Mahathi Vempati

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Education

University of Maryland, College Park — **College Park, USA**
PhD in Computer Science — 2022 – Present

- Advisor: Andrew Childs
- CGPA: 3.71/4.0

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: 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 Conference Papers

- **Quantum Advantage and Lower Bounds in Parallel Query Complexity** by Joseph Carolan, Amin Shiraz Gilani and Mahathi Vempati. Accepted at **ITCS 2024, QIP 2025.** [arxiv:2410.02665].
- **A-unital operations and quantum conditional entropy** by Mahathi Vempati, Saumya Shah, Nirman Ganguly and Indranil Chakrabarty, 2 February, 2022. Published in **Quantum journal.**
- **Witnessing negative conditional entropy** by Mahathi Vempati, Nirman Ganguly, Indranil Chakrabarty and Arun K. Pati, 19 July, 2021. Published in **Physical Review A, 104(1)**. [arxiv:2001.11237] , [github].

Experience

Research Intern — **Bristol, UK**
Phasecraft — Summer 2024

- Applied molecular symmetries to speed up Variational Quantum Eigensolvers.
- Ran and evaluated classical simulations in Julia

Teaching Assistant — **College Park/ Hyderabad**
UMD and IIITH

- Introduction to Cryptography — UMD, Fall 2023
- Advanced Data Structures — UMD, Spring 2022
- Introduction to Cryptography — UMD, Fall 2022
- Introduction to Quantum Information and Computation — IIITH, Spring 2021
- Introduction to Quantum Information and Computation — IIITH, Spring 2020
- Discrete Structures (Mathematics) — IIITH, Monsooon 2018

Duties included conducting weekly tutorials and office hours, setting and evaluating assignments, quizzes and student project presentations, preparing programming assignments

Quantum Annealing and Machine Learning Research Intern (remote) — **Calgary, Canada**
University of Calgary — June 2020 – June 2021

- Advisor: 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.

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

- Explored various aspects of experimental quantum information processing.

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 Python 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]
- **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]

Software Skills

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

Achievements

- One of the eight recepients of the UMD CS Summer 2023 Research Fellowship of $7500.
- Recepient of Dean's List Award [Top 15% of batch] at IIITH for 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).
- Recipient of the NTSE scholarship, a national level award based on a competitive exam (2012).

Service

- Reviewer at TQC 2024, QIP 2025
- 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

- I enjoy competitive programming. I record my progress on my **Youtube channel**. I also did a tutorial on **Linearity of Expectation** there.
- Was a 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**, **The Hadamard Sandwich**
- Used to be active on **Quantum Computing Stack Exchange**.
- Served as the **editor** of Ping!, the IIITH college magazine from 2018 – 2019.