SMIT CHAUDHARY

Rotterdam, The Netherlands

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WORK EXPERIENCE

PASQAL **Amsterdam, The Netherlands**

Quantum Algorithms Developer - ML Nov 2022 – Present

- Quantum Scientific Machine Learning (QSciML) researcher investigating the use of Variational Quantum Algorithms (VQAs).
- Build, train, and evaluate the QML models for expressivity, robustness, and trainability of for industry relevant use cases.
- Apply Physics Informed Neural Networks (PINNs), Quantum Kernel Models, and Quantum Neural Netwroks to optimization problems.
- Apply company's proprietary algorithms for an industry use case and lead a project vertical.

Menten AI **Remote / California, USA**

Quantum Computing Intern May 2022 – Sep 2022

- Examined different architectures for Quantum Generative Adversarial Networks (QGANs) along with their expressivity and trainability for discrete binary data.
- Proposed a novel architecture that incorporates several features found in classical and quantum machine learning models such as noise reuploading in the generator and use of auxilliary qubits in the discriminator.
- Used the generator to produce novel low energy ising states that have been generalised from the given training data.
- Published the results in the paper "Towards a scalable discrete quantum generative adversarial neural network".

EDUCATION

Delft University of Technology (TU Delft) **Delft, The Netherlands**

Master of Science in Applied Physics Sep 2020 – Aug 2022

- **Courses**: Applied Quantum Algorithms, Quantum Information, Quantum Computing Architecture, Quantum Hardware
- **Thesis**: Quantum walk based qubit mapping
- **Activities**: Debating, Bouldering

Indian Institute of Technology, Kanpur (IIT Kanpur) **Kanpur, India**

Bachelor of Science in Physics Jul 2016 – May 2020

- **Courses**: Quantum Computing, Quantum Field Thoery, Statistical Mechanics, Probability and Statistics, Optics
- **Undergraduate Project**: Bohmian Mechancics and Quantum Information
- **Activities**: Student Journalism, Debating, Cricket

RESEARCH & PUBLICATIONS

Towards a scalable discrete quantum generative adversarial neural network Sep 2022

Introduction of a novel fully quantum generative adversarial network leveraging noise reuploading, auxiliary qubits, and direct circuit connections for enhanced expressivity and potential generalization from discrete training data.

Quantum Machine Learning A review and current status Sep 2019

The paper reviews the current status and previous literature on quantum machine learning, exploring the potential advantages of quantum computational power in accelerating machine learning tasks.

PROJECTS

Quantum-Walks based qubit mapping

Msc. Thesis. Supervised by Prof. Sebastian Feld, TU Delft Aug 2021 – May 2022

- Inspected quantum walk algorithms and its application in speeding up backtracking problem
- Proposed a new model for qubit mapping based on Constraint Satisfaction Problem (CSP) and combinatorial optimization
- Designed a backtracking based strategy to solve CSP and implemented a quantum walk algorithm to give a quadratic speed up over classical algorithm
- Optimized space and depth by implementing a novel mapping specific heuristic and benchmarked overhead against classical solvers.

Barren Plateaus in QNN training with correlated Noise

Honors Track Project. Supervised by Prof. Jordi Tura, Leiden University Aug 2021 – Apr 2022

- Studied Barren Plateaus in QNN training landscape due to random parameter initialisation as well as due to noise. Reproduced the results for Haar random circuits and local pauli noise.
- Examined realistic noises in quantum chips and implemented channels with correlated noise

- Assessed the effect of correlated noises and noise strength on barren plateau and inspecting to get a tighter upper bound under certain noise strengths for correlated noise.

Quantum Generative Adversarial Networks (QGANs)
Applied Quantum Algorithms, Leiden University Feb 2021 – Apr 2021
- Reviewed Generative Adversarial Networks (GANs) and designed an analogous quantum version of the generator and discriminator
- Extended classical Generator-Discriminator pair to handle Quantum data (quantum states) and produce the desired quantum state
- Performed hyper-parameter optimization and exhibited the dependence of the QCBM on it and benchmarked the performance of the QGAN against classical GAN for quantum states

Quantum Approximate Optimization Algorithms (QAOA)
Prof. Leonardo di Carlo, TU Delft Nov 2020 – Jan 2021
- Studied Quantum Approximate Optimization Algorithms (QAOA) and its applications for combinatorial optimisation problems.
- Examined noises and built a noise model to implement QAOA for Max-Cut using simulator to determine the effect of noise.
- Analysed the performance of the algorithm on near term machines and studied the performance with varying circuit depth and different noise models.

Entanglement distillation on noisy quantum channels
Prof. Stephanie Wehner, TU Delft Dec 2020 – Jan 2021
- Investigated and compared 3 different 2-to-1 entanglement distillation protocols (EPL, DEJMPS, BBPSSW) and a 3-to-1 protocol under ideal conditions.
- Implemented the said protocols on the Quantum network simulator NetSquid.
- Inspected the performance of distillation protocols and the possibility of entanglement distillation in presence of noisy channels and imperfect initial states (SPAM errors).
- Compared the performance of the protocols for near term noisy quantum channels and examined the effects of noise and presence of quantum memory.

CO-CURRICULAR ACTIVITIES AND VOLUNTEERING

Student Journalism **IIT Kanpur, Kanpur, India**
Editor, Vox Populi, IIT Kanpur Mar 2018 – Mar 2019
- Led the organisation as Editor of Vox Populi, the student journalism body of the institute.
- Managed a 3 tier team of writers, editors, illustrators and investigators to produce regular content for the student news magazine.
- Collaborated with other student organizations, faculty advisors, and external partners to cover campus events, news, and issues.
- Organized round-tables and panel discussions with different stakeholders regarding different issues plaguing student life.

Volunteer Teacher **IIT Kanpur, Kanpur, India**
Prayas, IIT Kanpur Jan 2019 – Apr 2020
- Planned and delivered lessons to underprivileged children from surrounding areas. Provided individualized support and guidance to help students overcome challenges.
- Planned, organized and delivered training sessions and workshops on a variety of topics such as sexual health and awareness, addiction, effective time management, money management etc.
- Collaborated with other volunteers, staff members, and community stakeholders to coordinate activities, assess student progress, and address any issues or concerns.

Student Guide **IIT Kanpur, Kanpur, India**
Counselling Service, IIT Kanpur Jul 2017 – Apr 2018
- Assisting 8 first-year students in their transition to college life, providing guidance and support as they acclimate to the new environment.
- Served as a resource and point of contact for first-year students, answering questions, addressing concerns, and offering advice on academic, social, and personal matters.
- Organized and participated in orientation activities, workshops, and events designed to help first-year students navigate campus resources, connect with peers, and develop essential skills for success.

SKILLS, LANGUAGES, INTERESTS

- **Languages**: English (Native proficiency), Gujarati (Native speaker), Hindi (Native speaker)
- **Soft Skills**: Public Speaking, Debating, Communication, Critical Thinking, Leadership, Persuasive Writing, Technical Writing
- **Programming**: Python, C/C++, Rust, MATLAB/Octave, LaTeX, Verilog
- **Tools and Utilities**: Git, Penylane, PyTorch, TensorFlow, Cirq, Qiskit,, Jax
- **Interests**: Bouldering, Roller Skating, Reading Non-fiction, FOSS, Cricket