Hrushikesh Pramod Patil

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Summary

Ph.D. candidate in Computer Engineering specializing in quantum information science, with expertise in quantum algorithms and applications, quantum error correction, mitigation and machine learning. Skilled in Python and C++, high-performance numerical simulation, and object-oriented software development for quantum and hybrid quantum–classical workflows with experience in designing linear system solvers and ODEs. Strong background in HPC and accelerators like GPU and TPUs.

Technical Skills

Languages: Python, C, C++, Julia, CUDA

Libraries & Tools: Qiskit, Cirq, Stim, Pennylane, Mitiq, CUDA-Q, NumPy, JAX, Pytorch, OpenMP, Git, matplotlib, GPGPUSim, ,LSF

Expertise: Quantum Error Correction, Quantum Error Mitigation, Error Characterization, Variational Quantum Algorithms, Circuit Cutting and Knitting, GPU Programming and Architecture, Parallel Programming, High Performance Computing, Operating Systems, CV-DV Quantum Systems.

Education

North Carolina State University — Raleigh, NC
Ph.D. in Computer Engineering, Specialization in Quantum Computing (GPA: 4.0/4.0) — *Aug 2021 -- May 2026 (Expected)*

Stony Brook University — Stony Brook, NY
M.S. in Electrical Engineering (GPA: 3.79/4.0) — *Aug 2019 -- May 2021*

Pune Institute of Computer Technology — Pune, India
B.E. in Electronics and Telecommunications (GPA: 3.64/4.0) — *Aug 2014 -- May 2018*

Experience

SRI — Menlo Park, CA
Quantum Benchmarking Intern — *Jun 2025 -- Aug 2025*

- Developed the **Quantum Reinforcement Learning benchmark** for QED-C Application Oriented Benchmark. Demonstrated the need for **co-development of high performance computing (HPC) and Quantum computing control systems stack** for hybrid algorithms.
- Collaborated on **methods to benchmark dynamic (mid-circuit measurement)** circuits and applications. Pre-print available.

Los Alamos National Laboratory — Los Alamos, NM
Fellowship Student — *Jun 2024 -- Aug 2024*

- Collaborated on QAOA-based Quantum Linear System Problem **warm start optimization**s on JuliQAOA.
- Reduced runtime of QAOA Quantum Linear System Problem by **33% by instrumenting warm started global optimization.**

Research Experience

Quantum Error Mitigation, Correction and Characterization Strategies — NC State, Raleigh
Graduate Research Assistant — *Mar 2022 -- Present*

- Improved error rate by **88% using reliability-aware error mitigation strategies.** (Reliability-based Zero Noise Extrapolation).
- Integrated circuit cutting and knitting techniques with error mitigation to enhance circuit fidelity (Presented at QCE 2023).
- Designed novel unsupervised-learning-based Quantum Error Mitigation method with **machine learning based noise characterization** leading to improved **fidelity by 1.45x** for various quantum algorithms. Presented at IEEE QCE 2025 (code available on GitHub).
- Collaborated on **benchmarking fidelity estimation and noise characterization techniques** of quantum devices. Demonstrated improved performance of mitigation schemes by using better noise characterization techniques of upto 7.97x.(Presented at QCE 2025)
- Currently working on **combining quantum error mitigation and error correction** to enhance fault tolerance.
- Explored improvements to **magic state cultivation protocol** using code-switch protocols.

Effect of Noise on Quantum Linear Solvers — Stony Brook University, NY
Graduate Research Assistant — *Jun 2020 -- May 2021*

- Reduced resource use in **Variational Quantum Linear Solver by 67%** using dynamic ansatz and noise-aware optimization.
- Published in Physical Review A; Presented at invited session INFORMS 2022.

Publications

Chen, I., **Patil, H. P.**, Zhou, H., & Sornborger, A. (2026). Efficient Magic State Factory Via Transversal Non-Clifford Gate. arXiv preprint arXiv:2606.16199.

