QUANG DUONG

CONTACT INFORMATION

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RESEARCH INTERESTS

My research applies machine learning techniques to classical microarchitectural prediction problems (e.g. data prefetching, cache replacement and branch prediction) to distill insights that can guide the design of a more practical ML-based predictor or improve existing traditional table-and-counter-based predictors.

EDUCATION

The University of Texas at Austin . . . . Fall 2020 - Present
- Ph.D. in Computer Science [GPA: 4.0]
- Advisor: Calvin Lin

The University of Texas at Austin . . . . Fall 2015 - Spring 2020
- B.S./M.S. in Computer Science
- B.S. in Mathematics (Specialization in Scientific Computing)
- *Summa Cum Laude* [GPA: 3.9482]

EXPERIENCE

Graduate Research Assistant . . . . Spring 2021 - Present
Department of Computer Science, The University of Texas at Austin
- Reduced the size ($>1000\times$) and latency ($>100\times$) of neural temporal prefetchers while improving generalization by reformulating the temporal prefetching prediction problem.
- Extracted salient branches from profiled neural branch predictors for compression.

CPU Performance Exploration Intern . . . . Summer 2024
Arm, Austin
- Implemented temporal prefetch engine with up to 3% performance headroom.
- Managed prefetcher aggression with fine-grained throttling using machine learning.

CPU Performance Exploration Intern . . . . Summer 2023
Arm, Austin
- Improved speculative cache management using SOTA academic prediction algorithms.
- Explored performance and efficiency headroom of modern cache replacement policies.

Architecture Research Intern . . . . Summer 2022
Arm Research, Austin
- Found double digit traffic reduction opportunity using smarter prefetcher management.
- Implemented practical ML algorithm that achieves a significant portion of the headroom.

Graduate Research Assistant . . . . Fall 2019 - Summer 2020
Space and Geophysics Laboratory, Applied Research Laboratories, Austin
- Proposed and implemented data format for 4-10$\times$ speedup in processing time.
- Migrated code base from Python 2 to 3 and wrapped legacy C++ code into Python libraries with SWIG and Cython to streamline data analysis.

Student Technician . . . . Fall 2018 - Summer 2019
Space and Geophysics Laboratory, Applied Research Laboratories, Austin
- Leveraged clustering and reinforcement learning techniques to iteratively refine estimations of ionospheric model parameters competitive with commercial software.
- Achieved real-time speed by adaptively sampling a fast surrogate model.

Honors Scholar . . . . Summer 2018
Space and Geophysics Laboratory, Applied Research Laboratories, Austin
- Denoised raw ionosonde output via clustering and adaptive thresholding.
- Generated interdependent feasible ranges for the ionospheric model parameters from denoised ionosonde information via multi-layer perceptrons.

Texas Institute for Discovery Education in Science Fellowship . . . . Summer 2017
College of Natural Sciences, The University of Texas at Austin
- Analyzed different Pareto frontiers by weighting the objective function for the 3D model approximation genetic algorithm that traded off generated OpenSCAD code complexity with convergence and error rate to allow for downstream non-expert modification.
- Implemented vectorized voxelization code to approximate expensive objective functions.

Freshman Research Initiative Fellowship . . . . Summer 2016
College of Natural Sciences, The University of Texas at Austin
- Adapted CPPN-NEAT to refine a neural network to functionally approximate a 3D model.
- Generated OpenSCAD's model descriptor language using the neural network output.

PUBLICATIONS

***A New Formulation of Neural Data Prefetching* [ISCA]** 2024
- Quang Duong, Akanksha Jain, and Calvin Lin

TEACHING

CS 395T: Prediction Mechanisms in Computer Architecture . . . . Spring 2024
Co-Instructor for Graduate Course
CS 395T: Prediction Mechanisms in Computer Architecture . . . . Spring 2023
Co-Instructor for Graduate Course
CS 395T: Prediction Mechanisms in Computer Architecture . . . . Spring 2022
Co-Instructor for Graduate Course
CS 380P: Parallel Systems . . . . Summer 2021
Teaching Assistant for Graduate Course
CS 380P: Parallel Systems . . . . Fall 2020
Teaching Assistant for Graduate Course
CS 373: Software Engineering . . . . Spring 2018
Proctor / Undergraduate Teaching Assistant for Undergraduate Course
CS 309: Computational Intelligence in Game Research FRI . . . . Spring 2017
Freshman Research Initiative Mentor for Undergraduate Course

ACTIVITIES

IEEE/ACM International Symposium on Microarchitecture [MICRO] 2023
Artifact Evaluation Committee Member
Principles and Practice of Parallel Programming [PPoPP] 2022
Artifact Evaluation Committee Member
Machine Learning Data Prefetching Competition [ISCA / MLArchSys] 2021
Co-Organizer
Association of Computing Machinery . . . . Fall 2015 - Present
Student Member
Machine Learning and Data Science Student Organization . . . . Spring 2016 - Spring 2018
Student Member
Information and Systems Security Society . . . . Fall 2015 - Spring 2017
Student Member

AWARDS

TIDES Advance Summer Research Fellowship . . . . Summer 2017
  · Awarded to undergraduate students working on advanced research with a supervisor

Freshman Research Initiative Fellowship . . . . Summer 2016
  · Awarded to freshmen students to continue working on their FRI research proposal

Distinguished College Scholar / Students of High Academic Achievement . . 2017 - 2019

Kemp-Forman Memorial Endowed Presidential Scholarship . . . . 2017 - 2018

Tracor/Frank McBee, Jr. Scholarship . . . . 2016 - 2017

RESEARCH TALKS

A New Formulation of Neural Data Prefetching . . . . Summer 2024
Arm, Austin

SKILLS

  · **Languages**: Python, C/C++, Rust, HTML/CSS, Go, Java, JavaScript, x86 Assembly, LaTeX, SQL, MATLAB, Julia
  · **Libraries**: numpy, PyTorch, TensorFlow, sklearn, scipy, matplotlib/seaborn, React, Flask, OpenGL
  · **Other Skills**: Unix Systems (Ubuntu, Debian, Arch Linux), Vietnamese, 🐱 Cat Enthusiast

MISC

  · Contributed to an open-source project (GPSTk) during my UT ARL graduate assistantship.