

Subhadeep Mondal

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Education

- 2020 – 2025 **Ph.D., Indian Institute of Technology Kharagpur, India**
Prime Minister's Research Fellow (PMRF) (*Fellowship Certificate*)
Thesis Title: *Efficient Quantum Computation Techniques for State Tomography, Machine Learning and Search Algorithm.*
Thesis defended: 18 November 2025
Degree awarded: 2 December 2025 (*Provisional Certificate*)
- 2018 – 2020 **M.Tech., Indian Institute of Technology Kharagpur, India**
Specialization: Wireless Communications and Networks.
CGPA: 8.9/10
Thesis Title: *ML Criterion Based Signal Detection of a MIMO-OFDM System Using Quantum and Semi-Quantum Assisted Modified DHA/BBHT Search Algorithm.*
- 2014 – 2018 **B.Tech., Kalyani Government Engineering College, West Bengal, India**
Branch: Electronics and Communications Engineering
CGPA: 8.29/10

Research Interest

- **Quantum Algorithms:** Advancing quantum signal processing, including developing efficient training methods for Quantum machine learning.
- **Applications of Quantum Algorithms in Wireless Communication:** Exploring how quantum algorithms can improve signal processing, channel estimation, resource allocation, and network optimization in next-generation wireless systems.
- **Quantum State Tomography:** Innovating efficient reconstruction protocols that minimize measurement requirements and computational complexity, enabling high-accuracy quantum state estimation for both small- and medium-scale quantum systems.
- **Hybrid Quantum-Classical Frameworks with circuit design:** Designing quantum-classical architectures to integrate variational algorithms with classical machine learning for NISQ Applications.
- **Tensor Network-based Quantum-Inspired Machine Learning:** Leveraging advanced tensor network techniques to emulate quantum correlations on classical hardware for machine learning.
- **Continuous-Variable Quantum Key Distribution (CV-QKD):** Developing signal processing and machine learning techniques to enhance performance, security, and scalability of practical CV-QKD systems.

Journals

1. S. Mondal and A. K. Dutta, "Relative entropy-based training of quantum neural networks," *IEEE Transactions on Quantum Engineering*, vol. 7, pp. 1–14, Art. no. 3100414, 2026, doi: 10.1109/TQE.2025.3638878.
2. S. Mondal, M. R. Laskar, and A. K. Dutta, "ML criterion based signal detection of a MIMO-OFDM system using quantum and semi-quantum assisted modified DHA/BBHT search algorithm," *IEEE Transactions on Vehicular Technology*, vol. 70, no. 2, pp. 1688–1698, 2021, doi: 10.1109/TVT.2021.3055537.
3. S. Mondal and A. K. Dutta, "A modified least squares-based tomography with density matrix perturbation and linear entropy consideration along with performance analysis," *New Journal of Physics*, vol. 25, no. 8, Art. no. 083051, 2023, doi: 10.1088/1367-2630/acf187.

4. S. Mondal and A. K. Dutta, "A Bayesian quantum state tomography along with adaptive frameworks based on linear minimum mean square error criterion," *New Journal of Physics*, vol. 25, no. 12, Art. no. 123001, 2023, doi: 10.1088/1367-2630/ad0e49.
5. M. R. Laskar, S. Mondal, and A. K. Dutta, "Eigen-spectrum estimation and source detection in a massive sensor array based on quantum assisted Hamiltonian simulation framework," *IEEE Transactions on Communications*, vol. 70, no. 6, pp. 4013–4025, 2022, doi: 10.1109/TCOMM.2022.3167057.
6. M. R. Laskar, S. Mondal, and A. K. Dutta, "A low-complexity quantum simulation framework for Toeplitz-structured matrix and its application in signal processing," *IEEE Transactions on Quantum Engineering*, vol. 4, pp. 1–23, 2023, doi: 10.1109/TQE.2023.3271995.

Conferences

- Mondal, Subhadeep, M. Saravanan, and Abhik Ghosh. *Quantum-Inspired Learning with Hybrid DPD Cost Function and Robust SVD for Noisy Scenarios*. In *Proceedings of the 17th International Conference on Communication Systems and Networks (COMSNETS)*, Bengaluru, India, 2025, pp. 1102–1107. DOI: 10.1109/COMSNETS63942.2025.10885696
- S. Mondal and M. Saravanan, "Enhanced Quantum-Inspired Supervised Learning for Telecommunication Networks," in *Proc. 2025 Computing, Communications and IoT Applications (ComComAp)*, Madrid, Spain, 2025, pp. 42–49, doi: 10.1109/ComComAp68359.2025.11353139.

