Huiyun Peng

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Research Theme

My research primarily focuses on AI for Software Engineering (AI4SE), exploring how artificial intelligence can improve the development, optimization, and maintenance of complex software systems. I am also interested in software security and responsible AI. Currently, I am developing novel approaches to automate high-performance, energy-efficient software development by leveraging and fine-tuning Large Language Models (LLMs) to analyze, generate, and optimize code.

Education

Purdue University, West Lafayette, Indiana, USA *August 2024–May 2029*

Ph.D. in Electrical and Computer Engineering **GPA**: 3.94/4.0

Mount Holyoke College, South Hadley, MA, USA *August 2018–May 2022*

B.A. in Computer Science, Minor in Philosophy, *magna cum laude* **GPA**: 3.92/4.0

Research Experience

Purdue Duality Lab *Purdue University, IN, USA*

Under the supervision of Dr. James C. Davis *July 2024–Present*

- Designed a multi-agent pipeline that automatically optimizes software systems by integrating static analysis insights with architecture-level abstractions to guide optimization decisions.
- Conceptualized a reinforcement learning fine-tuning (RLFT) method that enables multi-objective code optimization, and analyzed the CodeNet dataset to construct training data.
- Designed and developed an LLM-based framework that leverages LLMs to automatically optimize large-scale real-world software systems for performance and energy efficiency.
- Evaluated the effectiveness of the ZTD_JAVA tool in mitigating software supply chain vulnerabilities by introducing vulnerabilities into Java benchmark programs.

Harvard Forest *Harvard University, MA, USA*

Under the supervision of Dr. Barbara Staudt Lerner *January 2020–July 2020*

- Designed and implemented an automated Python tool to capture and analyze data provenance, converting SQL data into JSON to enable End-to-End provenance workflow integration.

Professional Experience

Software Engineer II

Mastercard Data & Services, Arlington, VA, USA *June 2022–June 2024*

- Led the design, development, testing, and rollout of new internal library APIs to help engineers in the company improve development experience and efficiency.
- Analyzed, developed, and rolled out C# enhancements to improve the reliability and performance for apps used across various products.
- Designed and built on front-end infrastructure in TypeScript using React framework to provide an outstanding modern experience for end users.

Publications

1. **H. Peng**, A. Gupte, R. Hasler, N.J. Eliopoulos, C.C. Ho, R. Mantri, L. Deng, K. Läufer, G. K. Thiruvathukal, and J.C. Davis. *SysLLMatic: Large Language Models are Software System Optimizers*. Under review at The Journal of Systems and Software (JSS). Preprint at https://arxiv.org/pdf/2506.01249. 2025.
2. E. Pautsch, T. Singla, W. Jiang, **H. Peng**, B. Hassanshahi, K. Läufer, G. K. Thiruvathukal, and J.C. Davis. *AgentHub: A Research Agenda for Agent Sharing Infrastructure*. https://arxiv.org/pdf/2510.03495. 2025.
3. J.C. Davis, S. Chen, **H. Peng**, P. Amusuo, and K. Kalu. *A Guide to Stakeholder Analysis for Cybersecurity Researchers*. https://arxiv.org/pdf/2508.14796. 2025.
4. P.V. Patil, W. Jiang, **H. Peng**, D. Lugo, K.G. Kalu, J. LeBlanc, L. Smith, H. Heo, N. Aou, J.C. Davis. *Recommending Pre-Trained Models for IoT Devices*. Proceedings of the 7th International Workshop on Software Engineering Research & Practices for the Internet of Things (2025). 26% acceptance rate (25/97). 5 pages.
5. P.C. Amusuo, K.A. Robinson, T. Singla, **H. Peng**, A. Machiry, S. Torres-Arias, L. Simon, J.C. Davis. *ZTD_JAVA: Mitigating Software Supply Chain Vulnerabilities via Zero-Trust Dependencies*. Proceedings of the 47th International Conference on Software Engineering (ICSE'25). 24% acceptance rate (248/1031). 13 pages.
6. **H. Peng**, A. Gupte, N.J. Eliopoulos, C.C. Ho, R. Mantri, L. Deng, W. Jiang, Y.H. Lu, K. Läufer, G. K. Thiruvathukal, and J.C. Davis. *Large Language Models for Energy-Efficient Code: Emerging Results and Future Directions*. https://arxiv.org/abs/2410.09241. 2024.

Technical Course Projects

Socially Assistive Agent — Built an AI-assisted programming tool that enhances trust and interactivity through user-centered design and user studies.

Reasoning About Programs — Implemented an LLM-based translation framework from C to Rust.

Artificial Intelligence — Re-implemented the "Automatic Chain of Thought Prompting in Large Language Models" paper.

Teaching Experiences

Purdue University

ECE 461 Software Engineering: Graduate Teaching Assistant *Fall 2024*

Mount Holyoke College

CS 151 Intro to Computer Science and CS 205 Data Structures (TA) *Fall 2019–Spring 2022*

Academic Service

PC Member - USENIX Security Artifact Evaluation Track	2026
PC Member - TechDebt Junior PC Track	2026
PC Member - MSR Junior PC Track	2026
PC Member - S&P Artifact Evaluation Track	2026
PC Member - ICSE Shadow PC Track	2026
Student Volunteer - ICSE	2025
Judge - Purdue University SURF Symposium	2025
Sub-reviewer - FSE	2025
PC Member - ASE Artifact Evaluation Track	2024