

# 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

## RELEVANT SKILLS

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

**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

- 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

- 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)

**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)*

## SERVICE

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

## PROJECT EXPERIENCE

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### **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

### **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

### **MARS: Multi-Agent Review System for Academic Papers**

Jan 2025 – Mar 2025

*Research Project*

*Python, LLMs, Multi-Agent Systems*

- Built a multi-agent LLM pipeline that simulates peer review with specialized agents for novelty, grammar, and critical questioning
- Achieved high accuracy on ICLR 2023 reviews, outperforming *o3-mini* and *NotebookLM* baselines
- Deployed privacy-preserving, local LLM evaluations using Ollama on consumer-grade hardware

### **gem5 Vision**

Jan 2023 – Jun 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