Sawan Bhattacharyya

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Education

1. **Bachelor of Technology(B.Tech) (CSE)** University of Calcutta Kolkata,2022-Till Date
2. **Bachelor of Science(BS) (Computer Science)** CGPA:9.56, (**Gold Medalist**) R.K.M.V.C.C, Kolkata, 2019-2022. Degree Certificate
3. **A.I.S.S.C.E** Percentage : 90.4%, Central Board of Secondary Education,New Delhi, 2019. Certificate
4. **A.I.S.C.E** CGPA : 9.8, Central Board of Secondary Education, Education,New Delhi, 2019. Certificate

Research Experience

1. **Undergraduate(BTech) Thesis Student (November 2023 - Present)** *Centre for Quantum Engineering, Research and Education, TCG Centres for Research and Education in Science and Technology*
   - Conducting research over Device Independent Quantum Key Distribution.
   - Finding Novel approach toward Fault tolerant QKD.
   - Analyzing of the threshold value for the non maximally entangled pair.
2. **Undergraduate(BS) Thesis Student (January 2020 - May 2022)** *A.K. Choudhury School of Information Technology, University of Calcutta*
   - Researched over the effect of Quantum Key Distribution protocol in presence of noise.
   - Conducted experiments to characterize the noise.
   - Analyzed the result to define the secret key rate of the QKD protocols.
   - Presented findings at 7th International Conference on Data Management, Analytics and Innovation.
   - BS Thesis title: "Comparative Study of the Quantum Communication Protocol in Noisy Environment." Project Report

Research Interests

Quantum Computing: Quantum Communication, Quantum Cryptography, Post Quantum Cryptography

Skills

1. **Technical Skills:**
   - **Operating Systems:** Linux and Windows
   - **Programming Languages:** C, C++, JAVA, Python
   - **Software and Frameworks:** MS Office, Libre Office, LaTeX, Eclipse, Visual Studio, Git, Anaconda, Qsim
   - **Modules:** Qiskit, Numpy, Matplotlib, Cirq
2. **Soft Skills:**
   - Communication
   - Leadership
   - Time Management
   - Presentation

Internships and Training

1. **Quantum Computing using Indigenous Quantum Simulator QSim**

   Organised by Centre for Development of Advanced Computing in collaboration with Indian Institute of Technology Roorkee and Ministry of Electronics and Information Technology, Government of India

   Certificate
   - Basics of Quantum Computing
   - Quantum Protocols and Algorithm Implementation in QSim
   - Studied Quantum Algorithm,QKD
2. **Introduction to Quantum Computing (Two Semester Course)**

   Organised by Qubit by Qubit, The Coding School

   Certificate
   - Basics of Quantum Computing
   - Quantum Protocols and Algorithm Implementation in Qiskit and run on IBM Quantum
   - Studied Quantum Error Correction,Quantum Search,Graph colouring and others
3. **Qiskit Global Summer School - 2022**

   Organised by IBM Quantum in collaboration with Qiskit Community

   Certificate
   - Created and tested noise for Quantum Devices
   - Stimulated various real time problem on quantum devices
   - Study and implementation of Quantum Dyanamics
4. **QRD Lab Summer Internship**

   Project Report and Certificate

- Study of Continuous Time Random Walk on the domain of Quantum Computing
- Implementation of Continuous Time Quantum Random Walk over IBM Quantum where randomness is obtained by the evolution of time dependent Hamiltonian

5. **Qiskit Global Summer School - 2021**

   Organised by IBM Quantum in collaboration with Qiskit Community

   Certificate

   - Created Parameterized Quantum Circuits and quadratic programs and how to solve optimization problems using QAOA.
   - Implemented quantum feature maps, quantum kernels and quantum support vector classification.
   - Trained circuit-based variational models, using different training techniques and see restrictions the models have and how they might be overcome.
   - Used quantum process tomography to see how noise affects a typical parameterized quantum circuit used in machine learning.

6. **Cross Tabulation Research**

   Organised by Rabindrik Psychotherapy Research Institute Trust

   Project Report and Certificate

   - Studied Holland's Theory of Career Choice - RIASEC Framework
   - Analysis of psychology regarding Career Choice among the student of age group 16 to 17.
   - Study of their psychology based on HOLLAND RIASEC Model and finding out the associativity of the five skills put forwrad in RIASEC Model

Projects

1. Device Independent QKD simulation engine in presence of noise (Nov 2023 - Present)
   Supervised by
   Dr. Prasenjit Deb, CQuERE, TCG CREST

2. Quantum Random Number Generator in collaboration with (May 2023 - October 2023)
   Centre for Quantum Engineering, Research and Education(CQuERE),
   TCG Centre for Research and Education in Science and Technology (CREST)
   Supervised by
   Dr. Amlan Chakrabarti, A. K. Choudhury School of Information Technology, University of Calcutta and
   Dr. Aishik Acharya, CQuERE, TCG CREST Project Report

