Himanshu Sharma

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Academic Qualifications

Year	Degree/Certificate	Institute	CPI/%
2023 - Present	B.S. (Physics)	Indian Institute of Technology, Kanpur	**8.1/10**
2023	CBSE(XII)	Amity International School, Saket	**98.0%**
2021	CBSE(X)	Amity International School, Saket	**98.2%**

Scholastic Achievements

- Secured **All India Rank of 4506** in JEE Advanced 2023 among the **1,20,000+ shortlisted candidates** across India *(2023)*
- Qualified the **Pre Regional Mathematics Olympiad** organized by HBCSE, ranked amongst **top 300** in Delhi region *(2019)*

Relevant Coursework (*) represents ongoing

Quantum Physics (A)	Quantum Computing and Communication (A)	Quantum Mechanics I (*)	Nanophotonics (*)
Special Relativity	Quantum Processes in Semiconductors (*)	Mathematical Methods I (*)	Classical Mechanics

Relevant Certifications

IBM Quantum Global Summer School 2025 | *(July'25)*

Objective	• Develop a theoretical and hands-on understanding of Quantum Computing, **Simulation**, **Advanced Algorithms**, **Architectures**, **Hardware**, **Noise Characterization**, and **Error Correction**, **Benchmarking**.
Approach	• Characterized and mitigated computational errors by implementing **Zero Noise Extrapolation** (ZNE) with global and local **circuit folding**, demonstrating practical approach to managing decoherence in quantum systems. • Determined ground state energy of a molecular Hamiltonian (N_2) using hybrid **Sample-based Quantum Diagonalization** (SQD) algorithm, employing a physically-motivated **LUCJ ansatz** to prepare the quantum state. • Developed a post-processing workflow to correct noisy experimental data by implementing a **self-consistent configuration recovery** technique that enforces physical symmetries on quantum measurement samples. • Engineered the mathematical structure of **Quantum Error Correction** (QEC) codes by constructing the stabilizer parity check matrices for both a locally-connected **Toric code** and a **non-local Gross** (QLDPC) code.

IBM Quantum Challenge 2024 | *(June'24)*

Objective	• Develop understanding of Quantum Computing using **Qiskit 1.0** and the updates which come along with it
Approach	• Built a Variational Quantum Classifier on ideal, simulated and quantum backends using Qiskit Patterns workflow • Implemented error suppression techniques like Dynamical Decoupling to address decoherence in quantum hardware • Optimized random circuits via **Cartan's KAK Decomposition** and **stochastic SWAP mapping heuristics**.

Relevant Independent Readings

Quantum Query Complexity and Lower Bounds

- **Source:** CS860: Quantum Lower Bounds; Thesis of Robert Špalek on Quantum Algorithms, Lower Bounds, Time-Space Tradeoffs
- Studied hybrid and **adversary methods** (positive and negative-weight variants), analysis via linear programming duality, **fractional certificate frameworks**, and semidefinite programming-based formulations to establish **tight quantum lower bounds**.
- Investigated applications of query complexity techniques to **quantum search**, **quantum counting**, **random walks**, and **matrix verification**, emphasizing their role in understanding time–space tradeoffs, and the tightness of known quantum algorithms.

Work Experience

Interpretability Research Intern | Dr Tushar Sandhan, IIT Kanpur | SURGE *(May'25 - July'25)*

Objective	• Uncover the internal **transformer** mechanisms behind in-context learning and **multi-shot prompting** (MSP)
Approach	• Implemented **GPT-2**, used **TransformerLens** to trace core circuits (induction, logit attribution, OV-copying) • Developed and benchmarked interpretability methods to dissect **superposition** and **feature entanglement** • Applied interpretability tools like **Linear Probes**, **Sparse AutoEncoders**, **Sparse CrossCoders**, **Function Vectors** and **Circuit Tracing** on novel datasets of diverse tasks utilizing MSP and studied related statistics
Outcome	• Discovered novel **circuit-level explanations** for the **scaling laws** of multi-shot prompting, helping in **improving accuracy** of Large Language Models without retraining, fine-tuning or providing it with massive context

Machine Learning Engineer | StepsAI *(Dec'24 - June'25)*

Objective	• Develop a production-grade, modular and **autonomous AI Agents framework** using OOP abstract classes
Approach	• Utilized **LlamaIndex** and **LangGraph**, integrating API access for GitHub, Jira, OneDrive, Airtable etc • Implemented **stateful session management** via RClone, and **robust retry logic** for enhanced user experience • Developed scalable **ETL pipelines** for real-time ingestion, transformation, and semantic indexing of large files • Implemented **vector search** & long-term memory via **Milvus**, **mem0**, enabling recall and multi-session context • Parallelized agent tasks with **Celery asynchronous task queue**, to achieve low latency response times

Technical Skills

- **Programming Languages:** Python, MATLAB, C, C++, Rust, JavaScript LaTeX
- **Software and Libraries:** COMSOL Multiphysics, Qiskit, Tensorflow, Keras, PyTorch, Git, PostMan, Django, SQL

Community Work

Programming Club | Coordinator *(April'25 - Ongoing)* | Secretary *(June'24 - April'25)*

- Led a two-tier team of 30+ students to organize campus-wide hackathons, sessions, projects promoting computational awareness.
- Mentored 20+ students in theory and implementation of Quantum Algorithms and QML Algos through the IBM Qiskit framework.