Junze Yin

GitHub
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Google Scholar
Personal Website

EDUCATION

Rice University   Houston, TX

Ph.D. in Computer Science   Expected May 2030

Boston University (Cumulative GPA: 3.74/4.00), *Cum Laude*   Boston, MA

M.A. in Mathematics **(major GPA: 3.85/4.00)**   May 2024
  – Thesis: Efficiently Approximate the Attention Computation Problem Through the Softmax Regression (Link)

B.A. in Mathematics **(major GPA: 3.76/4.00)**   May 2024
  – Graduate with honor
  – Thesis: Juliabulb, Mandelbulb, and Logisticbulb (Link)

B.A. in Philosophy and Religion **(major GPA: 3.73/4.00)**   May 2024

RESEARCH INTERESTS

- Numerical Linear Algebra, Machine Learning, Large Language Models, and Fractal Geometry

SELECTED RESEARCH EXPERIENCES

Mentor: Professor Mark Kon   Boston University, Boston, MA

- **Teaching Assistant** for the **Cancer Diagnostic Meta-Learning** project   October 2023 - May 2024
  – Funded by Professor Mark Kon and Professor Julio Castrillon at Boston University.
  – Researching the existing literature for meta-learning and feature extraction; finding the optimized parameters and techniques to train cancer diagnostic machines through using meta-learning.
  – Mentoring undergraduate and master's students in research: organize subgroup meetings; guide them in constructing and developing a machine learning pipeline, where the input is a numerical or image-based cancer dataset and the output is the cancer diagnostic accuracy of the trained model.

Mentor: Professor Emma Previato   Boston University, Boston, MA

- **Student Research Award** for **Factorization of Multivariate Polynomial**   June - August 2022
  – Funded by the Undergraduate Research Opportunities Program (UROP) at Boston University.
  – Studied the influence of quantum computers on public-key cryptography; analyzed the reducibility of multivariate polynomials and factored the reducible multivariate polynomials.

- **Student Research Award** for **Fractal Analysis of the Urbanization Development**   June - August 2021
  – Funded by UROP at Boston University.
  – Analyzed the urbanization of the recent 20 years and extrapolated the future trend by using different models: the difference equation and the logistic differential equation; present the detailed comparison between the existing methods for the fractal dimension approximation, like box-counting method, radial method, deep learning tools, and planimetric maps.
  – Used Python to code the box-counting method and radial method, for approximating the fractal dimension which can be found at my GitHub page.

Publications (Author names in alphabetical order)

Accepted in the peer-reviewed journals and conferences:

1. Zhao Song, **Junze Yin**, Ruizhe Zhang. "Revisiting quantum algorithms for linear regressions: quadratic speedups without data-dependent parameters." In the 28th Quantum Information Processing Conference (QIP2025). (Article Link)

2. Zhao Song, **Junze Yin**, Lichen Zhang, and Ruizhe Zhang. "Fast dynamic sampling for determinantal point processes." In the 27th International Conference on Artificial Intelligence and Statistics (AISTATS 2024). (Article Link)

3. Zhao Song, **Junze Yin**, and Lichen Zhang. "Solving attention kernel regression problem via pre-conditioner." In the 27th International Conference on Artificial Intelligence and Statistics (AISTATS 2024). (Article Link)

4. Yuzhou Gu, Zhao Song, **Junze Yin**, and Lichen Zhang. "Low rank matrix completion via robust alternating minimization in nearly linear time." In the Twelfth International Conference on Learning Representations (ICLR 2024). (Article Link)

5. **Junze Yin**. "Dynamical fractal: Theory and case study." Chaos, Solitons & Fractals 176 (2023): 114190. (Article Link)

6. Zhao Song, Mingquan Ye, **Junze Yin**, and Lichen Zhang. "A nearly-optimal bound for fast regression with ℓ_∞ guarantee." In the Fortieth International Conference on Machine Learning (ICML 2023), pp. 32463-32482. PMLR, 2023. (Article Link)

7. **Junze Yin**, Jiale Zhang, and Ying Chen. "Analysis of research and trends in online review: A perspective." In 2021 International Symposium on Artificial Intelligence and its Application on Media (ISAIAM), pp. 137-141. IEEE, 2021. (Article Link)

Theses:

1. **Junze Yin**. "Efficiently approximate the attention computation problem through the softmax regression." Master's Thesis. Boston University (2024). (Article Link)

2. **Junze Yin**. "Juliabulb, mandelbulb, and logisticbulb." Undergraduate Honor Thesis. Boston University (2022). (Article Link)

