

Kunal Pai

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EDUCATION

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

Expected: June 2025

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

June 2023

WORK EXPERIENCE

Graduate Student Researcher, DArchR Lab @ University of California, Davis

Jun 2023 - Present

- Leading a team to deliver 10x acceleration in the simulation of cryogenic semiconductor and superconductor computing.
- Leading a team to develop the first add-on to the gem5 simulator for quantum error correcting codes (QECC).
- Collaborating with a team to develop and deliver 90% correlation between gem5 simulation results and hardware measurements.
- Mentoring 5 undergraduate students in the Davis Computer Architecture Lab to prepare them for graduate research.

Teaching Assistant, University of California, Davis

Sep 2023 - Dec 2023

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

Software Developer Intern & Tech Lead, humanID, Davis

Jan 2022 - Jun 2022

- Completed 10 projects with global teams, including:
 - Documentation of a Discord bot that combats spam and fake users.
 - Django-based web application for permission management for 100 users.

Technical Product Marketing Intern, SiTime Corp., Santa Clara

Jul 2021 - Sep 2021

- Presented strategy to improve distributor margin management and earned profits by \$250,000.
- Conducted a market survey on optical transceivers used in AI networking, to identify customers for MEMS timing chips.
- Created Visio diagrams for the product requirements document (PRD) of a timing chip.

ACADEMIC PROJECTS

Automated Frameworks of Semantic Augmentation to Improve MWP Solving

Apr 2024 - Jun 2024

Machine Learning Project

Python, NLP, Prompt Engineering

- Improved PaLM 2 LLM prompting accuracy on math word problems (MWPs) by 10% and TinyLlama fine-tuning LM accuracy by 60% through a one-shot digit-level semantics framework.
- Introduced a novel demonstration selection model to improve accuracy of LLMs. Model used BLEU scores and Levenshtein distance to identify the most similar equations for one-shot examples.

Effects of Toxicity on Disengagement in Open-Source Projects

Jan 2024 - Mar 2024

Software Engineering Project

Python, GitHub mining, scikit-learn

- Found a strong correlation (0.76 R-square) between high developer engagement in FAANG projects with larger codebases and lower levels of toxicity, providing actionable insights for community management.
- Quantified toxic behavior using sentiment analysis across corporate and non-profit communities, revealing how toxicity disproportionately impacts new developers compared to experienced ones.

Behavior of Spectre in Different Branch Predictors in gem5

Oct 2023 - Dec 2023

Computer Architecture Project

C++, gem5

- Validated design enhancements for Spectre-resistant branch predictors, demonstrating up to a 55% reduction in susceptibility to speculative execution attacks by emphasizing longer training periods and minimizing biased branches.
- Investigated the vulnerability of x86-based in-order and out-of-order processors to Spectre V1 attacks, revealing a strong correlation between branch predictor training periods and attack effectiveness.

gem5 Vision

Jan 2023 - Jun 2023

Framework

Next.js, Python, MongoDB, JSON Schema

- Boosted resource discovery speed by 20x with optimized search functionality across 1,200+ resources.
- Enabled faster retrieval of resources across 20+ categories by introducing categorization and semantic versioning.
- Enhanced accessibility for 500+ industry and academic user by integrating local/remote JSON files and MongoDB with gem5.

PUBLICATIONS

Calibration and Correctness of Language Models for Code

International Conference on Software Engineering (ICSE) 2025

Spiess, C., Gros, D., [Pai, K.](#), et. al.

Automatic Semantic Augmentation of Language Model Prompts (for Code Summarization)

International Conference on Software Engineering (ICSE) 2024

Ahmed, T., [Pai, K.](#), et. al.

Potential and Limitation of High-Frequency Cores and Caches

ModSim 2024: Workshop on Modeling & Simulation of Systems and Applications

[Pai, K.](#), Nand, A. & Lowe-Power, J.

gem5 Vision

gem5 Workshop at International Symposium on Computer Architecture (ISCA) 2023

Shah, P., [Pai, K.](#), et. al.

Validating Hardware and SimPoints with gem5: A RISC-V Board Case Study

gem5 Workshop at International Symposium on Computer Architecture (ISCA) 2023

[Pai, K.](#), Qiu, Z., & Lowe-Power, J.

TECHNICAL SKILLS

Languages: Python, C++, Java, JavaScript

Frameworks: React, Next.js, TensorFlow, PyTorch, Django, Flask, scikit-learn, pandas, NumPy, Matplotlib

Tools & Technologies: Git, Docker, MongoDB, gem5