Asish Kumar Mandoi

Senior Undergraduate
Department of Electrical Engineering
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Education

2019 – 2024 **Dual Degree (BTech - MTech) in Electrical Engineering**, *CPI: 7.57/10.00*
Minor in Quantum Physics
Indian Institute of Technology Kanpur, India

2019 **Grade XII (CBSE Board)**, *Cumulative Percentage: 93.80%*
MBS Public School, Bhubaneswar, India

2017 **Grade X (CBSE Board)**, *CGPA: 10.0/10.0*
DAV Public School, Bhubaneswar, India

Interests

Quantum Computing, Quantum Technologies, Optimization Theory, Neuromorphic Computing, Open-Source Software, DevOps, Cloud Native Computing

Experiences

Jan '23 – Present **Quantum Computing Analyst Intern, Unisys India**
Enterprise Computing Solutions Research & Innovation Team
- **Developed a proof of concept based prototype** to tackle generic optimization problems like Air Cargo Distribution and Vehicle Routing and demonstrated its effectiveness with current D-Wave technology
- Evaluated the commercial viability of the optimization prototype through rigorous testing on datasets with over 100 nodes, working **in collaboration with the D-Wave** team.

Dec '21 – Present **Research Associate, QResearch Project, QWorld**
QWorld *Optimizing Logistics using Quantum Algorithms, Mentor: Dr. Paweł Gora*
- **Contributed to a working publication** focused on various **hybrid quantum-classical techniques** to solve **combinatorial optimization problems in logistics**
- Validated theoretical results of 5 solvers of the Vehicle Routing Problem (VRP) by performing experiments for **550+ VRP instances** on the **D-Wave quantum annealers**
- **Devised a new solver** for VRP with **higher performance** compared to existing solvers
- **Co-mentored** several interns in designing **QUBO** formulations for VRP
- Presented our work on Quantum Annealing based VRP formulations at **IT conferences – WDI 2022 and Data Science Summit 2022**

May '22 – Jul '22 **Software Engineer Intern, Citrix**
DevOps and Automation Services Team, Bengaluru, India
- Developed a robust monitoring system for detecting issues related to **Grafeas**, a software auditing service critical for multiple internal applications at Citrix
- Implemented a **Golang** microservice with **safeguarded endpoints against DDoS attacks** and deployed it with **Kubernetes** using **Helm** Charts to private cloud
- Built a periodically triggered **CI/CD** pipeline using **Jenkins** and incorporated it with a **metadata capturing** component handled using Grafeas
- Facilitated **active monitoring of the Grafeas API** by creating a dashboard and an alert system on Slack based on reports collected from the pipeline logs using **Splunk**
- Secured a **pre-placement offer** for valuable contribution during the internship

Oct '21 – Jan '22 **Quantum Open Source Foundation**
QOSF *Quantum Computing Mentorship Program, Mentor: Dr. Vesselin G. Gueorguiev*
- Among **40 out of 1000+** applicants to be selected for the program and recognized for developing **one of the best solutions** to a Quantum Search problem

Task
- Implemented new solvers for the **Travelling Salesman Problem** (TSP) and the **Vehicle Routing Problem** (VRP) based on clustering and non-clustering techniques

Project
- **Improved performance** of existing quantum annealing-based solvers for TSP and VRP by optimizing our algorithms to use **minimal number of qubits**
- Benchmarked accuracies and running times of solvers by testing them on **D-Wave Quantum Annealers**

Presentations

Apr '22 S. Borah, **A. Mandoi**, A. Verma, "*Heuristic QUBO Formulations for solving the Vehicle Routing Problem using Quantum Annealing*." Talk presented at the 13th **WDI '22**, Warsaw, Poland.

Nov '22 **A. Mandoi**, "*Quantum Annealing methods for solving the Vehicle Routing Problem*." Talk presented at **Data Science Summit 2022**, Warsaw, Poland.