Patil, H.P., Baron, D., Zhou, H. (2025). Q-Cluster: Quantum Error Mitigation Through Noise-Aware Unsupervised Learning. IEEE International Conference on Quantum Computing and Engineering (QCE 2025).

Mohapatra, S., **Patil, H.P.**, Liu, J., Zhou, H. (2025). Benchmarking Fidelity Metrics of Quantum Computers. IEEE International Conference on Quantum Computing and Engineering (QCE 2025).

Patel, N., Giri, A., **Patil, H. P.**, Siekierski, N., Chatterjee, A., Johri, S., ..., Niu, S. Platform-Agnostic Modular Architecture for Quantum Benchmarking. arXiv [Quant-Ph]. (2025).

Baron, D., **Patil, H.P.**, Zhou, H. (2024). Maximum Likelihood Quantum Error Mitigation for Algorithms with a Single Correct Output. IEEE International Conference on Quantum Computing and Engineering (QCE 2024).

Li, P., Liu, J., **Patil, H.P.**, Hovland, P., Zhou, H. (2023). Enhancing Virtual Distillation with Circuit Cutting. IEEE International Conference on Computer Design (ICCD 2023).

Patil, H.P., Li, P., Liu, J., Zhou, H. (2023). Folding-Free Zero Noise Extrapolation. IEEE International Conference on Quantum Computing and Engineering (QCE 2023).

Patil, H.P., Wang, Y., Krstić, P. S. (2022). Variational Quantum Linear Solver with Dynamic Ansatz. Physical Review A.

Wu, B., **Patil, H.P.**, Krstić, P. S. (2022). Effect of Matrix Sparsity and Quantum Noise on Quantum Random Walk Linear Solvers. arXiv:2205.14180.

Projects

Implementing Steane Code and Quantum Reed Muller Code in Deltakit Ongoing
Open Source *NCSU*

Currently extending the CSS code framework for Steane code and qRM code.

Code in progress at https://github.com/Deltakit/deltakit/issues/132

CUDA Implementation of Quantum Gates Jan 2023
Course Project *NCSU*

Simulated quantum gates using CUDA.

Observed 5x performance improvement by using cudaMalloc and cudaMemcpy versus cudaMallocManaged. Code available at github.com/hrushikesh890/Cuda_Quantum_Gate.

Acceleration of LRCN networks using FPGA May 2020
Course Project *Stony Brook University*

Achieved 8x times acceleration of LRCN networks using firmware development on the miniZed FPGA.

Designed the hardware and the software algorithm to accelerate LSTM part of LRCN network.

Quantum Kernel Methods for Graph-Structured Data Feb 2023
QHack 2023 Hackathon *Amazon Braket Challenge Winner*

Implemented Quantum Evolving Kernel for graph classification in drug discovery for neutral atom qubit arrays.

Utilized CAFQA initialization for accelerated convergence. Featured on AWS blog.

Courses

Quantum: Quantum Error Correction, Open Quantum Systems, Quantum Machine Learning, Quantum Computing in Physical Sciences

Computer Science: Compiler Optimization, Advanced Computer Architecture: Data Parallel Processors (GPU design and architecture), Embedded Systems, Parallel Computing, Micro-architecture

Machine Learning: Learning Systems, Hardware Architectures for Deep Learning (using FPGAs)

Other: Artificial Intelligence, Distributed Computation and Learning Over Networks, Signal Processing

Activities

Currently providing mentorship in research and development to high school and undergrad students.

Former Student-postdoc council member at Institute for Robust Quantum Simulation.

Reviewer for Nature Scientific Reports, IEEE Quantum Week and IEEE Transactions on Quantum Engineering.

References

Dr. Huiyang Zhou - hzhou@ncsu.edu

Dr. Dror Baron - dzbaron@ncsu.edu

Dr. Siyuan Niu - siyuan.niu@ucf.edu

Dr. Manas Sajjan - msajjan@ncsu.edu