Vashishtha Kochar
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ROAD AHEAD

Quantum technology is a continuum of the greatest developments in human history.
With my knowledge of quantum science combined with an entrepreneur mindset, I am looking for all opportunities to contribute to the quantum revolution, especially in the quantum software technology areas dealing with applications of quantum cybersecurity, and quantum machine learning.

PROFESSIONAL EXPERIENCE

Quantum networking Intern | *Qulabs Software India*   [Aug'22 - Sep'22]
Quantum Communication and Quantum Computing company | Quantum Networking Research Team

- Software architecture design and development of the **discrete-event Quantum Network simulator kernel and physical layer** to incorporate multiplexing of qubits, reducing space complexity for quantum state management, dynamic scheduling of simulation events and introducing unidirectional graph data structure for storing the physical components and connections between them
- Developed **Django based Restful APIs** for simulating
  - E91 quantum key distribution
  - End to End entanglement generation
  - Greenberger–Horne–Zeilinger state analyser
  - Quantum Secure Direct Communication based on IP1 Protocol
  - Quantum Secure Direct Communication based on Ping-Pong Protocol
  - Quantum Teleportation

Software engineer | *Office Efficiencies India Private Limited*   [Apr'20 - Jul'22]
Computer and Network security company | SafeSquid: Content Filtering Internet Proxy Server

- Engineered a real-time **security information aggregator and analyser** to analyse all web traffic of the proxy server in high performance environment generating thousand requests per second
- Design and development of **full stack web automations** for the subscription management, marketing, and helpdesk portals using **MERN stack**

EDUCATION

Dual Degree (B.Tech. + M.Tech.) | *Indian Institute of Technology, Bombay*   [Aug'17 - Aug'22]
Nanoscience and Nanotechnology (Engineering Physics) | CPI: 7.99

TECHNICAL PROJECTS

Quantum entanglement between magnon modes inside quantum cavity | *Supervised Learning Project*
Guide: Prof. Himadri Dhar   [Aug'21 - Dec'21]

- Presented literature review on **entanglement in continuous-variable systems** with special emphasis on **logarithmic negativity entanglement measure** to quantify bipartite entanglement, formalism for entanglement in two mode Magnon-Cavity system and results describing **strong coupling between YIG sphere and cavity photons at both cryogenic and room temperatures**
- Calculation and quantification of the entanglement between **two modes of macroscopic magnetic sample** in terms of the experimentally observed quantities

Net charge fluctuation in proton-proton collisions | *Dual Degree Project*   [Jan'22 - Jul'22]
Guide: Prof. Sadhana Dash

- **Authored thesis** describing the mathematical model of various scattering processes in pp collisions and the collision simulation results comparing **correlation of moments of net charge fluctuation with multiplicity and spherocity** between event generator and expected Skellam distribution
- Systematic investigation of charge variations in pp collisions by **simulating the events using Pythia event generator** and analysis of higher moments of net charge for different multiplicity classes using **ROOT Analysis Framework in C++ language**

Deep Inelastic Scattering in Electron-Ion Collider | *Dual Degree Project* [Aug'21 - Dec'21]
Guide: Prof. Sadhana Dash and Prof. Anselm Vossen

- Presented research summary discussing the **mathematical model of deep inelastic scattering** processes, parton model, description of electron ion collider, and the **simulation architecture**
- **Contributed to the largex-eic GitHub** project to run analysis and comparison of various kinematic variables on events generated in full and fast simulation
- Prepared resolution plots for ATHENA proposal of Electron-Ion Collider sent to **US government**

Feedback Controlled Magnetic Levitation for Measuring Small Force | *B.Tech. Project*
Guide: Prof. Kantimay Das Gupta [Aug'20 - Dec'20]

- Design and optimization of **sensing and feedback circuits** to control magnetic field
- Demonstration of **levitated platforms**, which can support substantial weight, on table-top models

Automated Piezoelectric Devices Characterisation | *Research Project* [Aug'19 - Aug'20]
Guide: Prof. Dinesh Kabra

- Achieved **Real-time voltage and charge characterisation** of various piezoelectric devices at different frequencies and force using Arduino-based feedback and actuator setup

RISC microprocessor, IITB-Proc | *Course Project* [Aug'19 - Aug'20]
Guide: Prof. Virendra Singh | Electronics

- Design of a 16-bit **multi-cycle** microprocessor using **point-to-point** communication infrastructure

Handwriting recognition | *Course Project* [Aug'18]
Guide: Prof. Sunita Sarawagi | Introduction to Machine Learning

- Designed and developed a **convoluted neural network** for detection and classification of alphabets

Decision Tree regression | *Course Project* [Aug'18]
Guide: Prof. Sunita Sarawagi | Introduction to Machine Learning

- Implemented the **regression algorithm** and **optimized hyperparameters** with tree pruning

POSITION OF RESPONSIBILITY

Coordinator for ProNites | Mood Indigo, IIT Bombay [Aug'18 - Dec'18]
Asia's Largest College Cultural Festival | Audience of 1,50,000

- **Market research survey** gauging the demand for various musical genres within the target group
- **Negotiation with top Indian artists** for opening slots of concerts spanning various musical genres
- **Spearheaded team of 20+ organizers** to execute to India's largest student-organized crowds

SCHOLASTIC ACHIEVEMENTS

- Secured **All India Rank 468** in JEE Advanced out of nearly 0.2 million candidates [Jun'17]
- Secured **All India Rank 2451** in JEE Mains out of nearly 11.5 million candidates [Apr'17]

TECHNICAL SKILLS

Programming Languages	C/C++, Python, JavaScript, PHP, SQL, LATEX, Shell Programming, VHDL, Assembly level
Python Libraries	Qiskit, QuTip, Django, Flask, OpenCV, TensorFlow, Keras, Pandas, NumPy, Matplotlib
C++ Libraries	OpenCV, DLib, LibArchive, TagLib, Boost

KEY COURSES UNDERTAKEN

Quantum Physics	Quantum Information and Computing, Quantum Devices, Quantum Optics, Quantum Field Theory, Relativistic Quantum Mechanics, Photonics
Nanoscience	Advanced Laboratory Techniques, Nanomaterials, Nanostructures & Nanofabrication, Thin Film Physics & Technology, Semiconductor Physics, Condensed Matter Physics
Other Physics Courses	Nuclear & Particle Physics, Atomic and Molecular Physics, Optics and Spectroscopy Lab, Electromagnetic Theory, Special Theory of Relativity, Continuum Mechanics, Ultrafast Sciences
Mathematics and Statistics	Advanced Simulation Techniques, Statistical Physics, Machine Learning, Differential Equations, Linear Algebra, Numerical Analysis, Complex analysis, Analytical Techniques, Group Theory
Other Courses	Renewable Energy Technologies, Energy Management, Microprocessor Lab