3. Comparative study of noise over QKD protocol(BS Thesis) (April 2021 - May 2022)
   Supervised by
   Dr. Amlan Chakrabarti, A. K. Choudhury School of Information Technology, University of Calcutta Project Report

Patents and Copyright

1. **Title:** "Quantum Random Number Generator Using NISQ Device Noise As EntropySource"
   Registration Number: L-140725/2024 Certificate

Hackathons

1. **Qiskit Fall Fest Kolkata Chapter 2022**

   Organised by Indian Statistical Institute(ISI) Kolkata and IBM Quantum

   ***Problem Statement**: Noisy behavior of classification QML algorithm to study the accuracy and precision.*

   Project Report and Certificate

   - Behavioral study of Quantum Support Vector Machine and Variational Quantum Circuit in presence of noise
   - Noise model include depolarization, bit and phase flip and damping.

2. **Quantum Hackathon using QSIM 2023**

   Organised jointly by Centre for Development of Advanced Computing(CDAC) and Indian Institute of Technology(IIT) Rookree in association with Ministry of Electronics and Information Technology(Meity)

   ***Problem Statement**: Behavioral study of two board classes of QKD protocol in density matrix simulation.*

   Project Report and Certificate

   - Investigation of the two board classes of QKD protocols viz 1.Prepare and Measure Class 2.Entanglement Class in presence of noise.
   - The noise model used in this study is sourced from the noise dictionary available in the *dm_simulator* of the Qiskit framework. The noise model data can be accessed from the following GitHub repository: Qiskit Aakash - Noise Model.
   - Data Collection and Analysis:

     Quantum key distribution protocols will be simulated and executed using the noise model from the provided GitHub repository.
   - Data will be collected on the key generation rate, error rate, and other relevant performance metrics for both BB84 and Ekert 91 protocols under different noise scenarios.
   - The impact of noise on the security and reliability of these QKD protocols will be thoroughly analyzed.

Publications

1. **Bhattacharyya S.**, Chakrabarti A. (2022) Post-quantum Cryptography. In: Sharma N., Chakrabarti A., Balas V.E., Bruckstein A.M. (eds) Data Management, Analytics and Innovation. Lecture Notes on Data Engineering and Communications Technologies, vol 71. Springer, Singapore.
   https://link.springer.com/chapter/10.1007/978-981-16-2937-2_24
   DOI: 10.1007/978-981-16-2937-2_24

2. **Bhattacharyya, S.**, Das, A., Banerjee, A., Chakrabarti, A. (2023). Comparative Study of Noises Over Quantum Key Distribution Protocol. In: Sharma, N., Goje, A., Chakrabarti, A., Bruckstein, A.M. (eds) Data Management, Analytics and Innovation. ICDMAI 2023. Lecture Notes in Networks and Systems, vol 662. Springer, Singapore.
   https://link.springer.com/chapter/10.1007/978-981-99-1414-2_54
   DOI: 10.1007/978-981-99-1414-2_54

Courses Taken

1. Programming Fundamental using C and C++
2. Computer System Architecture
3. Discrete Structure
4. Programming in JAVA
5. Data Structure
6. Operating System
7. Computer Network
8. Design and Analysis of Algorithm
9. Software Engineering
10. Database Management System
11. Theory of Computation
12. Internet Technology
13. Microprocessor and Micro controller
14. Numerical Method
15. Distributed Systems
16. Optimization Technique

Awards and Achievements

1. 1st Runners Up at Quantum Hackathon organised by CDAC.Certificate
2. Winner of Qiskit Fall Fest Kolkata Chapter 2022.Certificate
3. Recipient of "Shree Ramakrishna Gold Medal" for academic excellence.Certificate
4. Advanced Badge Holder in Qiskit Global Summer School 2022.Certificate
5. Foundational Badge Holder in IBM Quantum Challenge 2021.Badge
6. Secured Gold Medal in Envision T20 in event, "Following" organized by Ramakrishna Mission Residential College, Narendrapur.Certificate

Certificates

1. **Programming for Everybody (Getting Started with Python)** Certificate
   University of Michigan
   Credential ID: VK6MJKBDC3DN, 6/2020

2. **Python Data Structure** Certificate
   University of Michigan
   Credential ID: R3HJZQHXQL44, 7/2020

References

1. **Dr.Amlan Chakrabarti**

   Designation: Director, A.K. Choudhury School of Information Technology

   University of Calcutta, India

   Email: acakcs@caluniv.ac.in

2. **Dr.Sunirmal Khatua**

   Designation: Assistant Professor, Department of Computer Science and Engineering

   University of Calcutta, India

   Email: skhatuacomp@caluniv.ac.in