Dhanvi Bharadwaj

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Education & Honors

University of Michigan-Ann Arbor
PhD in Computer Science & Engineering | Advisor: Dr. Gokul Ravi   Aug. 2024 – Present
- MICDE Fellowship 2024

University of Wisconsin-Madison
Bachelor of Science in Physics, Minor in Data Science   Sept. 2020 – May 2024
- **GPA**: 3.9/4.0, Graduated with Academic Distinction
- Hilldale Research Fellowship 2023 (undergraduate research)

Coursework: Computer Arch. (Grad.), High-Performance Computing, Quantum Mechanics, Machine Learning

Technical Skills

Languages: Python, C++, Cython, Julia, SystemVerilog
Libraries: Qiskit, Pennylane, cuQuantum, PyTorch, NumPy, CuPy, Pybind11
Software: CUDA, Linux, Git, CMake, Docker, AWS

Professional Experience

Quantum Computing Software Intern   May 2024 – Aug. 2024
NVIDIA   Santa Clara, CA
- Worked on the cuQuantum team within the CUDA-X Math Libraries to optimize tensor network (TN) simulations for quantum circuits using NVIDIA Tensor Core GPUs
- Implemented a TN algorithm with CuPy and C++ to optimize matrix product states (MPS), enhancing the accuracy of TN contractions involving 2-qubit gates and matrix product operators
- Designed a preprocessing method to introduce canonical gauge structures into user-provided MPS

Software Engineer Intern   Feb. 2024 – May 2024
qBraid   Chicago, IL
- Conducted detailed profiling and performance analysis using Qiskit Quantum Volume circuits on qBraid Lab, identifying and resolving kernel bottlenecks
- Led comprehensive benchmarking studies on SOTA NVIDIA GPU hardware systems, exploring the effect of depolarizing noise on density matrix-based simulation techniques

Quantum Machine Learning Intern   May 2023 – Aug. 2023
Oak Ridge National Laboratory   Oak Ridge, TN
- Developed Quantum Machine Learning models using PennyLane and Qiskit frameworks to achieve 90% accuracy in classifying multidimensional and non-linear datasets
- Utilized PyTorch to implement data re-uploading algorithm to enhance the accuracy of models by 30%
- Created hardware efficient layers with $SU(4)$ and IsingZZ quantum circuits for binary and multi-class classification tasks on imbalanced datasets (Presented at IEEE QCE23)

Projects

TorchQuantum - Open Source Contributions
- Implemented 15 unsupported quantum gates to expand the functionality of the PyTorch-based framework for fast GPU-supported circuit simulations
- Integrated various quantum circuits and template layers to improve library's versatility at unitaryHack 2023

Qiskit_research - Open Source Contributions
- Expanded pauli twirling functionality in IBM Qiskit's research library by adding gate-set generation support and modularizing code for scalability
- Implemented comprehensive tests to ensure robustness and validate new two-qubit gate features

N-Way Out-of-Order RISC-V Processor
- Designed R10K CPU incorporating variably-associative data cache, G-Share branch predictor, and victim cache
- Developed robust testing infrastructure, including GUI debugger and coverage-driven unit tests

Leadership & Involvement

Quantum Software Lead   Feb. 2023 – May 2024
Wisconsin Quantum Computing Club
- Led a team of 5 students to organize the inaugural IBM Qiskit Fall Fest 2023 at UW-Madison
- Developed and leading interactive workshops for 80+ students in Quantum Simulations and Error-Correction