Patents

1. **Title:** System and method to characterize an unknown Quantum State and obtain physically reliable estimate of the unknown Quantum state. **Assignee:** IIT Kharagpur **Patent Number:** 541007 **Status:** Granted (India). [Link](#)
2. **Title:** Bayesian Quantum State Tomography System with Adaptive Linear Minimum Mean Square Error Method. **Assignee:** IIT Kharagpur **Application Number:** 202431030098 **Status:** Published (India), 24/01/2025
3. **Title:** Method for Training Quantum Neural Networks in Mixed State with Entropy based Cost Function. **Assignee:** IIT Kharagpur **Application Number:** 202531023136 **Status:** Published (February 2026)
4. **Industry Patent Title:** Training a Tensor Network to Identify a Handover Candidate for a User Equipment in a Telecommunications Network. **Assignee:** Ericsson India Private Limited **Reference:** P11805WO01 (PCT/IN2025/050380 — to be published after the 18-month period) **Status:** Filed (March 17, 2025)
5. **Industry Patent Title:** Augmented Quantum Train Framework for Beam Level Mobility Management. **Assignee:** Ericsson India Private Limited **Reference:** P113500 (PCT/SE2025/050753 — to be published after the 18-month period) **Status:** Filed (August 21, 2025)
6. **Industry Patent Title:** KalmanNet-Based Carrier Phase Recovery for Continuous-Variable Quantum Key Distribution (CV-QKD). **Assignee:** Tata Consultancy Services **Patent Application No.:** 202621077479 **Status:** Filed (June 23, 2026)

Work Experience

- 2026-  **Assistant Professor:** Indian Institute of Technology (Indian School of Mines), Dhanbad.
- 2025  **PhD Intern:** Tata Consultancy Services ([Certificate](#))
- Project Title:** Signal Processing and ML for CV-QKD-Enabled 6G Secure Communication Systems. ([Patent Under Filing](#))

Work Experience (continued)

- 2025-  **Research Associate:** Indian Institute of Technology, Kharagpur. [May,2025-July,2025]
Project Title : A Low- complexity Quantum Simulation Framework for Efficient Spectrum Estimation and Detection in Large Antenna Array Communication System.
- 2024-2025  **Intern Researcher in [Ericsson R&D](#) ([Internship Certificate](#)) :** Chennai,India.
[April, 2024 - March, 2025.]
- Applied quantum-inspired and tensor-network techniques to beam-level mobility optimization and RAN throughput prediction.
 - Developed low-complexity classical models using quantum-inspired optimization, reducing parameters and training cost while preserving accuracy.
 - Designed tensor-network-based model compression for efficient deployment in communication network workflows.
 - Introduced a VQC-inspired sampling method for training without classical back-propagation, improving efficiency for large-scale RAN analytics.
 - [Outcome:](#) **2 invention disclosures (patents) filed;** 2 conference publications.
- 2021-24  **PMRF Teaching Assistant (NPTEL) ([Teaching Experience certificates](#)) :** Served as a teaching assistant in Signal Processing for mm-Wave Communication for 5G and Beyond, Spread Spectrum Communications and Jamming, and Analog Communication.

Skills

- Quantum Framework  Proficient in leading quantum programming environments such as Cirq, Tensorflow Quantum, Qiskit ([Qiskit Badges](#)), QuTiP, and PennyLane, enabling the design and execution of quantum circuits and simulations.
- Coding Languages  Proficient in MATLAB, Simulink, Python, LaTeX, Git, and GitHub for computational modeling, documentation, and collaborative development.
- Quantum Projects  Source code and projects available at: github.com/Subhadeep701
- Signal Processing  Proficient in Linear Algebra, Advanced Numerical Methods, machine learning, and their applications in wireless communication systems.

Achievements

- 2025  Technical Program Comittee Member in "Symposium Celebrating the Quantum Century (SCQC) 2025."
- 2025-  [Peer reviewer](#) for "Quantum Information Processing" and "IEEE Access".
- 2023- 2025  Qiskit Advocate and obtained Quantum Excellence Badge in Qiskit Global Summer School (IBM).
- 2021  **Finalist in Qualcomm** Innovation Fellowship India (2021).
Project Proposal: Channel Estimation and Data Detection based on Quantum Least Square and Quantum Detection algorithm for Massive MIMO-OFDM System.
- 2020  **Prime Minister Research Fellow (PMRF):** [Awarded and completed the PMRF](#) from the Ministry of Education (MoE), Govt. of India, as one of only 12 students nationwide representing the field of Electrical Engineering.