Zuoyan Zhang

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Education

Hunan University *Sep 2024 – present*
PhD in Computer Science and Technology *Changsha, Hunan*

- **Supervisor:** Jie Zhao
- **Laboratory:** CYCLE Lab
- **Research Interests:** AI Compilers, LLM Distributed Training Acceleration

Information Engineering University *Sep 2021 – Jun 2024*
Master in Computer Technology (GPA: 88.7/100) *Zhengzhou, Henan*

- **Laboratory:** State Key Laboratory of Mathematical Engineering and Advanced Computing
- **Research Interests:** Numerical Program Analysis, Polyhedral Compiler

Henan University of Technology *Sep 2017 – Jun 2021*
Bachelor in Computer Science and Technology *Zhengzhou, Henan*

Experience

AI for Science Institute *Jun 2023 – Sep 2023*
Intern Research *Beijing, China*

- Implemented and optimized accuracy testing framework for ABACUS core numerical functions.
- Developed customized precision testing schemes targeting diverse function categories.
- Designed and implemented comprehensive test suites for Simpon's integral and spherical harmonic functions.

Publications

[1] **Arfa: An agile Regime-based Floating-point Optimization Approach for Rounding Errors**
Jinchen Xu, Mengqi Cui, Fei Li, **Zuoyan Zhang**, Hongru Yang, Bei Zhou, Jie Zhao.
In Proceedings of the 33rd ACM International Symposium on Software Testing and Analysis (**ISSTA 2024**).
DOI: 10.1145/3650212.3680378

[2] **Eiffel: Inferring Input Ranges of Significant Floating-point Errors via Polynomial Extrapolation**
Zuoyan Zhang, Bei Zhou, Jiangwei Hao, Hongru Yang, Mengqi Cui, Yuchang Zhou, Guanghui Song, Fei Li, Jinchen Xu, Jie Zhao.
In Proceedings of the 38th IEEE/ACM International Conference on Automated Software Engineering (**ASE 2023**).
DOI: 10.1109/ASE56229.2023.00139

[3] **Hierarchical search algorithm for error detection in floating-point arithmetic expressions**
Zuoyan Zhang, Jinchen Xu, Jiangwei Hao, Yang Qu, Haotian He, Bei Zhou.
The Journal of Supercomputing.
DOI: 10.1007/s11227-023-05523-6

Projects

Intelligent Compilation and Optimization Techniques for Supernode Parallelism Strategies *Jan 2025 – Dec 2026*

- Huawei Technologies (Agreement No. TC20241115006).
- My research will focus on two key aspects of LLM distributed training optimization:
  - Design automated search algorithms for distributed parallelization strategies in large-scale model training.
  - Investigate compute-communication co-optimization approaches to enhance training efficiency.
- Core Researcher
- ¥ 2,286,000

Research on Error Detection Methods for Floating-point Arithmetic Expressions *Jan 2023 – Dec 2024*

- Open Project of the State Key Laboratory of Mathematical Engineering and Advanced Computing (Grant No. 2023B02).
- Developed Maxfpeed, an innovative floating-point error detection tool, with optimized detection algorithms achieving significant efficiency improvement over existing methods for complex arithmetic expressions analysis.
- Core Researcher
- ¥ 600,000

Deep Learning and Tensor Compilers based on the Polyhedral Model *Jan 2021 – Dec 2024*

- National Natural Science Foundation of China (Grant No. U20A20226).
- Contributed to developing an automatic mixed-precision code generator that utilizes the polyhedral model with fitting functions to determine optimal iteration space for nested loop programs.
- Research Team Member
- ¥ 2,600,000 in total; ¥ 800,000 for the Information Engineering University

Elementary Mathematics Library System *Jan 2018 – Dec 2022*

- National major special project.
- Architected and implemented a comprehensive test framework for high-performance mathematical libraries, including correctness, anomaly detection, precision and performance testing modules, with automated test suites and scripts for continuous validation.
- Core Team Member

Honors and Awards

- Excellent MEng Dissertation Award — Information Engineering University, *Oct 2024*
- National Scholarship — Ministry of Education of China, *Dec 2023*
- First Class Academic Scholarship — Information Engineering University, *Nov 2023*
- Second Class Academic Scholarship — Information Engineering University, *Nov 2022*
- First Class Academic Scholarship — Information Engineering University, *Nov 2021*

Technical Skills

Languages: C, C++, Python, Shell, and etc.
Technologies: PyTorch, MindSpore, Linux, Latex, Matlab, Git, Docker, Make, CMake, and etc.
Concepts: Machine Learning Systems, AI Compilers, Polyhedral Compiler, Large Language Model, Distributed System, Computation-Communication Co-design, Floating-point Error, Dynamic Analysis.

Activities and Leadership

Undergraduate Teaching Assistant: Compiler Principles Course, Hunan University
Executive Committee Member: CCF Student Chapter, Hunan University