

# 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

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**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

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

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

**Tools & Technologies:** Git, Docker, MongoDB, gem5