Yao Xiao

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This is the verbose version. You may want to check out the short version with a selected subset of information instead.

Education

Harvard University | Master of Science | Computational Science and Engineering 2024.09 – 2026.05 (expected)
- GPA: 3.92/4.00, including: Computer Networks, Data Systems, Distributed Systems, Parallel Computing, etc.

New York University Shanghai | Bachelor of Science | Honors Mathematics | Computer Science 2020.09 – 2024.05
- Honors Mathematics GPA: 4.00/4.00, including: Linear Algebra, Math Modeling, Probability Theory, Numerical Analysis, etc.
- Computer Science GPA: 3.97/4.00, including: Data Structures, Algorithms, Operating Systems, Software Engineering, etc.

Publications

Authors with † are sorted by α-β order, others are sorted by contribution

[1] Yuejie Wang, Qiutong Men, **Yao Xiao**, Yongting Chen, and Guyue Liu. 2024. ConfMask: Enabling Privacy-Preserving Configuration Sharing via Anonymization. In *Proceedings of the ACM SIGCOMM 2024 Conference (ACM SIGCOMM'24)*. Association for Computing Machinery, New York, NY, USA, 465–483. doi:10.1145/3651890.3672217

[2] Shengbin Yue, Shujun Liu, Yuxuan Zhou, Chenchen Shen, Siyuan Wang, **Yao Xiao**, Bingxuan Li, Yun Song, Xiaoyu Shen, Wei Chen, Xuanjing Huang, and Zhongyu Wei. 2024. LawLLM: Intelligent Legal System with Legal Reasoning and Verifiable Retrieval. In *29th International Conference on Database Systems for Advanced Applications (DASFAA'24)*. doi:10.1007/978-981-97-5569-1_19

[3] Xinyu Li†, **Yao Xiao**†, and Yuchen Zhou†. 2023. Efficiently Visualizing Large Graphs. doi:10.48550/arXiv.2310.11186

Working Experience

Scikit-learn | Open Source | Core Developer | 128 Merged Pull Requests 2023.04 – present

Skills: Python, Cython, JavaScript, Sphinx, scikit-learn, numpy, scipy, pandas, polars, CI/CD
- Managed maintenance tasks e.g., test suite coverage, code refactoring, developer API improvement, automated GitHub workflows, etc.
- Enhanced sparse array and polars dataframe support, estimator representation, metrics visualization, multilabel data cross-validator, etc.
- Optimized IncrementalPCA on sparse data (>10x faster, >30x less memory), SPD matrix generator (>10x less memory), etc.
- Led the redesign the entire scikit-learn main website and coordinated efforts in documentation improvements and UI / UX enhancements.

DISC Lab, Fudan University | Lab Assistant | DASFAA'24 | GitHub 2023.05 – 2023.08

Skills: Python, PyTorch, HuggingFace, LLM, instruction tuning
- Led the construction of 403K legal knowledge instruction data, curated with legal syllogism prompting for higher expertise.
- Fine-tuned DISC-LawLLM, an LLM specialized for legal services based on Baichuan 13B Chat, outperforming GPT-3.5 Turbo.
- Participated in designing a verifiable knowledge retrieval module to inject external knowledge and enhance output actuality.
- Drove the implementation of a comprehensive benchmark for legal systems evaluation in both objective and subjective dimensions.

Research Experience

Privacy-Preserving Network Configuration Sharing via Anonymization | SIGCOMM'24 | GitHub 2022.10 – 2024.08

Advisor: Professor Guyue Liu, guyue.liu@gmail.com
- Proposed the ConfMask framework to systematically anonymize topology and routing information in network configurations.
- Designed the anonymization algorithm for different protocols that mitigated deanonymization risks yet preserved important utilities.
- Managed to rigorously prove the route equivalence and routing utility preservation properties of the anonymization framework.
- Led the implementation of the end-to-end network configuration anonymization system and the artifact evaluation.

Analyzing the Critical Behavior of Bernoulli Percolation in $\mathbb{Z}^3$ via Invasion Percolation | Capstone 2023.09 – 2024.01

Advisor: Professor Wei Wu, ww44@nyu.edu
- Proved that in $\mathbb{Z}^d$, infinite cluster density at critical point $\mathbf{P}_\infty(p_c) = 0$ if and only if invasion probability $G_{\mathbb{Z}^d}(0, x) \to 0$ as $|x| \to \infty$.
- Verified via simulation that $G_{\mathbb{Z}^3}(0, x) \le G_{\mathbb{Z}^2}(0, x)$ for each $|x|$, thus proving that $\mathbf{P}_\infty(p_c) = 0$ in $\mathbb{Z}^3$ given the fact that it holds in $\mathbb{Z}^2$.
- Estimated the fractal dimension of the invasion percolation cluster in $\mathbb{Z}^3$ numerically which was approximately 2.627.

Efficient Distributed Serving System for Large Language Model Inference | Capstone 2023.09 – 2024.01

Advisor: Professor Guyue Liu, guyue.liu@gmail.com
- Enabled larger batch sizes beyond KV cache limit for layers except self-attention, observing that only self-attention relies on KV cache.
- Batched prefills and decodes dynamically in self-attention to mitigate pipeline bubbles caused by varying transformer input lengths.
- Packed multiple short attention computations with the longest one, while concurrently swapping KV cache to minimize overhead.

