

Kunal Pai

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EDUCATION

M.S., Computer Science, University of California, Davis (GPA: **4.0/4.0**)

Expected: June 2026

B.S., Computer Science & Engineering, University of California, Davis (GPA: **3.8/4.0**)

June 2023, with Honors

RELEVANT SKILLS

Languages: Python, C++, C, JavaScript, Java, Rust

ML/AI: TensorFlow, PyTorch, scikit-learn, LLMs, Prompt Engineering, Ollama, Hugging Face, Multi-agent Systems

Web/Data: React, Next.js, Django, Flask, MongoDB, pandas, NumPy, Matplotlib

Tools: Git, Docker, Unix/Linux, gem5, Jupyter, LLVM, Clang

WORK EXPERIENCE

Graduate Student Researcher, DavSec Lab @ UC Davis

Apr 2025 – Present

Research Project

Python, LLMs, C++, Rust, Compiler Analysis

- Built automated C-to-Rust transpilation pipeline using LLMs with 5 prompt variations, benchmarking state-of-the-art models across 746 programs and achieving 70.2% functional accuracy
- Identified Halstead vocabulary as strongest predictor of translation difficulty; validated ensemble semantic augmentations (e.g., filename context) improving accuracy by 5%
- Developed cross-layer analysis framework combining compiler metrics with hardware performance counters to expose semantic and optimization gaps in LLM-translated, syntax-directed and manually-written Rust translations

Graduate Student Researcher, DECAL Lab @ UC Davis

Sept 2022 – Dec 2024

Research Project

Python, LLMs, Machine Learning, Code Analysis

- Developed a 4,500-sample dataset for pairwise code-documentation alignment from 200 open-source Python projects, enabling future research in software maintenance
- Engineered a pipeline for measuring calibration and correctness of large language models for code repair, using Defects4J
- Collaborated in validating efficacy of semantic augmentation of language model prompts for code summarization using precision and recall metrics like ROUGE and METEOR

Teaching Assistant, University of California, Davis

September 2023 – December 2023

- Assisted 180 students in a senior-level Probability & Statistical Modeling class.

PUBLICATIONS (SELECTED)

SPECTRA: Understanding Hardware–Compiler Interplay in C-to-Rust Transpilation, Pai, K., et. al., *Object-Oriented Programming, Systems, Languages and Applications (OOPSLA) 2026 (under review)*

Calibration and Correctness of Language Models for Code, Spiess, C., Gros, D., Pai, K., et. al., *International Conference on Software Engineering (ICSE) 2025*

Automatic Semantic Augmentation of Language Model Prompts (for Code Summarization), Ahmed, T., Pai, K., Devanbu, P. & Barr, E. T., *International Conference on Software Engineering (ICSE) 2024*

CoDocBench: A Dataset for Code-Documentation Alignment in Software Maintenance, Pai, K., Devanbu, P. & Ahmed, T., *Mining Software Repositories (MSR) 2025: Data and Tool Showcase Track*

HASHIRU: Hierarchical Agent System for Hybrid Intelligent Resource Utilization, Pai, K., Shah, P. & Patel, H., *arXiv preprint*

Implications of Full-System Modeling for Superconducting Architectures, Pai, K., Samani, M., Nand, A. & Lowe-Power, J., *Workshops of the International Conference for High Performance Computing, Networking, Storage and Analysis (SC Workshops '25)*

Validating Hardware and SimPoints with gem5: A RISC-V Board Case Study, Pai, K., Qiu, Z. & Lowe-Power, J., *gem5 Workshop at International Symposium on Computer Architecture (ISCA) 2023*

PROJECT EXPERIENCE

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| HASHIRU: Hierarchical, Resource-Aware Multi-Agent Framework <i>Research Project</i> | March 2025 – Present <i>Python, LLMs, Multi-Agent Systems</i> |
| <ul style="list-style-type: none">Designed and deployed a multi-agent architecture enabling dynamic, LLM-driven collaboration across diverse tasksImplemented task decomposition with intelligent agent delegation based on resource cost models and task specializationEngineered autonomous generation of tools and APIs for task executionDeveloped a robust evaluation framework for agent performance across complex, multi-step tasks | |
| SuperNOVA: Superconducting Graph Accelerator in gem5 <i>Research Project, DArchR Lab @ UC Davis</i> | Jan 2024 – Present <i>C++, Python, gem5, Hardware Simulation</i> |
| <ul style="list-style-type: none">Modeled a superconducting graph accelerator and interconnect in gem5, achieving up to 24x speedup and 73x energy efficiencyIntegrated cryogenic/superconducting cores, caches, and interconnects to evaluate bottlenecks for realistic workloadsMentored undergraduates on modeling, benchmarking, and research writing; one co-authored a ModSim 2024 poster | |
| MARS: Multi-Agent Review System for Academic Papers <i>Research Project</i> | Jan 2025 – Mar 2025 <i>Python, LLMs, Multi-Agent Systems</i> |
| <ul style="list-style-type: none">Built a multi-agent LLM pipeline that simulates peer review with specialized agents for novelty, grammar, and critical questioningAchieved high accuracy on ICLR 2023 reviews, outperforming o3-mini and NotebookLM baselinesDeployed privacy-preserving, local LLM evaluations using Ollama on consumer-grade hardware | |
| gem5 Vision <i>Resource Discovery Framework</i> | Jan 2023 – Jun 2023 <i>Next.js, Python, MongoDB, JSON Schema</i> |
| <ul style="list-style-type: none">Accelerated resource discovery 20x for 1,200+ gem5 artifacts by optimizing search and categorization logicImplemented categorization and semantic versioning across 20+ resource types to streamline retrievalIntegrated local and remote JSON schemas with MongoDB, improving accessibility for 500+ users | |

AWARDS AND HONORS

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| Provost Award , UC Davis | 2019–2023 |
| Dean's List , UC Davis College of Engineering | Fall 2019, Fall 2020, Winter 2022, Spring 2022 |

SERVICE

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| Program Committee Member , 23rd International Conference on Mining Software Repositories: Data and Tool Showcase Track |
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