Paul Jiang

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Education

Purdue University | John Martinson Honors College **Aug. 2022 – May 2026**

Bachelor of Science in Computer Science | Minor in Mathematics *West Lafayette, Indiana*

Relevant Coursework: Object-Oriented Programming, Information Systems, Data Structures, Linear Algebra, Computer Architecture, Systems Programming, Statistical Methods, Artificial Intelligence, Real Analysis, Analysis of Algorithms

Publications & Research Results

- Jiang, P., Valpey, B., and Gopalakrishnan, G. "Characterizing and Correcting Tensor Core Arithmetic." **Under review** at ACM SIGPLAN Conference on Programming Language Design and Implementation (PLDI '26)
- Jiang, P., and Zheng, V. "A Formal Characterization of Non-Monotonicity in Tensor Cores". Poster at The International Conference for High Performance Computing, Networking, Storage, and Analysis (SC '25). November 16-21, St. Louis, MO. (**ACM SRC 2nd Place**)
- Jiang, P. "Characterizing and Correcting Non-Standard Arithmetic in GPUs for Scientific Computing". Speaker at 2nd Workshop on Correctness and Reproducibility for Earth System Software. November 5-7, Boulder, CO.
- Jiang, P., and Lin, I. "Formal Approaches to Characterize Emerging Arithmetic Realizations". Poster at The International Conference for High Performance Computing, Networking, Storage, and Analysis (SC '24). November 17-22, Atlanta, GA.
- Jiang, P. and Fassman, E. et al."Evaluating the Impact of Noisy Point Clouds on Wireless Gesture Recognition Systems." In Proceedings of the Twenty-fourth International Symposium on Theory, Algorithmic Foundations, and Protocol Design for Mobile Networks and Mobile Computing (ACM MobiHoc '23)

Experience

ML@Purdue x TE Connectivity **Sept 2025 – Present**

TE AI Cup Project Manager *West Lafayette, Indiana*

University of Utah **May 2025 – Present**

Research Assistant Under Prof. Ganesh Gopalakrishnan *Salt Lake City, Utah*

- Formally characterized the numerical deviations of NVIDIA Tensor Cores, defining the exact mathematical conditions for non-monotonic behavior and deriving tight error bounds across hardware generations
- Developed approach for recovering exact, multi-term mathematical result from non-standard Tensor Core arithmetic, additionally devising efficient scheme to achieve a single correctly rounded output from these terms

Purdue University **December 2024 – Present**

Research Assistant Under Prof. Jingbo Wang *West Lafayette, Indiana*

- Conducting differential Zonotope-based verification of token pruning on deep Vision Transformers, quantifying certified bounds on the output difference introduced by said pruning for a set of values contained within some l-infinity ball
- Established a baseline by implementing a sound mask over-approximation of TopK pruning in existing Zonotope verification workflow DeepT, computing sound interval bounds (not differential) between a pruned and unpruned ViT

National Science Foundation I-GUIDE **August 2024 – May 2025**

Geospatial Data Science Research Intern *West Lafayette, Indiana*

- Optimized social vulnerability analysis of aging dam infrastructure; intersecting spatial flood inundation maps for nearly 400 dams with census block-level socio-economic indicators
- Processed large-scale geospatial data for Distributed Aging Dams, including a 30GB GeoJSON field containing nearly 9 million records with associated geometries with Apache Spark, Apache Sedona, GeoParquet, and GeoPandas

National Science Foundation REU – University of Utah **May 2024 – August 2024**

HPC Research Intern Under Prof. Ganesh Gopalakrishnan *Salt Lake City, Utah*

- Leveraged Z3 SMT solver to model bit-vector representations of non-IEEE standard behaviors in GPUs and Matrix Accelerators, enabling formal downstream reasoning about intricate deviations in AI hardware functionalities
- Formally verified previously unknown non-monotonic properties across arithmetic realizations without intermediate normalization, providing mathematical proof of behavioral deviations without requiring direct hardware access

National Science Foundation REU – Purdue University **May 2023 – August 2023**

ML/AI Research Intern Under Prof. Tao Li *Indianapolis, Indiana*

- Conducted seminars on computer vision and adversarial learning, focusing on topics such as convolutional architectures, generative adversarial networks, and robust machine learning
- Investigated the robustness of millimeter-wave wireless sensing systems using deep learning architectures: LSTM, CNN, and Transformer models, analyzing their resilience to various types of noise in dynamic environments

Projects

CDCL SAT Solver with XOR Model Counting | *C++* **December 2024**

- Developed SAT solver with conflict-driven clause learning, non-chronological backtracking, and 2-watched literals
- Integrated approximate model counting through the implementation of randomized XOR constraints, iteratively halving the solution space to estimate SAT formula model count with probabilistic guarantees

Formal Model of Matrix Accelerators | *Python, Z3py* **July 2024**

- Developed a flexible SMT framework for modeling non-standard arithmetics, enabling rapid prototyping of custom behaviors, including non-standard rounding and irregular bit widths for downstream use
- Created comprehensive bit-level representations of floating-point components (sign, exponent, mantissa, guard/round/sticky bits) to accurately simulate non-standard arithmetic operations

C Shell | *C, C++, GDB, Lex, UNIX, Yacc* **April 2024**

- Engineered a POSIX-compliant shell interpreter in C/C++, implementing advanced features including piping, I/O redirection, environment variable management, and support for complex scripting constructs (if/while/for)
- Leveraged Flex and Bison for lexical analysis and parsing, integrating sophisticated functionalities such as wildcard expansion, tilde resolution, signal handling, and tab completion with custom prompt customization

Malloc Library | *C, GNU Debugger, UNIX* **January 2024**

- Developed a custom dynamic memory allocation library in C, utilizing sbrk() system calls for heap management, implementing efficient metadata structures and free-list algorithms for optimized memory use
- Employed advanced debugging techniques with GDB, including watchpoints, backtrace analysis, and memory inspection to resolve complex logical errors and memory leaks

C Compiler | *C, Lex, UNIX, x86-64 Assembly, Yacc* **December 2023**

- Constructed C compiler using Yacc and Lex, supporting full ANSI C syntax including control structures, loops, and multi-dimensional arrays, with integrated semantic analysis for type checking and scope resolution
- Generated x86-64 assembly using techniques such as constant folding, dead code elimination, and register allocation

Additional

Conferences & Workshops Attended: PLMW PLDI '25, VSS ETAPS '25, SC '24, REUNS MobiHoc '23

Grants and Awards: PLMW Scholarship, RMBL Travel Grant, ACM SIGHPC Travel Grant, CRA Travel Grant,

Technical Skills: Python, C, C++, Java, Javascript, HTML/CSS, SQL, React