

# CYRUS (ZIKAI) ZHOU

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## EDUCATION

### University of Chicago

BS in Computer Science

Chicago, US

September 2020 - Present

- **GPA:** 3.9/4.0, **Major:** 3.93/4.00.
- **Selected Awards:** UChicago Summer Quad Research Scholar ([S2023](#)), 2xUChicago Quad Research Scholar ([2022-2023](#), [2023-2024](#)), [UChicago Dean's List](#) (2021-2022, 2022-2023), Jeff Metcalf Award (May 2022).
- **Selected Courses:** Grad Deep Learning Systems, Grad Advanced Operating Systems, Grad Machine Learning for Computer Systems, Grad 3D Computer Vision, Computer Architecture, Systems Programming, Algorithms.

## PUBLICATIONS, PREPRINTS & PRE-SUBMISSIONS

1. **Cyrus Zhou**, Vaughn Richard, Pedro Savarese, Zack Hassman, Michael Maire, Michael DiBrino, and Yanjing Li, "[SySMOL: A Hardware-software Co-design Framework for Ultra-Low and Fine-Grained Mixed-Precision Neural Networks](#)", June 2024, *International Symposium on Computer Architecture (ISCA)*, under review.
2. **Cyrus Zhou**, Zack Hassman, Ruize Xu, Dhirpal Shah, Vaughn Richard, and Yanjing Li, "[YFlows: Systematic Dataflow Exploration and Code Generation for Efficient Neural Network Inference using SIMD Architectures on CPUs](#)", March 2024, *ACM SIGPLAN International Conference on Compiler Construction (CC)*.
3. Lefan Zhang, **Cyrus Zhou**, Michael L. Littman, Blase Ur, and Shan Lu, "[Helping Users Debug Trigger-Action Programs](#)", Jan 2023, *Proc. ACM Interact. Mob. Wearable Ubiquitous Technol. (IMWUT/UbiComp)*.
4. Bogdan Stoica, Utsav Sethi, Yiming Su, **Cyrus Zhou**, Suman Nath, Jonathan Mace, Madan Musuvathi, and Shan Lu, "If At First You Don't Succeed, Try, Try, Again...? Automatically Detecting Retry Bugs in Distributed Applications", *In Preparation (Withdrawn from OSDI)*.
5. Haochen Pan, **Cyrus Zhou**, Suman Nath, Madan Musuvathi, and Shan Lu, "Understanding and Detecting Idempotency Violations in Serverless Applications", *In Preparation*.

## RESEARCH EXPERIENCE

### University of Chicago

Chicago, US

Research Assistant to [Professor Yanjing Li](#)'s Group

#### ADHD: a Compiler for Fast Neuroscience Simulation

December 2023 - Present

- **Description:** Computational neuroscience usually involves tensor operations that 1) are very sparse and 2) have weight tensors dependent on intermediate results. We device a compiler for such computations.
- Leading a team of 3 students, proposed the research idea.
- Designing algorithms to exploit input-dependent weight sparsity.
- Developing compiler backend with LLVM IR, SIMD Intrinsics, and CUDA.
- Work in progress.

#### Hardware-software Co-design for Ultra-low Precision Fine-grained Mixed Precision Networks

June 2023 - Present

- **Description:** Current hardware lacks support for ultra-low precision mixed-precision neural networks. We provide the first hardware-software co-design framework for these networks utilizing SIMD architecture.
- Led a team of 4 students, proposed the research idea.
- Designed modified SIMD ALUs to support ultra-low precision mixed-precision computations.
- Integrated these SIMD ALUs into processor pipelines and designed instructions for MAC and MUL operations.
- Designed hardware-aware training with noise injection and constraint enforcement.
- Developed hardware-aware inference code generator for efficient inferences on the new architectures.
- Ran training and inference experiments, composed the paper.

#### SIMD Dataflow Co-optimization for Efficient Neural Networks Inferences

October 2022 - September 2023

- **Description:** Compiler support for SIMD programs remains lacking. Existing compilers usually fail to optimize SIMD code or parallelize code with SIMD instructions. We develop a framework for generating efficient SIMD code for serving neural networks, substantially lowering the costs and barriers of deploying neural networks on edge devices and commercial servers, democratizing the use of AI.
- Led a team of 5 students.
- Proposed the research idea, extended the notion of dataflows to CPUs, analyzed further reuse opportunities.
- Developed a SIMD code generation framework for generating efficient programs for neural networks.
- Designed and implemented end-to-end optimization algorithms.
- Ran experiments, collected data, performed data analysis, compared different dataflows, composed the paper.
- Substantially outperformed state-of-the-art frameworks.

