

Haoyang Zhang

SENIOR STUDENT, COMPUTER ENGINEERING, UNIVERSITY OF MICHIGAN

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Education

University of Michigan

Ann Arbor, U.S.

B.S.E. COMPUTER SCIENCE (DUAL DEGREE)

Aug. 2020 - May. 2022(Expected)

- GPA: 4.00/4.00
- Course Highlights: Adv. Topics in Computer Arch.(grad, in progress), Operating Systems (in progress), Parallel Programming with GPU (grad, in progress), Computer Architecture (A), Compiler Construction (A+)

Shanghai Jiao Tong University

Shanghai, China

B.S.E. ELECTRICAL AND COMPUTER ENGINEERING (DUAL DEGREE)

Sep. 2018 - Aug. 2022(Expected)

- GPA: 3.68/4.00
- Course Works: Programming & Data Structures (A+), Honors Physics (A, A+), Logic Design (A), Intro. Circuits (A)

Mcgill University

Montreal, Canada

WINTER EXCHANGE PROGRAM

Jan. 2020 - Feb. 2020

Course Works: Intro. to Data Modeling/Project Management

Publication

Debugging in the Brave New World of Reconfigurable Hardware.

Jiacheng Ma, Gefei Zuo, Kevin Loughlin, **Haoyang Zhang**, Andrew Quinn, Baris Kasikci. (ASPLOS 2022). *To Appear.*

Research

Efeslab - University of Michigan

Ann Arbor, U.S.

ADVISOR: BARIS KASIKCI

Apr.2021 - Present

- **Project: Reconfigurable Hardware Debugging**
 - **Objectives:** Study bugs in existing FPGA designs and produce a testbed to reliably reproduce each bug. Build a novel collection of hybrid static/dynamic program analysis and monitoring tools for debugging FPGA designs.
 - **Responsibility:** Implement the simulator for SignalCat, a recorder and printer on actual hardware deployments. Study Intel/Xilinx platforms and Interfaces, implement special building blocks to help reproduce hardware bugs. Search and find more opensource buggy examples, reproduce and debug them, update our bug study and further improve our tools.

CELAB - University of Michigan

Ann Arbor, U.S.

ADVISOR: TODD AUSTIN

Sept. 2021 – Present

- **Project: A Spectre Attack Targeting Compiler-based Protections. (Also EECS573 Course Project)**
 - **Objectives:** Find a way to subvert compiler-based LFENCE Spectre protections by identifying and jumping over the speculation barrier code inserted by the compiler using the special partially-tagged partial-data BTB.
 - **Responsibility:** Lead this project, design experiments. Details are confidential until the work is submitted

Emerging Computing Technology Laboratory – Shanghai Jiao Tong University

Shanghai, China

ADVISOR: WEIKANG QIAN

Jan. 2021 – Present

- **Project: MiniHLS: A Simple High-Level Synthesis Tool**
 - **Objectives:** An HLS tool based on LLVM, which can compile C functions to Verilog modules, having multiple features including loop optimization, support for structs and classes, tcl file parsing, etc.
 - **Responsibility:** Study the start-of-art array partition algorithms for HLS and the Polyhedral Compilation Model, and try to implement our own memory partition algorithm using Polly. Test the HLS output on FPGA, do post-synthesis debugging/on-board verification and hence modify the source code of our Mini-HLS.

Trusted Cloud Group - Shanghai Jiao Tong University

Shanghai, China

ADVISOR: PROF. ZHENGWEI QI

Nov. 2020 – Jul. 2021

- **Project: FPGA-based Accelerator Design for Neural Network Algorithms in Image Compression**
 - **Objectives:** An end-to-end exploration of hardware acceleration for learning-based image compression, which used an optimized systolic array architecture and the winograd accelerating algorithm.
 - **Responsibility:** Study and be proficient in Xilinx Vivado HLS, implement the winograd transformation for our convolution data flow, implement part of the accelerator, conduct simulations and tests.

Industry Experience

T-head Division, Alibaba Cloud

MENTOR: YUNHAI SHANG

Hangzhou, China

Jul. 2021 - Aug. 2021

- **Position:** Software Research & Development Intern
- **Project:** Implement the optimization for the jpeg library for RISC-V vector processors.

Selected Projects

3-Way Superscalar R10K-Style Out-of-Order Processor Core

Ann Arbor, U.S.

ADVISOR: JON BEAUMONT

Feb. 2021 - April. 2021

- **Description:** Build a 3-way Superscalar R10K-Style Processor with a few advanced features: Non-blocking L1 Data cache, Dynamic branch prediction, Instruction prefetching, etc.
- **Responsibility:** Implement Data Cache, Memory Controller, Retire Stage, Map Table/Arch. Map Table, Branch FU, and do debugging. Analysis and optimize the performance of our processor.

An Optimized Compiler for Decaf Language

Ann Arbor, U.S.

ADVISOR: LINGJIA TANG

Jan. 2021 - April. 2021

- **Objectives:** Implement a working compiler with source language Decaf and target language MIPS using flex (lexical analysis), yacc/bison (syntax analysis), and C/C++ (other parts).
- **Responsibility:** Build and optimize the compiler by gradually implementing scanner, parser, IR generator and Mips generator. Chose Chaitin's Algorithm for register allocating and implemented a few IR optimization including Dead Code Elimination, Common Subexpression Elimination and Constant Propagation.

An Optimized CUDA Implementation for GCN

Ann Arbor, U.S.

ADVISOR: REETUPARNA DAS

Nov. 2021 - Dec. 2021

- **Objectives:** Implement optimized CUDA kernel code for aggregation and combination steps in GCN algorithm. Use tiled shared memory, exploit DRAM coalescing and avoid bank conflicts for optimization.
- **Responsibility:** Implement and optimized the CUDA kernel code for combinations in GCN. Design time measuring experiments and do performance analysis.

Skills

Language C/C++, Verilog/SystemVerilog, CUDA, Python, MATLAB, TeX
ISAs RISC-V, X86, LEGv8, MIPS, LC2K
EDA Tools Synopsys VCS, Verilator, Xilinx Vivado, Cadence Virtuoso

Teaching

SHANGHAI JIAO TONG UNIVERSITY

SU. 2020 Honors Physics (VP160), Teaching Assistant

Selected Awards and Honors

2021 Roger King Scholarship, University of Michigan
2021 University Honors, University of Michigan
2021, 2020 Dean's List, University of Michigan
2020, 2019 Undergraduate Academic Excellence Scholarship, Shanghai Jiao Tong University
2020 Student Development Scholarship, Shanghai Jiao Tong University
2019 Silver Medal, University Physics Competition
2019 Honorable Mention, Mathematical Contest of Modeling

Service and Activities

SERVICE

2019 SJTU Student Science and Technology Innovation Association, Consultant
2019 JI Young Volunteers Association, Minister

VOLUNTEERING

2019 Yunnan San He Junior High School Volunteer Teaching Team, Team leader