Smit Chaudhary | CV

Masters student, Applied Physics, TU Delft

+31 0613782478 • S.N.Chaudhary@student.tudelft.nl • smitchaudhary.github.io

Education

Year	Degree	Institution
2022*	Masters of Science in Applied Physics	Delft University of Technology, Delft
2020	Bachelor of Science in Physics	Indian Institute of Technology, Kanpur
2016	Class XII (CBSE)	New Tulip International School, Ahmedabad
2014	Class X (CBSE)	Kendriya Vidyalaya, Sabarmati, Ahmedabad

Key Projects and Experience

- ***Qubit Mapping with Quantum Enhanced Algorithm (In Progress)*** *Aug'21 - Present*
  `MSc. Thesis:` *Supervisor : Prof. Sebastian Feld, QuTech, TU Delft*
  - Inspected quantum walk algorithms and its application in speeding up backtracking problem
  - Designed a backtracking based mapping strategy and implemented a quantum walk algorithm to give a quadratic speed up over classical algorithm
  - Currently solving routing problem using backtracking techniques and examining ways to extend quantum walk on it for beyond graphs with unbounded degree

- **Barren Plateaus in QNN training with correlated Noise (In Progress)** *Aug'21 - Present*
  `Honors Track Project:` *Supervisor : Prof. Jordi Tura, Leiden University*
  - 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 Network*** *April - May'21*
  `Course:` *Applied Quantum Algorithms, Leiden University* `[CODE]` `[REPORT]`
  - Reviewed Generative Adversarial Networks (GANs) and designed a quantum version of the same
  - Extended classical Generator-Discriminator pair to one able of handling Quantum data (quantum states) and produce the desired quantum state
  - Performed hyper-parameter optimization and exhibited the dependence of the QCBM on it
  - Benchmarked the performance of the QGAN against classical GAN for quantum states

- ***Quantum Approximate Optimization Algorithms*** *Nov'20-Jan'21*
  `Mentor:` *Prof. Leonardo DiCarlo, TU Delft* `[CODE]` `[REPORT]` `[SLIDES]`
  - Studied QAOA and its applications for a number of combinatorial optimisation problems
  - Examined noises and built a noise model to implement QAOA for Max-Cut using simulator to determine the effect of different kinds of noises
  - Modified the algorithm to run it on different superconducting qubits based quantum hardware (IBM's Vigo and QuTech's Starmon5) with reduced calls to the hardware
  - 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*** *Dec'20-Jan'21*
  `Mentor:` *Prof. Stephanie Wehner, TU Delft*
  - 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 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

- ***Quantum Machine Learning*** *August'19*
  `Mentor:` *Prof. P.K. Panigrahi, Physicsal Sciences, IISER Kolkata* `[LINK]`
  - Studeied Classical ML and the connection to hybrid classical-quantum Machine learning
  - Analysed Quantum HHL algorithm and its implementation and simulated components of the algorithm on the five-qubit IBM Quantum Computer
  - Examined classifiers that use classical and quantum machine learning and contrasted them
  - Co-authored the review paper *Quantum Machine Learning : A Review and Current Status* presented at ICDMAI 2020, New Delhi `[CONFERENCE]`

- ***Quantum Key Distribution using BB84 protocol*** *May'18-July'18*
  `Mentor:` *Prof. Saikat Ghosh, Department of Physics, Indian Institute of Technology, Kanpur*
  - Developed understanding of informtation theory, various coding algorithms and their optimality
  - Learned about quantum and classical communication protocols such as BB84, SPI, and UART
  - Set up nultiple sensors such as GPS, accelerometer, and gyroscope and integrated the signal collected from them to deploy a self-aligning network of lasers and detectors for communication
  - Used an SoC development board (Zybo Z7) with FPGA & programmed it using Xilinx SDK and Xilinx Vivado to integrate data from sensor modules and run the stepper motor and laser system
  - Established a classical channel using SPI protocol by low-cost lasers and detectors scavenged from old CD drivers. Designed a circuit on a development board to run the system
  - Implemented Huffman and variants of Lempel Ziv (LZ77 & 78) algorithms to encode information

- ***Temperature dependence of refractive index of liquids*** *July-Nov'17*
  `Mentor:` *Prof. Saikat Ghosh, Department of Physics, IIT Kanpur* [REPORT]
  `Course:` *Optics (PHY224A)*
  - Devised and set up a modified version of **Michelson's interferometer** with a column of liquid along one arm of the interferometer
  - Observed the collapsing circular fringes with changing temperature of the liquid column placed along one of the arms of the interferometer
  - Calculated the change in refractive index with changing temperature using the number of fringes collapsed with each degree Celsius change in temperature

Technical Skills

Programming: Python, C/C++, Verilog
Utilities: Qiskit, Pennylane, MATLAB, LaTeX, Vivado Design Suite, Arduino, Mathematica

Teaching and Co-curricular activiteis

- **Teaching Assistant:** NB2211 - Electronics Instrumentation, TU Delft 2020-21 & 2021-22
- **Volunteer Teacher:** Volunteer teacher for under-priviled students from villages near IIT Kanpur
- **Editor, Vox Populi:** Editor of *Vox Populi*, the student journalism body of IIT Kanpur