

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 develop a graph accelerator in the gem5 simulator for quantum error correcting codes (QECC).
 - Leading a team to deliver 10x acceleration in the simulation of full-system cryogenic semiconductors and superconductors.
 - Collaborating with a team to develop an autotuning methodology with 90% correlation between gem5 simulation results and hardware profiling metrics.
 - 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 ($R^2 = 0.76$) between high developer engagement in FAANG projects with larger codebases and lower levels of toxicity, offering actionable insights for community management.
 - Quantified toxic behavior using sentiment analysis and mining corporate and non-profit repositories, revealing that toxicity disproportionately impacts new developers, affecting them up to 1.3x more than experienced ones.
- Behavior of Spectre in Different Branch Predictors in gem5** Oct 2023 - Dec 2023
Computer Architecture Project Python, C++, gem5, Docker
- Demonstrated up to a 55% reduction in susceptibility to speculative execution attacks by validating design enhancements like longer training periods and minimizing biased branches for Spectre-resistant branch predictors.
 - 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** 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.](#), et. al.
International Conference on Software Engineering (ICSE) 2024
- Potential and Limitation of High-Frequency Cores and Caches** [Pai, K.](#), Nand, A. & Lowe-Power, J.
ModSim 2024: Workshop on Modeling & Simulation of Systems and Applications
- gem5 Vision** Shah, P., [Pai, K.](#), et. al.
gem5 Workshop at International Symposium on Computer Architecture (ISCA) 2023
- 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

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, Unix/Linux, LaTeX