Preprints:

1. Chenyang Li, Zhao Song, Zhaoxing Xu, and Junze Yin. "Inverting the Leverage Score Gradient: An Efficient Approximate Newton Method." arXiv preprint arXiv:2408.11267 (2024). (ArXiv Link)

2. Jiuxiang Gu, Yingyu Liang, Heshan Liu, Zhenmei Shi, Zhao Song, and **Junze Yin**. "Conv-basis: A new paradigm for efficient attention inference and gradient computation in transformers." arXiv preprint arXiv:2405.05219 (2024). (ArXiv Link)

3. Zhihang Li, Zhao Song, Weixin Wang, **Junze Yin**, and Zheng Yu. "How to inverting the leverage score distribution?." arXiv preprint arXiv:2404.13785 (2024). (ArXiv Link)

4. Zhihang Li, Zhao Song, Zifan Wang, and **Junze Yin**. "Local convergence of approximate newton method for two layer nonlinear regression." arXiv preprint arXiv:2311.15390 (2023). (ArXiv Link)

5. Zhao Song, Guangyi Xu, and **Junze Yin**. "The expressibility of polynomial based attention scheme." arXiv preprint arXiv:2310.20051 (2023). (ArXiv Link)

6. Zhao Song, Weixin Wang, and **Junze Yin**. "A unified scheme of ResNet and softmax." arXiv preprint arXiv:2309.13482 (2023). (ArXiv Link)

7. Yeqi Gao, Zhao Song, Weixin Wang, and **Junze Yin**. "A fast optimization view: reformulating single layer attention in LLM based on tensor and svm trick, and solving it in matrix multiplication time." arXiv preprint arXiv:2309.07418 (2023). (ArXiv Link)

8. Yeqi Gao, Zhao Song, and **Junze Yin**. "Gradientcoin: A peer-to-peer decentralized large language model." arXiv preprint arXiv:2308.10502 (2023). (ArXiv Link)

9. Zhao Song, Mingquan Ye, **Junze Yin**, and Lichen Zhang. "Efficient alternating minimization with applications to weighted low rank approximation." arXiv preprint arXiv:2306.04169 (2023). (ArXiv Link)

10. Xiang Chen, Zhao Song, Baocheng Sun, **Junze Yin**, and Danyang Zhuo. "Query complexity of active learning for function family with nearly orthogonal basis." arXiv preprint arXiv:2306.03356 (2023). (ArXiv Link)

11. Yichuan Deng, Zhao Song, and **Junze Yin**. "Faster robust tensor power method for arbitrary order." arXiv preprint arXiv:2306.00406 (2023). (ArXiv Link)

12. Song Bian, Zhao Song, and **Junze Yin**. "Federated empirical risk minimization via second-order method." arXiv preprint arXiv:2305.17482 (2023). (ArXiv Link)

13. Zhao Song, Weixin Wang, Chenbo Yin, and **Junze Yin**. "Fast and efficient matching algorithm with deadline instances." arXiv preprint arXiv:2305.08353 (2023). (ArXiv Link)

14. Yeqi Gao, Zhao Song, and **Junze Yin**. "An iterative algorithm for rescaled hyperbolic functions regression." arXiv preprint arXiv:2305.00660 (2023). (ArXiv Link)

15. Jiehao Liang, Somdeb Sarkhel, Zhao Song, Chenbo Yin, **Junze Yin**, and Danyang Zhuo. "A faster k-means++ algorithm." arXiv preprint arXiv:2211.15118 (2022). (ArXiv Link)

16. Jiehao Liang, Zhao Song, Zhaozhuo Xu, **Junze Yin**, and Danyang Zhuo. "Dynamic maintenance of kernel density estimation data structure: From practice to theory." arXiv preprint arXiv:2208.03915 (2022). (ArXiv Link)

17. Hang Hu, Zhao Song, Runzhou Tao, Zhaozhuo Xu, **Junze Yin**, and Danyang Zhuo. "Sublinear time algorithm for online weighted bipartite matching." arXiv preprint arXiv:2208.03367 (2022). (ArXiv Link)

18. Baihe Huang, Zhao Song, Omri Weinstein, **Junze Yin**, Hengjie Zhang, and Ruizhe Zhang. "A dynamic fast gaussian transform." arXiv preprint arXiv:2202.12329 (2022). (ArXiv Link)

19. Baihe Huang, Zhao Song, Runzhou Tao, **Junze Yin**, Ruizhe Zhang, and Danyang Zhuo. "InstaHide's sample complexity when mixing two private images." arXiv preprint arXiv:2011.11877 (2020). (ArXiv Link)

PRESENTATIONS

Oral presentations:

1. **Junze Yin**. "Fractal Analysis of the Urbanization Development in Boston: 2000-2020." Joint Mathematics Meetings 2022. AMS Special Session on Geometry in the Mathematics of Data Science. American Mathematical Society. Seattle, WA. 6-9 Apr. 2022.

