Archisman Ghosh

*Research Interest: **Quantum Error Correction, Quantum Security & Quantum Computing***

📍 *Pennsylania, USA* ✉ apg6127@psu.edu 📞 +1 - 814 - 769 - 6586 G Google Scholar 🔗 LinkedIn

Summary

- Skilled in quantum computing and software development, delivering integrated project solutions.
- Proficient in quantum error correction and secure quantum systems, actively publishing, reviewing, and collaborating.
- Proficient in quantum computers and tools including Qiskit, Pennylane, Stim, and LLVM.

Education

2023 – Present	**Ph.D. Pennsylvania State University** Computer Science & Engineering. ***Advisor***: *Dr. Swaroop Ghosh. Primary research: Secure Quantum Systems and Quantum Error Correction; **GPA:** 3.86 out of 4*
2019 – 2023	**B.Tech. National Institute of Technology Durgapur** Computer Science & Engineering. ***Advisor***: *Dr. Bibhash Sen. Primary research: Test Generation and Hardware Trojans; **GPA:** 8.99 out of 10*

Relevant Work & Research Experience

Graduate Research Assistantship, Pennsylvania State University. ——— **2023 - Present**

1. A novel design of Quantum Tensor Networks to assist in protein design and classification. [Drug Discovery]
2. Analyzed and proposed a watermarking scheme using the inherent noise characteristics of quantum hardware to protect the user IP of quantum GANs. [QGANs] [Noise model] [Security]
3. Introduced the first adversarial model to Reverse Engineer QML models and extract parameters from transpiled circuits. Also proposed potential security measures for the safe execution of QML models in an untrusted environment. [Reverse Engineering] [QML] [Security]
4. Designed an improved surface code architecture to reduce the overall qubit overhead during quantum error correction, leading to efficient fault-tolerant quantum computing. [Stim] [QECC] [Surface Codes]
5. Developed a genetic algorithm-based framework to determine the optimum embedding during QML training. [QML] [Genetic Algorithm] [Optimization]

Undergraduate Research Assistant, National Institute of Technology Durgapur, India. ——— **2021 - 2023**

1. Designed a robust test generation framework based on the genetic algorithm to reduce the search overhead for test vectors during post-silicon validation. Also demonstrated Hardware-Trojan insertion at intermediate representations of RTL-level code in HLS software.
[Test generation] [ISCAS benchmarks] [Hardware Trojan] [HLS] [LLVM] [Hardware Accelerators]

Relevant Publications 🔗 Complete List of Publications on Google Scholar

1. Kundu D, **Ghosh A**, Ekambaram S, Wang J, Dokholyan N, Ghosh S. Application of Quantum Tensor Networks for Protein Classification. In Proceedings of Great Lakes Symposium on VLSI, 2024. **[Best Paper Award]**.
2. **Ghosh A**, Kundu D, Chatterjee A, Ghosh S. Guardians of the Quantum GAN. Preprint arXiv:2404.16156. 2024. **[Under Review]**.
3. **Ghosh A** and Ghosh S. The Quantum Imitation Game: Reverse Engineering of Quantum Machine Learning Models. In Proceedings of the 2024 Workshop on Attacks and Solutions in Hardware Security. **[Accepted]**.
4. **Ghosh A** and Ghosh S. AI-driven Reverse Engineering of QML Models. Preprint arXiv:2408.16929. 2024. **[Under Review]**.
5. Chatterjee A, **Ghosh A**, Ghosh S. Quantum Prometheus: Defying Overhead with Recycled Ancillas in Quantum Error Correction. Preprint arXiv:2411.12813. 2024. **[Under Review]**.
6. Phalak K, **Ghosh A**, Ghosh S. Optimizing Quantum Embedding using Genetic Algorithm for QML Applications. Preprint arXiv:2412.00286. 2024. **[Under Review]**.

Academic Peer Reviewing Contributions

1. **2024**: Springer Nature - Quantum Machine Intelligence
2. **2024**: Sub-reviewer in The IEEE QCE 2024. Track: Quantum Systems Software.