Hankun Dai

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Education

Institute of Computing Technology (ICT), Chinese Academy of Sciences (CAS) Aug 2023 - Now

- *Master in Computer Science*, GPA: 3.96/4.0

University of California, Berkeley Aug 2022 - Dec 2022

- *Visiting Student*, GPA: 4.0/4.0

University of Chinese Academy of Sciences (UCAS) Aug 2019 - July 2023

- *Bachelor in Computer Science*, GPA: 3.75/4.0

Research Interests

Computer Systems: architecture, parallel/distributed computing, operating system, accelerators, hardware/software co-design

Machine Learning: reinforcement learning, AI for Science, infrastructure

Always interested in systems to boost ML and ML algorithms to design better systems

Projects

Systems

Pipelined CPU able to boot Linux on FPGA [Git repo]

Built a RISC CPU on FPGA board and ran Linux core on it. Personal contributions:

- Basic structure of the pipeline and cache
- Support for privilege instructions
  - Privilege registers organization
  - TLB management
  - Sketchpad extension to RISC-V
- Interaction with AXI bus
- Prior to that, I also built a simple CPU with an agile, automatic CI/CD framework

Operating system running on dual core RISC-V RocketChip [Git repo]

Designed a Unix-like OS running on a dual-core RISC-V CPU on FPGA. I wrote all features/components, including:

- Interactive bootloader
- Exception handler, process scheduler and task binding
- Process communication and semaphore
- Virtual memory management
- File system
- Device drivers for communication on NIC

Tiny C compiler based on ANTLR [Git repo]

Implemented a compiler with multiple translation stages for core features of C. Syntax analysis was done by ANTLR and the target architecture was RISC-V 64GC. I did most of the work, including:

- Wrote some of the grammar rules
- Semantic analysis
- Intermediate representation generation
- Vector operation extension to C
- Assembly generation and optimization

Memory database query engine [Git repo]

Supported fundamental relation operations and SQL keywords for a real database system. Personal contributions:

- Filter and project operator implementation
- SQL aggregate keyword

Machine Learning

Reimplementation and evaluation of ECCV NeRF [Git repo]

- Reimplemented the work *NeRF: Representing Scenes as Neural Radiance Fields for View Synthesis* with PyTorch

Survey and improvement of TVCG PRS-Net [Git repo]

- Reimplemented the work *PRS-Net: Planar Reflective Symmetry Detection Net for 3D Models* and replaced linear transformations with high-performance ones
- Proposed to use transformation matrices for higher accuracy and generalization on other datasets

Thesis

Optimization and Acceleration of Atmospheric Model Core FV3 on AMD GPUs, *supervised by Prof. Huiyuan Li*

FV3 is the core of Global Forecast System (GFS) simulation suite. This thesis acts as part of a system software development project. We did a survey on its principles and analyzed effects of some numerical methods. We ported critical parts of it to AMD GPUs and optimized its performance on distributed systems.

Awards and Competitions

Outstanding Student of UCAS (top 20%) 2020 - 2021

Academic Scholarship of UCAS 2020 - 2021

The first Tsinghua Jittor's AI challenge competition Spring, 2021

- Award for entering B ranking list (50 teams)

Related Coursework

Graduate: AI Computing Systems, Advanced Computer Architecture, Parallel Computing, GPU programming
Undergraduate: Computer Architecture, Operating System, Compiler: Principles and Practices, Intro to AI

Skills

Programming languages: C/C++, Python, CUDA, Verilog, Assembly, Mathematica, Java

TOEFL: 101

Software and Tools: PyTorch, Visual Studio (Code), Xterm, Git, Vivado, Qemu