA for CS395T, Coding Theory (graduate class)   Spring 2022
  – TA for CS388R, Randomized Algorithms (graduate class)   Fall 2021
  – TA for CS388T, Theory of Computation (graduate class)   Spring 2020

                 At Fudan University
  – TA for Data Structure (undergraduate class)   Fall 2016

SERVICES   Conference referee:
  – ESA 2020, Eurocrypt 2021, QIP 2021, AQIS 2021, QIP 2022, STOC 2022, ICML 2022, SODA 2023, QIP 2023, AAAI 2023, STACS 2023, STOC 2023, TQC 2023, CRYPTO 2023, FOCS 2023, NeurIPS 2023, AAAI 2024

                 Journal referee:
  – Quantum, PRX Quantum, Physical Review Letter, Physical Review A, Transactions on Information Theory, Advances in Engineering Software

CODING SKILLS   C/C++, Python, Matlab, Latex