Kunal Pai

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Education

Ph.D., Computer Science, University of California, Los Angeles — Expected: June 2032

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**), *with Honors* — June 2023

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* — April 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
- Engineered a multi-variant performance-aware transpilation framework that explores alternative Rust implementations in an evolutionary agent setting, yielding up to 3× runtime reduction across benchmarks
- 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* — September 2022 – December 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)

Toward Reproducible and Standardized Computer Architecture Simulation with gem5, Pai, K., Patel, H., Le, E., et. al., *IEEE International Symposium on Performance Analysis of Systems and Software (ISPASS) 2026*

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)*

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

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

Automatic semantic augmentation of language model prompts (for code summarization), Ahmed, T., Pai, K.S., Devanbu, P. & Barr, E.T., *International Conference on Software Engineering (ICSE) 2024*

Project Experience

HASHIRU: Hierarchical, Resource-Aware Multi-Agent Framework March 2025 – Present
Research Project *Python, LLMs, Multi-Agent Systems*

- Designed and deployed a multi-agent architecture enabling dynamic, LLM-driven collaboration across diverse tasks
- Implemented task decomposition with intelligent agent delegation based on resource cost models and task specialization
- Engineered autonomous generation of tools and APIs for task execution
- Developed a robust evaluation framework for agent performance across complex, multi-step tasks

NAAMSE: Neural Adversarial Agent Mutation-based Security Evaluator Nov 2025 – Feb 2026
Research Project *Python, LLMs, Evolutionary Algorithms*

- Won 2nd place (Agent Safety) at the UC Berkeley RDI AgentBeats Competition; framework infrastructure was subsequently forked by Mozilla's 0din team.
- Designed and implemented a clustering engine to identify semantic attack vectors in LLM-generated adversarial prompts
- Engineered an attack pipeline that iteratively generates, evaluates, and refines adversarial prompts against target models
- Benchmarked multiple frontier LLMs within the framework to validate attack effectiveness and refine scoring metrics

SuperNOVA: Superconducting Graph Accelerator in gem5 Jan 2024 – Present
Research Project, DArchR Lab @ UC Davis *C++, Python, gem5, Hardware Simulation*

- Modeled a superconducting graph accelerator and interconnect in gem5, achieving up to 24× speedup and 73× energy efficiency
- Integrated cryogenic/superconducting cores, caches, and interconnects to evaluate bottlenecks for realistic workloads
- Mentored undergraduates on modeling, benchmarking, and research writing; one co-authored a ModSim 2024 poster

gem5 Vision January 2023 – June 2023
Resource Discovery Framework *Next.js, Python, MongoDB, JSON Schema*

- Accelerated resource discovery 20× for 1,200+ gem5 artifacts by optimizing search and categorization logic
- Implemented categorization and semantic versioning across 20+ resource types to streamline retrieval
- Integrated local and remote JSON schemas with MongoDB, improving accessibility for 500+ users

Awards and Honors

2nd Place (Agent Safety), UC Berkeley RDI AgentBeats Competition 2026

Dean's List, UC Davis College of Engineering Fall 2019, Fall 2020, Winter 2022, Spring 2022

Provost Award, UC Davis 2019–2023

Service

- **Program Committee member**, 23rd International Conference on Mining Software Repositories: Data and Tool Showcase Track
- **Artifact Evaluation Committee member**, 2026 IEEE International Symposium on Performance Analysis of Systems and Software (ISPASS)
- **Reviewer**, Second Workshop on Agents in the Wild: Safety, Security, and Beyond (ICML 2026)
- **Artifact Evaluation Committee member**, 35th ACM SIGSOFT International Symposium on Software Testing and Analysis (ISSTA)