Research Assistant to [Professor Shan Lu](#)'s Group

#### Analyzing and Exposing Retry Bugs in Large-Scale Distributed Systems

June 2023 - Present

- **Description:** Many developers are not aware of bugs related to retries in distributed systems. We find bugs in these systems using a combination of static checking, large language models, and exception injection.
- Refined and instrumented Wasabi, a tool that leverages unit tests to validate and track the retry behavior within large-scale distributed systems through exception injection, analyzed bug reports.
- Developed Coconut (Code Coverage for iNdividual Unit Tests), a tool that leverages JaCoCo to find the line coverage of each individual unit test, which is intended to find out useful unit tests to simulate and eventually expose retry bugs in large-scale distributed systems (e.g., Hadoop).
- Helped compose the paper.

#### Detecting and Exposing Idempotency Violations in Serverless Computing

October 2022 - June 2023

- **Description:** Serverless computing has become popular for event-driven applications. However, idempotency bugs are often overlooked by developers, leading to undesired effects. We strive to expose and fix these bugs.
- Collected Problematic Codebases from Open Source Github Repositories, categorized them by application type, API type, root cause, and symptoms, and found general anti-patterns leading to idempotency violations.
- Deployed 20+ repositories of serverless software, tested static checkers for anti-patterns, and refined and ran experiments with the testing framework for symptom diagnosis.

#### Helping Users Debug Trigger-Action Programs (TAP)

March - August 2022

- **Description:** This project is the first empirical study of users' end-to-end TAP debugging process, focusing on obstacles users face in debugging TAPs and providing them with three debugging tools.
- Designed user study methodology, proposed, and refined the user obstacles mental model.
- Tested and refined the software system.
- Conducted user study, analyzed the result, and composed the paper.

Research Assistant to [Professor Blase Ur](#)'s Group

#### Personalized Classifier for Finding and Deleting Sensitive Files on Google Drive

March 2023 - September 2023

- **Description:** Users often mistakenly upload sensitive files to Google Drive. We develop a recommendation system for deleting these files to greatly enhance user security and privacy.
- Enhanced the existing sensitive file classifier by integrating multiclass classification and reinforcement learning for improved deletion recommendation personalization.
- Developed programs for integrating large-language models (LLMs) locally to extract features from textual data.
- Proposed the design of a new rule-based classifier using ILP and formal reasoning techniques.
- Designed user studies for training classifiers more effectively.
- Deployed codebases from preceding works, performed feasibility analysis of backend extension.

#### SELECTED COURSE PROJECTS

##### Detecting Webcams' Spying Behavior via Machine Learning

Autumn 2022

- Applied machine learning techniques to detect if any spying application is running on the host computer.
- Empirically collected experiment data, trained and cross-validated machine learning models, performed both multiclass classification and binary classification, presented the report using Sphinx using nbSphinx.

##### ARM Instruction Set Simulator

Autumn 2022

- Implemented a CPU-based ARM ISA Simulator in the following cumulative stages: (1) Single-stage, (2) Pipelined, (3) Branch Predictor, and (4) Memory Hierarchy. Topped the class in accuracy.

##### VR Diver Interface

Autumn 2022

- Led a team of 4 students, implemented an augmented reality (AR) diver interface on Unity using C#.

##### Orienteering Problem with Time Windows

Spring 2022

- Designed and implemented three algorithmic solutions (greedy, dynamic programming, and backtracking) for an NP-hard problem, wrote a program to find the best solutions, further optimized results with local search.

##### Chiventure Game Engine

Spring 2022

- Led the graphics team (5 members), designed, implemented, and integrated graphical interfaces.

##### Simple Shell & Cache

Winter 2022

- Implemented a Shell in C that performs argument parsing, process forking, and output redirection (all correct)
- Implemented a simulator of cache (behavior all correct) and optimized its performance (topped the class).

#### WORK EXPERIENCE, TEACHING EXPERIENCE & SERVICES

Teaching Assistant to [Professor Yanjing Li](#), CMSC 14400 - Systems Programming II

Autumn 2023

[UChicago Student Summer CS Research Fellowship Program](#), Student Lead

Summer 2023

Teaching Assistant to [Professor Borja Sotomayor](#), CMSC 14200 - Introduction to Computer Science

Winter 2023

Teaching Assistant to [Professor Haryadi Gunawi](#), CMSC 15400 - Introduction to Computer Systems

Autumn 2022

[Moody's](#), Database Infrastructure & Middleware Intern, under [Ryan Galloway, SVP](#)

June - August 2022

[CreditEase GenZ Forum](#), Co-organizer

March - September 2021

[Vision Knight Capital](#), Investment Intern

June - August 2021

[Kinzon Capital](#), Investment Intern (Technology Sector)

March - June 2021