Mahathi Vempati

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Education

International Institute of Information Technology, Hyderabad — **Hyderabad, India**
MS by Research in Computational Natural Sciences — 2020 – 2021

- Thesis: *Towards Detection and a Resource-Theoretic Characterization of Negative Quantum Conditional Entropy*
- Advisor: Professor Indranil Chakrabarty
- CGPA: 9.75/10.0

International Institute of Information Technology, Hyderabad — **Hyderabad, India**
B.Tech in Computer Science — 2016 – 2020

- CGPA: 8.73/10.0

Publications and Preprints

- **Witnessing negative conditional entropy** by Mahathi Vempati, Nirman Ganguly, Indranil Chakrabarty and Arun K. Pati, 2021. Published in **Physical Review A, 104(1)**. [arxiv] , [github].
- **A-unital operations and quantum conditional entropy** by Mahathi Vempati, Saumya Shah, Nirman Ganguly and Indranil Chakrabarty, 2021. Submitted to QIP 2022. [arxiv].

Experience

Undergraduate Research Intern — **Calgary, Canada**
University of Calgary — June 2020 – June 2021

- Advisor: Professor Barry Sanders
- Project title: Searching for the Quantum Computing Advantage
- Worked on the formulation of an intelligent search for problem classes that demonstrate a scaling advantage for the DWave quantum annealer over classical algorithms.

Teaching Assistant — **Hyderabad, India**
International Institute of Information Technology, Hyderabad

- Served as a teaching assistant in three semesters:
  - Discrete Structures (Mathematics) — Monsoon 2018
  - Introduction to Quantum Information and Computation — Spring 2020, 2021
- Conducted weekly tutorials.
- Set and evaluated quizzes, assignments and student project presentations

Academic/Research Visits

USEQIP Summer School (online) — **Waterloo, Canada**
University of Waterloo — May 2021 – July 2021

- Among the approximately 60 undergraduate students selected for the summer school.
- Explored various aspects of experimental quantum information processing.

Research Visit — **Allahabad, India**
Harish-Chandra Research Institute — December 2018

- Hosted by Professor Arun K. Pati.
- Interacted with several researchers: ideas from the visit resulted in my MS thesis topic.

Quantum Information Summer School — **Kolkata, India**
Indian Statistical Institute — May 2018 – June 2018

- Hosted by Professor Guruprasad Kar.
- Summer school for quantum information processing theory.

Software Projects

- **Compiler and Interpreter:** Designed the grammar for a programming language similar to Decaf, and wrote a scanner and parser for the same. Developed an interpreter, as well as a compiler to convert the language source code to **LLVM intermediate representation**. Used Flex, Bison and the C programming language. [github]
- **Search Engine:** Developed a search engine for large data dumps from Wikipedia. The search engine takes as input a data dump, and creates an inverted index after parsing the input data using various **NLP techniques**. It then returns the top titles matching different types of input queries, based on the tf-idf ranking. The k-way merge algorithm and Python shelves were used during the creation of the large index which does not fit in main memory. [github]
- **Bomberman Game:** Developed a single-player multi-level game in which the player uses the keyboard to control a character moving around in a maze, and drops bombs to destroy enemies. Features include asynchronous enemy movement and random maze generation. [github]
- **DNA Sequence Classification:** Used a **convolutional neural network** to perform binary classification on DNA sequences based on whether certain unknown motif instances were present in a specific region, or were spread out. Visualised the output of the neural network, and predicted the motif sequence and region. Used Pysster library for the task. [github]
- **Deadlock Detection:** Given as input a Wait-For graph, the program spawns processes which depend on each other in accordance with the graph, runs global deadlock detection algorithms on these spawned processes, and returns whether or not they are deadlocked. Implemented the Kshemkalyani-Singhal and Deng-Attie-Sun detection algorithms. The **Erlang functional programming language** was used. [github]
- **Remote Server:** Wrote a server programme that maintains a database of graphs. Used Java's **Remote Method Invocation** to allow clients to call methods on the server to add, update or compute functions of data stored in the server. [github]

Software Skills

- **Over 10,000 lines:** C, C++, Python
- **Familiar:** Java, MATLAB, Erlang, MySQL, Javascript, HTML, Q#, LaTeX

Achievements

- Received Dean's Academic Award in three semesters (2017, 2019, 2020).
- Placed 70th out of around 600 participants in the Microsoft Q# Quantum Coding Contest (2020).
- Won Megathon, a hackathon organized by IIT Hyderabad and IIIT Hyderabad (2017).
- Recepient of the NTSE scholarship, a national level award based on a competitive exam (2012).

Service

Volunteered at

- IndiQ Introduction to Quantum Computing Workshop — IIIT Hyderabad, 2020
- Microsoft Workshop on Quantum Computing for Women — Microsoft Hyderabad, 2019
- National Workshop on Quantum Information and Information Security — IIIT Hyderabad, 2018

Interests

- Member of the **IIITH Theory group**. Hosted reading groups on quantum information, quantum algorithms and ZX Calculus. Presented a seminar on ZX Calculus: **Youtube link**.
- Occasionally write blog posts. My best articles: **A tutorial on the nuances of backpropagation**, **How Grover's search algorithm emerges from quantum signal processing**.
- Enjoy using **Quantum Computing Stack Exchange**.
- Served as the **editor** of Ping!, the college magazine from 2018 – 2019.