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 Jun 2023 - Present
DArchR Lab @ University of California, Davis *Davis, CA*
- Leading a project to achieve 10x acceleration in the simulation of cryogenic semiconductor computing, superconductors, and more fidelity in simulating quantum error correcting codes.
- Collaborating with 3 researchers to develop and deliver 90% correlation between gem5 simulation and hardware measurements.
- Mentoring 5 undergraduate students in the Davis Computer Architecture Lab to prepare them for graduate research.

Teaching Assistant Sep 2023 - Dec 2023
University of California, Davis *Davis, CA*
- Assisted 180 students in understanding course material and assignments, conducted weekly office hours, and gave and graded assignments for senior-level Probability & Statistical modeling class.

Software Developer Intern & Tech Lead Jan 2022 - Jun 2022
humanID *Davis, CA*
- Delivered 10 completed projects with global teams, including documentation of a Discord bot that combats spam and fake users, and a Django-based web application for permission management for 100 users.

Technical Product Marketing Intern Jul 2021 - Sep 2021
SiTime Corporation *Santa Clara, CA*
- Presented strategy to better distributor margin management and improve earned profits by $250,000.
- Conducted a market survey on types of optical transceivers used in AI networking infrastructure, to identify potential customers for MEMS timing chips.
- Created Visio diagrams for the product requirements document of a timing chip.

Projects

Automated Frameworks of Semantic Augmentation to Improve MWP Solving Apr 2024 - Jun 2024
Machine Learning Project *Python, NLP, Prompt Engineering*
- Improved language model accuracy on MWPs by 10% (prompting PaLM2) and 60% (finetuning TinyLlama) through a one-shot digit-level semantics framework, over base model performance.
- Introduced a novel demonstration selection model to identify the most similar equations for one-shot examples using BLEU scores and Levenshtein distance.

Effects of Toxicity on Disengagement in Open Source Projects Jan 2024 - Mar 2024
Software Engineering Project *Python, GitHub mining, scikit-learn*
- Analyzed factors contributing to developer disengagement in open-source projects, identifying a 0.76 R-squared value between less toxicity and large codebase size with high engagement for FAANG projects.
- Quantified toxicity across corporate and non-profit open-source communities, examining how toxic interactions disproportionately affected new developers compared to experienced ones, ultimately providing a roadmap for community managers to foster a more productive codebase.

Behavior of Spectre in Different Branch Predictors in gem5 Oct 2023 - Dec 2023
Computer Architecture Project *C++, gem5*
- Investigated susceptibility of x86-based in-order and out-of-order processors to Spectre V1 attacks using gem5 v23.0, identifying a strong correlation between Spectre attack effectiveness and branch predictor type.
- Validated design enhancements for a Spectre-resistant branch predictor, emphasizing longer training periods and mitigation of biased branches, aimed at reducing susceptibility to speculative execution attacks by upto 55%.

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.
- Introduced semantic versioning and built a categorization system, enabling faster retrieval of resources across 20+ categories.
- Integrated local/remote JSON files and MongoDB for gem5, enhancing accessibility for 500+ industry and academic users.

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

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

Frameworks: React, Next.js, TensorFlow, PyTorch, Django, Flask

Tools & Technologies: Git, Docker, MongoDB, gem5