Saif Khattak

Work Experience

Jan. 2022 - Apr. 2022 — **Compiler Engineering Intern**, *Groq Inc.*, Mississauga ON (remote)
- Designed and implemented algorithms to efficiently utilize hardware resources for common tensor operations, increasing inference throughput by up to 40%
- Wrote **MLIR/LLVM** passes in **C++** to perform optimizations on **ONNX** graphs
- Created models in **PyTorch** to measure cycle-accurate compiler performance

Jan. 2020 - Aug. 2020 — **Software Engineering Co-Op**, *RadComm Systems*, Oakville ON
- Researched cutting-edge radiation detection techniques, using **GNU Octave** and **Python** for data visualisation to assess development options
- Applied statistical techniques to analyze gamma-ray radiation patterns in **C#**
- Automated voltage calibration process for complex device configurations

Sep. 2020 - Dec. 2020 — **Undergraduate Research Assistant**, *University of Waterloo*, Waterloo ON
- Wrote **C** implementation of novel post-quantum cryptographic algorithms
- Implemented cache-aware optimizations resulting in 60% speed improvement
- Created custom boolean matrix library for use in cryptographic algorithms

May 2019 - Aug 2019 — **Secure Software Developer**, *ESCRYPT*, Waterloo ON
- Implemented process for periodically provisioning digital certificates on-vehicle
- Improved signing/verifying algorithms in **C++** targeted at vehicular embedded systems
- Wrote standards-compliant tests using **GoogleTest** framework to prove functionality

Projects

May 2022 - Aug. 2022 — **Bayesian Network Accelerator**, Python — VHDL — Chisel
- Designed hardware in **VHDL** for efficient Bayesian inference
- Created **protobuf**-based specifications for model description and elaboration
- Implemented compiler in **Python** to analyze models and emit VHDL for accelerator

Feb. 2022 - Mar. 2022 — **CHIP-8 Emulator**, C++ — SDL2 — ImGUI
- **C++** interpreter for CHIP-8 instruction set, runs publicly available ROMs
- Includes graphical and audio interface using **SDL2**
- Designed live debugger using **ImGUI** to inspect memory dumps and processor state

Dec. 2021 - Jan. 2022 — **3D Rasterized Render System**, C++ — CMake — OpenGL
- 3D rasterized rendering system written with **OpenGL 3.3** in **C++17**
- Implements mesh generation, texture loading and phong lighting shaders
- Allows model loading from common file types based on the **Assimp** library

Sep. 2021 - Nov. 2021 — **Pipelined 32-Bit RISC-V Core**, Verilog — Verilator
- Implements RV32I spec; written from scratch in **Verilog**, simulated using **Verilator**
- Wrote **Python** script to run standardized RV32I instruction and benchmark tests
- 5-stage pipeline with static branch prediction, register bypassing, hazard detection

Education

Sep. 2019 - Apr. 2023 (expected) — **University of Waterloo**, *Candidate for Computer Engineering B.A.Sc*, Waterloo ON

Relevant coursework:

- Computer Architecture
- FPGAs
- ARM & RISC-V ISAs
- Operating Systems
- Compilers
- Reinforcement Learning

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