Selected Projects

Dec '22 – Present **Stochastic Neuromorphic Hardware for Combinatorial Optimization**
Advisor: Prof. Shubham Sahay
- Studied the properties of annealing-inspired computing accelerators based on **nonvolatile memory technology** for combinatorial optimization with **near-optimal accuracy and performance**
- Simulated the effects of **intrinsic noise** in memristor and flash memory based Hopfield Neural Networks to implement **power efficient hardware** with **stochastic behaviour**

Mar '22 – Apr '22 **Quantum Algorithms for Semidefinite Programming and its Applications**
Report *Advisor: Prof. Ketan Rajawat*
- Studied **Arora and Kale**'s classical algorithm based on Multiplicative Weights Update method for solving Semidefinite Programs (SDPs)
- Compared its complexity and lower bounds with that of **Brandão and Svore**'s quantum extension of SDP solvers and **Apeldoorn and Gilyén**'s subsequent speed-ups
- Investigated practical applications of quantum algorithms for solving SDPs like **Quantum Error Recovery** and **Shadow Tomography**

May '21 – Jul '21 **IITK-Coin**
GitHub *Backend of a pseudo-currency system | Programming Club, IIT Kanpur* *GitHub*
- Developed a containerized **microservices**-based application using **Golang** and **SQLite**
- Reinforced **backend security** by employing **Bcrypt algorithm** to **hash & salt passwords**
- Built an **additional layer of protection** by incorporating endpoints with user authorization using **JSON Web Tokens** and implementing an **OTP-based confirmation system** for transactions
- Facilitated **transaction tracking** for admins by logging all activity into the database
- **Increased server efficiency** by allowing up to **300 concurrent transactions per second** by utilizing **Redis** for caching and enabling WAL journal mode in SQLite

Achievements & Honours

Programming Achievements

2022 **HAQS, qBraid**
Won the qBraid Open Challenge and among the top 3 contenders in the QML Challenge

2022 **Quantum Excellence, Qiskit Global Summer School 2022, IBM**
Badge **Among 1200 worldwide** to complete the 2 week long **Qiskit Global Summer School** program with intensive hands-on labs focused on **quantum simulations using NISQ hardware**

2021, 22 **IBM Quantum Challenges**
Badges **Among 1000 worldwide** to complete challenges of *fall 2021* and *spring 2022* by solving problems in areas of finance, fermionic chemistry, machine learning and optimization

2020, 2021 **Google Kickstart**
Globally ranked 846 in Round E 2022, **1055** in Round D 2021, and **976** in Round H 2020

2020, 2021 **Facebook Hacker Cup**
Globally ranked 1967 in Round-1 2021 and **2769** in Round-1 2020

Scholastic Achievements

2019 **All India Rank 3592** in **JEE-Advanced** out of 220,000+ shortlisted candidates

2019 **All India Rank 7480** in **JEE-Main** out of 0.9 million+ candidates

2019 **National Top 300** to be selected for **Indian National Chemistry Olympiad**, HBCSE

2017 **All India Rank 322** in **KVPY** out of 50,000+ candidates and selected for **KVPY Fellowship** by Govt. of India, and IISc Bangalore

Technical Skills

Languages C, C++, Python, Go, MATLAB, JavaScript
Web Node.js, Next.js, HTML, CSS, PHP, MySQL, SQLite, Redis
Frameworks/SDKs QuTiP, TensorFlow, Qiskit, Ocean
Utilities/Tools Git, Docker, Kubernetes, Jenkins, Splunk, LaTeX, Linux shell utilities

Relevant Coursework

Computer Science Quantum Computing, Data Structures and Algorithms, Fundamentals of Computing, Introduction to Machine Learning
Electrical Core Quantum Optics[#], Digital Communication Networks, Convex Optimization in SP-COM, Digital Control, Digital Electronics, Microelectronics, Principles of Communications
Maths & Physics Quantum Physics, Probability and Statistics, Partial Differential Equations, Complex Analysis

'#': *ongoing in Spring '23*, '↗': *hyperlinks*