Efficiently Visualizing Large Graphs | Dean's Undergraduate Research Fund | ArXiv 2022.05 – 2022.08

Advisor: Professor Jie Xue, jiexue@nyu.edu
- Designed t-SGNE specialized for graphs, leveraging the neighboring relations between nodes and achieving 6.7x computation efficiency.
- Proposed SPLEE, a graph embedding method based on Laplacian eigenmaps and shortest paths, intended to suit t-SGNE.
- Combined SPLEE and t-SGNE for visualization of graphs with 300K nodes and 1M edges, achieving 10% improvement in visual effect.

Teaching Experience

- **Computer Networks**, COMPSCI.1450, Harvard School of Engineering and Applied Sciences, Teaching Fellow, Spring 2025
- **Linear Algebra**, MATH-SHU.0140, NYU Shanghai, Learning Assistant, Spring 2024
- **Calculus II**, MATH-SHU.0131, NYU Shanghai, Learning Assistant, Fall 2021, Fall 2023
- **Operating Systems**, CSCI-UA.0202, New York University, Teaching Assistant, Spring 2023

Projects

Deskulpt: A Cross-Platform Desktop Customization Tool | GitHub 2024.03 – present

Skills: Rust, TypeScript, Tauri, React, Vite, SWC | **Full-stack**

- Led the development of a cross-platform system for highly customizable desktop widgets that can be written in React / TypeScript.
- Integrated rich development tools in Deskulpt, enabling streamlined widget creation and debugging, editor and type hints, etc.
- Built Deskulpt using Tauri to ensure system security and compatibility across Windows, macOS, and Linux environments.
- Utilized Rust's async capabilities in the backend to ensure responsive interactions between the UI and system resources.
- Implemented security measures, e.g., CSP protection, constraints on file system access, limiting frontend capabilities, etc.

Column-Store Database Management System | Course Project | GitHub 2024.09 – 2024.12

Skills: C, SIMD/AVX, database optimizations, cache-conscious algorithms

- Streamlined CSV parsing and cache-aware chunked loading, achieving >4x speedup over naive row-wise loading on 400M data.
- Implemented shared scan for batchable queries with parallelization, achieving >20x speedup for 100M data and 100 queries.
- Supported B+ tree indexes, with <20ms bulk loading overhead and >25x select query speedup over 100M data with 5% selectivity.
- Optimized and parallelized radix hash join, outperforming naive hash join by >15x when joining 100M$\times$100M data.

VeritasTrial: AI-Driven Clinial Trial Search and Interpretation | Course Project | GitHub 2024.09 – 2024.12

Skills: TypeScript, React, instruction tuning, augmented retrieval, RESTful API, Google Cloud, Kubernetes, Ansible

- Led the development of VeritasTrial, an AI-driven application streamlining clinical trial searches and data interpretation.
- Enhanced searching and filtering with a database of vector embeddings for comprehensive semantic analysis and efficient matching.
- Designed and implemented an intuitive user interface for trial exploration and data interpretation.
- Deployed the application on Google Cloud with Kubernetes, Ansible, and GitHub Actions for automated deployment and scaling.

Comparitive Analysis of LAPACK Symmetric Tridiagonal Eigensolvers | Course Project | Paper | GitHub 2024.12

Skills: Python, scipy, Fortran LAPACK

- Compared QR iteration, divide & conquer, bisection, and MRRR algorithms regarding performance, stability, and accuracy.
- Evaluated their LAPACK implementations on real-world and synthetic symmetric tridiagonal matrices with different characteristics.

CampusHelper: WeChat / Alipay Miniprogram 2023.12 – 2024.08

Skills: TypeScript, MongoDB, WeChat / Alipay cloud, miniprogram frameworks | **Full-stack**

- Utilized miniprogram cloud, including cloud functions, database, and storage to enhance data management and service reliability.
- Optimized miniprogram performance through cloud-based technologies, lazy loading, list virtualization, etc.
- Built a clean, consistent, accessible, and user-friendly interface, enhancing the overall user experience.
- Won the 2nd Prize (4th Place) in the 2023 Alipay Miniprogram Developers' Competition.

YouTube Interface Customizer | Course Project | GitHub 2023.02

- Built a Firefox extension that supports changing color themes, rearranging, and customizing elements of the YouTube interface.
- Created the documentations of features and contribution guides, and released (self-distributed) v1.0 at Mozilla Add-ons.

Inequality Process Simulation | Course Project | Paper | GitHub 2022.12

- Simulated inequality process in economic systems via nuanced random transactions functions, reflecting on real-world economy.
- Discovered that the final distribution of wealth in a real-world economic system fits the shape of a gamma or beta prime distribution.

Gyro-Tower Simulation | Course Project | Paper | GitHub 2022.10

- Modeled gyroscopes as networks of springs, formulated the system with differential equations, and solved it via Euler's method.
- Simulated vertical stacks of gyroscopes, and found that they obeyed gyroscopic precession assuming a flexible middle axle.

Honors and Awards

[1] **Magma cum laude**, NYU Shanghai, 2024
[2] **Level I Certification**, CRLA's International Tutor Training Program, 2024
[3] **2nd Prize, 4th Place**, Alipay Miniprogram Developers' Competition, 2023
[4] **Meritorious Winner**, Mathematical Contest in Modeling, 2023
[5] **Dean's List of Academic Year**, NYU Shanghai, 2020 – 2021, 2021 – 2022, 2022 – 2023

Skills

[1] **Programming:** Proficient in Python, Rust, JavaScript / TypeScript; Intermediate in C, C++, MATLAB, Java, Julia
[2] **Frameworks and packages:** Tauri, React; Numpy, Pandas, Polars, Scikit-learn, PyTorch; CUDA; SIMD/AVX; OpenMP
[3] **DevOps:** Docker; Git; AWS, Google Cloud; Ansible; Kubernetes; GitHub Actions, CI/CD; Linux