Joseph Li

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Office: ATL 3258 in QuICS Suite

I am a graduate student in computer science at the University of Maryland, advised by Professor Xiaodi Wu. I am also part of the Joint Center for Quantum Information and Computer Science (QuICS).

I am broadly interested in the theory of quantum information, but my main research interest is the design and implementation of quantum algorithms on near-term devices. In particular, I try to develop methods towards the practical implementation of Hamiltonian-based quantum algorithms for both digital and analog devices.

Education

January 2022 - Present
University of Maryland, College Park - *Ph.D. student in Computer Science*

August 2018 - December 2021
University of Maryland, College Park - *B.S. in Mathematics, B.S. in Computer Science, Physics Minor*

Research

- Quantum Hamiltonian Descent. Jiaqi Leng, Ethan Hickman, Joseph Li, and Xiaodi Wu. Manuscript, 2023. (Website)

- Expanding hardware-efficiently manipulable Hilbert space by Hamiltonian embedding. Jiaqi Leng*, Joseph Li*, Yuxiang Peng, and Xiaodi Wu. Manuscript, 2023 (by contribution).

Work Experience

February 2022 - Present
University of Maryland - Graduate Research Assistant

February 2021 - May 2021
University of Maryland - Grader for STAT410 Introduction to Probability Theory

September 2020 - December 2020
University of Maryland - Grader for MATH402 Algebraic Structures

February 2020 - May 2020
University of Maryland - Grader for STAT410 Introduction to Probability Theory

September 2019 - December 2019
University of Maryland - Grader for MATH310 Introduction to Mathematical Proof

February 2019 - December 2019
University of Maryland - Undergraduate Research Assistant
FIRE: The First-Year Innovation & Research Experience
Engineering Biosensors Lab   Research Advisor: Dr. Catherine Spirito

- Constructed a chemostat to test microcompartment formation in pdu *E. coli* in continuous culture

- Assisted in the development of an aptamer-based biosensor for detection of *E. coli* in water samples using gold nanoparticles

- Developed professional lab procedures and reports for operation of chemostat

February 2019 - May 2019
University of Maryland - Grader for STAT410 Introduction to Probability Theory

Graduate Coursework

- CMSC858C Randomized Algorithms with Prof. Aravind Srinivasan — Spring 2023
- CMSC858L Quantum Complexity with Prof. Daniel Gottesman — Spring 2023
- CMSC660 Scientific Computing I with Prof. Howard Elman — Fall 2022
- CMSC858O The Foundation of End-to-End Quantum Applications with Prof. Xiaodi Wu — Fall 2022
- CMSC764 Advanced Numerical Optimization with Prof. Tom Goldstein — Spring 2022
- CMSC828L Deep Learning with Prof. David Jacobs — Spring 2022
- BMGT830 Operations Research: Linear Programming with Prof. Raghu Raghavan — Autumn 2021
- STAT650 Applied Stochastic Processes with Prof. Eric Slud — Spring 2020

Older Projects

- Developed a simulation that approximates the distribution for the number of matches of 3 or more orbs in a line in any $m \times n$ board, inspired by the mobile game *Puzzle and Dragons*. Designed a dynamic programming algorithm to count matches in $O(mn)$ time. Computed combinatorially the exact distribution for a 2×2 board with matches of 2 orbs in a line and verified correctness using simulation.
  https://jli0108.github.io/pazudora-simulation/
- Implementation of Gale-Shapley algorithm for stable matching in Ruby
  https://github.com/jli0108/gale-shapley
- Undergraduate course projects and assignments covering various topics (can be made available upon request)
    - Object-oriented programming (Java)
    - Systems programming (C, MIPS assembly)
    - Regular expressions, finite automata, lexical analysis (OCaml)
    - Signal processing transforms, including DFT, FFT, Haar wavelet (MATLAB)
    - Machine learning algorithms, including decision trees, perceptron, gradient descent, etc. (Python)
    - Data structures, including AVL trees, AA trees, k-d trees (Java)
    - Simulation of Hadamard walk with Qiskit (Python)
    - Diamond-square algorithm, Loop subdivision algorithm, shader programming (Java, GLSL)
- Implementation of simplex algorithm for linear programs in Python
  https://github.com/jli0108/simplex

Academic Service

- Reviewer for NeurIPS, ICML, ICLR 2023

Skills · Tools · Miscellaneous

- Java, C/C++, Python, MATLAB, HTML, JavaScript, Ruby
- MPI, OpenMP, Eigen
- CPLEX, Gurobi
- Participated in 2021 ICPC Quantum Computing Challenge - 79th best score of 246 participants
- Contributed to open-source quantum information toolkit toqito.