Aditya Morolia

CSE Student — Undergrad Researcher (Quantum Computing) at CCNSB and CQST, IIIT Hyderabad
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Education

B.Tech in Computer Science and MS by Research in Computational Natural Sciences — **IIIT Hyderabad**
July 2017–Present — *Hyderabad*

CGPA: 8.68; MS Thesis being co-advised by Prof. Shantanav Chakraborty and Prof. Indranil Chakrabarty

Research Experience

Mitacs Globalink Research Intern — **University of Calgary**
August 2021 - December 2021 — *Calgary, Canada*

- I'm working with Prof. Barry C. Sanders on 'Searching for Quantum Supremacy' in which we are formulating the problem of demonstrating limited quantum speedup of Quantum Annealing over classical Monte Carlo heuristics as an automated search problem using ML and structured search (by converting the problem to search over a manifold). I was continuing this project after the 3 month Mitacs intern got over to finish up a paper.

Undergrad Research Assistant — **International Institute of Information Technology (IIIT) Hyderabad**
May 2019 - Present — *Hyderabad, India*

- I work with Prof. Shantanav Chakraborty on Quantum Algorithms for Linear Algebra used in Machine Learning, in the block encoding and Quantum Singular Value Transformation framework. (Putting out the paper in the next few weeks.) We are also working on bounding the mixing time of quantum walks on certain graphs.
- I work with Prof. Indranil Chakrabarty on Quantum Information Theory.
- **Miscellaneous work:** (Link to) Independent study report on Adiabatic Quantum Computing and Optimization, Talk on PCPs and hardness of approximation for a course project, Course project report on Open Quantum Systems and Quantum Thermodynamics

Visiting Research Student — **Harish-Chandra Research Institute (HRI) Allahabad**
Dec 2019 - Jan 2020 — *Allahabad, India*

- Took up a research project on Quantum Coherence and tunnelling advised by Prof. A. K. Pati.

Honours Project on Monte Carlo Sampling — **International Institute of Information Technology (IIIT) Hyderabad**
January 2021 - May 2021 — *Hyderabad, India*

- Studied Monte Carlo Algorithms, Mixing time of Markov Chains, Ranking and Matchmaking Algorithms for gaming systems, and later worked on formulating a Matchmaking algorithm using Monte Carlo Sampling (with Prof. Girish Varma)

Research Intern — **Indian School of Business (ISB), Mohali**
June 2019–August 2019 — *WFH*

- Work on basketball game data collection and data analysis with Dr. Siddharth Sharma to derive relation between team performance and pollsters' predictions.

Summer School on Quantum Computing and Quantum Information — **Indian Statistical Institute (ISI) Kolata**
May 2019 — *Kolkata, India*

- Summer school was hosted by Prof. Guruprasad Kar and his team at PAMU, ISI Kolkata.
- We studied the formalism of quantum mechanics, no cloning, entanglement detection and resource use, key generation and distribution, non-locality, quantum information theory and processing, bell's theorem, quantum cryptography, and quantum computation.

Work Experience

Summer Analyst — **Goldman Sachs**
June 2021 - July 2021 — *GS Bengaluru, India*

- Worked on SecDB Architecture in the Saral Trading Team, which designs and implements state of the art distributed database systems for SecDB.

Technical Staff — **AICrowd**
April 2020–July 2020 — *WFH*

- Built a simulator for the purpose of hypothesis testing on our reputation and ranking system in **Python**, then added features on the basis of the observations to the **Rails web app**
- After **winning** the campus **Reinforcement learning** challenge DroneRL, I was responsible for creating a new in house RL challenges.
- Developed a new **Django web app** named AICrowd classrooms.

Teaching Assistant — **IIIT Hyderabad**
Jan 2020–May 2022 — *Hyderabad*

- **Linear Algebra**, Spring 2020 (UG1) and Monsoon 2020 (H2, PG1)
- **Introduction to Quantum Information and Computation**, Spring 2021 (H2, Elective)
- **Automata Theory**, Monsoon 2021 (H2, UG2)
- **Quantum Algorithms**, Spring 2022 (Elective)
- Responsibilities included taking tutorials, setting the assignments and projects, paper corrections and working with students on their projects.

Publications

Quantum Regularized Least Squares *June 27, 2022*
Shantanav Chakraborty, **Aditya Morolia**, Anurudh Peduri arXiv Preprint

Talks

Applications of Linear Algebra **IIIT Hyderabad**
May 2022 *Hyderabad, India*

I took a guest lecture for the Linear Algebra course taught by Prof. Siddhartha Das at IIIT Hyderabad. I talked about rank-nullity theorem, eigenvalues and eigenvectors, with applications to toy problems in dynamical systems, graph theory and random walks.

Quantum Signal Processing with application to Linear Systems **IIIT Hyderabad**
April 2022 *Hyderabad, India*

I gave a talk to the CQST (IIIT Hyderabad) students and faculty members, where I talked about block encodings, quantum signal processing, quantum singular value transformation and least squares optimization.

Projects

Graph Neural Network for Particle Data Classification | *pytorch, cirq*
- Implemented ParticleNet, a graph CNN for particle data classification. Github

Distributed MapReduce | *C++, Boost, MPI*
- C++ implementation of the MapReduce library to handle MapReduce tasks on a distributed system. This library handles worker failures and performs load balancing. Github

COVID-19 Vaccination Management | *Django, Python, HTML, CSS, JavaScript*
- Wrote a Django WebApp to manage the complete vaccination pipeline. Includes an algorithm to automatically distribute vaccines to states and districts on the basis of Population, number of vaccination centres and rate of change of number of active cases. Github

C- - Compiler | *C++, Antlr*
- Compiler for a toy language C– inspired by C and Decaf. Includes a parser made using Antlr, custom syntax tree construction using Visitor Design Pattern, and LLVM IR generation.

Automated Bidding Agent | *Java*
- Made an automated bidding agent for targeted Ad space using Java to compete in a second prize sealed bid auction under limited budget constraints.

Molecular Dynamics Simulation | *Python*
- Python script to simulate molecular dynamics to calculate macroscopic properties like temperature and pressure using **Minimum image convention** and **Periodic boundary condition** using **Monte Carlo Markov chains methods**

Skills

Programming and scripting: C, C++, Python, Javascript, Bash, Java
Web and Mobile: HTML5, Bootstrap, Django, ReactJS, React-Native, Flask
Misc.: Linux, Git, Docker, PostgreSQL, MySQL, Qiskit, Q#, Haskell, Sklearn, Pytorch, Scipy, SageMath, Latex, Golang, Neo4j

Co-curriculars

- Corporate Relations Head, E-Cell, IIIT-H April 2019 - May 2020
- Marketing Head, Felicity, IIIT-H June 2019 - May 2020
- Literary Club Coordinator, IIIT-H July 2018 - July 2020
- Kickboxing Regional Title Belt winner June 2015
- Boxing, Swimming, Drumming