2. **Junze Yin**. "Fractal Dimension as an Indicator of Urbanization" - 2021. Virtual MAA MathFest 2021. MAA Student Paper Sessions. Mathematical Association of America. Washington, DC. 2021. 15-16. https://www.maa.org/sites/default/files/pdf/mathfest/2021/StudentAbstractBook2021B.pdf

Poster presentations:

1. Yuzhou Gu, Zhao Song, **Junze Yin**, and Lichen Zhang. "Low rank matrix completion via robust alternating minimization in nearly linear time." In the Twelfth International Conference on Learning Representations (ICLR 2024). Messe Wien Exhibition and Congress Center. Vienna, Austria. May 7th, 2024 to May 11th, 2024. Poster presentation.

2. Zhao Song, **Junze Yin**, Lichen Zhang, and Ruizhe Zhang. "Fast dynamic sampling for determinantal point processes." In the 27th International Conference on Artificial Intelligence and Statistics (AISTATS 2024). Palacio de Congresos de Valencia. Valencia, Spain. Poster presentation.

3. Zhao Song, **Junze Yin**, and Lichen Zhang. "Solving attention kernel regression problem via pre-conditioner." In the 27th International Conference on Artificial Intelligence and Statistics (AISTATS 2024). Palacio de Congresos de Valencia. Valencia, Spain. Poster presentation.

4. Zhao Song, Mingquan Ye, **Junze Yin**, and Lichen Zhang. "A Nearly-Optimal Bound for Fast Regression with ℓ_∞ Guarantee." Fortieth International Conference on Machine Learning. Hawaii Convention Center. Honolulu, HI. 26 Jul. 2023. Poster presentation.

5. **Junze Yin**. "Solving the Multivariate Polynomial with More Than Two Key Systems Over Finite Fields." The 25th Annual Undergraduate Research Symposium. Boston University. Boston, MA. 21 Oct. 2022. Poster presentation.

6. **Junze Yin**. "Fractal Analysis of the Urbanization Development in Boston: 2000-2020." The 24th Annual Undergraduate Research Symposium. Boston University. Boston, MA. 22 Oct. 2021. Poster presentation.

Reviewer Experiences

- Conferences: Reviewer at **AISTATS 2025** (review 4 papers), **ICLR 2025** (review 3 papers), **NeurIPS 2024** (review 6 papers), and **AISTATS 2024** (review 6 papers). Technical Program Committee at **FLLM 2024** (review 3 papers).

- Journal: **PLOS ONE** (review 1 paper).

Research Awards

- *Travel Award for attending* **AISTATS 2024** *and* **ICLR 2024** - Department of Mathematics and Statistics, *Boston University*   March 2024
- *Student Research Award* - Undergraduate Research Opportunities Program (UROP), *Boston University*   June 2022
- *Travel Award for student member of American Mathematical Society* - Department of Mathematics and Statistics, *Boston University*   February 2022
- *Travel Award for Joint Mathematics Meetings 2022* - Undergraduate Research Opportunities Program (UROP), *Boston University*   December 2021
- *Travel Award for Mathematical Association of America MathFest 2021* - UROP, *Boston University*   July 2021
- *Student Research Award* - Undergraduate Research Opportunities Program (UROP), *Boston University*   June 2021

Working and Teaching Experiences

- **Peer Tutor** for the Education Resource Center, Boston University   February 2021 - May 2024
  - Tutoring Calculus 1, Calculus 2, Linear Algebra, and Differential Equations.
  - Helping tutees understand course material; explaining graded homework and tests; sharing study skills; helping with test preparations and concept reviews.
- **Data Scientist Internship**, IDG Capital   May - June 2023
  - Read and summarized the newly published research papers related to Large Language Models and Machine Learning Algorithms, which were done to support our current group tasks: creating a model that takes a document and a question as inputs and outputs the answer based on the document.
  - Presented the Mathematical concepts, like ODE, vectors, metric spaces, etc., of the machine learning models and explained how they are relevant to our group tasks.

Skills

LaTeX, Mathematica, Matlab, Python, R