Chaithanya Naik

PhD Student · University of Wisconsin-Madison
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Research Interests

Quantum Computing, Quantum Error Correction, Error mitigation, Reinforcement Learning, Quantum Synthesis

Education

University of Wisconsin-Madison — Madison, WI, USA
PhD student in Computer Sciences | Advisor: Prof. Swamit Tannu — 2022 - present

Indian Institute of technology Bombay — Mumbai, India
M.Tech & B.Tech in Computer Science and Engineering — 2016 - 2021
Minor in Physics | *Minor in AI and Data Science*

Publications

1. **Accurate Leakage Speculation for Quantum Error Correction**
   Chaithanya Naik Mude, Swamit Tannu.
   *58th IEEE/ACM International Symposium on Microarchitecture (**MICRO**), 2025, Seoul, Korea.*

2. **Efficient and Scalable Architectures for Multi-level Superconducting Qubit Readout**
   Chaithanya Naik Mude, Satvik Maurya, Benjamin Lienhard, Swamit Tannu.
   *62nd Design Automation Conference (**DAC**), 2025, San Francisco, California, USA.*

3. **Crosstalk-induced Side Channel Threats in Multi-Tenant NISQ Computers**
   Navnil Choudhury, **Chaithanya Naik Mude**, Sanjay Das, Preetham Tikkireddi, Swamit Tannu, Kanad Basu.
   *The Network and Distributed System Security Symposium (**NDSS**), 2025, San Diego, California, USA.*

4. **Understanding Side-Channel Vulnerabilities in Superconducting Qubit Readout Architectures.**
   Satvik Maurya, **Chaithanya Naik Mude**, Benjamin Lienhard, Swamit Tannu.
   *International Conference on Quantum Computing and Engineering (**QCE**), 2024, Montreal, Quebec, Canada.*

5. **Scaling Qubit Readout with Hardware Efficient Machine Learning Architectures.**
   Satvik Maurya, **Chaithanya Naik Mude**, William D. Oliver, Benjamin Lienhard, Swamit Tannu.
   *50th International Symposium on Computer Architecture (**ISCA**), 2023, Orlando, Florida, USA.*

6. **Efficient measurement of neutral-atom qubits with matched filters** | *Physical Review Applied*
   Robert M. Kent, Linipun Phuttitarn, **Chaithanya N. Mude**, Swamit Tannu, Mark Saffman, Gregory Lafyatis, Daniel J. Gauthier.

Pre-print

1. **Enabling Fast and Accurate Neutral Atom Readout through Image Denoising**
   Chaithanya Naik Mude, Linipun Phuttitarn, Satvik Maurya, Kunal Sinha, Mark Saffman, Swamit Tannu.

Selected Research projects

Efficient ML Decoder for Surface Code — *Ongoing*

- Designing an efficient ML model incorporating leakage speculation to enhance decoding accuracy for surface code
- Using adaptive RL techniques to adjust decoding for evolving error profiles of the system to boost resilience

Adaptive Leakage Detection for Quantum Error Correcting Codes (QECCs) — *Published at MICRO '25*

- Improve logical error rate by 16% by designing speculation strategies to precisely detect and mitigate leakage errors
- Reduced leakage accumulation by 2-3x using adaptive strategy for various QECCs, reducing QEC cycle time.

Enhanced Neutral Atom Readout with ML — *Presented at APS March Meeting 2025*

- Achieved 70x reduction in model size compared to state-of-the-art solution, enhancing computational efficiency.
- Developed modular and scalable machine learning models for neutral atom qubit readout, leveraging error profile

Scaling Multi-Level Qubit Readout using ML — *Published at ISCA '23, DAC '25*

- Achieved 16% relative improvement in readout accuracy by identifying relaxations that occur during qubit readout
- Designed efficient architecture using matched filters for qubit readout that used less than 8% resources on FPGA
- Enabled better leakage detection during readout with 6.6% relative improvement in accuracy for multi-level readout

Professional Experience

Quantum Machines | **Product Solutions Research Intern** *February 2026 - Ongoing*
- Working on projects related to calibration of superconducting systems and readout for neutral atom systems.

Research Assistant *January 2023 - 2026*
- Working on projects related to quantum error correction, quantum circuit synthesis, and assisting in coursework.

VMware Inc. | *Avi NSX-T load-balancer Manager: Anurag Palsule* *July 2021 - August 2022*
- Enhanced the performance of load balancer to manage heavy workloads through kubernetes operator
- Worked on a open source project for a kubernetes operator, catering to needs for NSX-T and openshift platforms

Other Research Experience

Understanding Security Risks on Multi-Tenant Quantum Computers *Published at NDSS '25*
- Designed an attack to deduce confidential user data by exploiting crosstalk-based side channel on quantum hardware
- Utilized information leak over crosstalk-based side channel to decipher victim's circuit using Graph Neural Network

ML for Quantum Circuit Synthesis *Ongoing*
- Designing unified adaptive ML model to optimize quantum compilation for varied dynamic hardware configurations

Academic Projects

- **Quantum Divide & Conquer** | Analyzed possible extensions to the paradigm | Quantum Algorithms
- **Gomoku RL Playing Agent** | Fundamentals of Intelligent agents
- **Depth Map Prediction From Single Image** | Computer Vision

Technical Skills

Programming & Tools	C/C++, Python, Bash, Go-Lang, Qiskit, Git, pennylane
Deep Learning	PyTorch, TensorFlow, Keras, TensorFlow Quantum

Awards & Achievements

- Awarded DAC Young Fellow at 62nd Design Automation Conference (**DAC**) *2025*
- Secured **2nd** position in HCL HACK IITK, the country's largest hackathon in **cybersecurity**, by IIT Kanpur *2022*
- Honourable Mention in **NSUCrypto-2021**, 8th International Olympiad in Cryptography *2021*
- Awarded **Gold** Medal in **Bosch's Route Optimization** challenge at the 8th Inter IIT Tech Meet *2019*
- Secured All India Rank **340** in IIT-JEE Advanced | All India Rank **90** in JEE Main Paper-II *2016*
- Amongst **Top 300** students in the country qualified for **INPhO** (for two straight years) and **INMO** *2015,14*
- Awarded **KVPY** Fellowship by IISc Bangalore | Recipient of **NTSE** Scholarship by NCERT *2014,12*

Service & Professional Development

Reviewer | Artifact - ISCA 2026, CAL 2024 *Ongoing*

Member of Graduate Student Advisory Board | CSE Department, UW-Madison *Ongoing*

Teaching Assistant | Assisted in assignments for Data Science and Quantum Computing courses *2021-2022*

Mentor
- Mentored a group of 15 students on Deep-Tech projects on Deep-Learning and Reinforcement Learning
- Helped a total of 12 students in pursuing their interests in Quantum Computing, Astronomy & Computer Vision

Department Academic Mentor | CSE Department, IIT Bombay *June 2020 - July 2021*

Department General Secretary | CSE Department, IIT Bombay *April 2019 - July 2020*

Miscellaneous

- Student Travel Grants - ISCA 2023, MICRO 2025
- Attended Near-term Quantum Algorithms Summer School by University of Sherbrooke *2024*
- Awarded second place at QED-Consortium poster presentation competition *2024*
- Part of the Inter IIT contingent securing **Runner's Up Position** at Inter IIT Tech Meet held at IIT Bombay *2018*
- Attended **Vijyoshi Science Camp** organized by Indian Institute of Science **(IISc)**, Bengaluru, India *2015*