Charles Yuan

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EDUCATION

Massachusetts Institute of Technology, Cambridge, MA.
Ph.D. in Computer Science expected May 2025
S.M. in Computer Science May 2022
Advisor: Prof. Michael Carbin. Thesis: *Foundational Abstractions for Quantum Programming.*

Carnegie Mellon University, Pittsburgh, PA.
B.S. in Computer Science May 2019
Advisor: Prof. Jan Hoffmann. Thesis: *Exact Bayesian Inference with Distribution Transformers.*

SELECTED PUBLICATIONS

The T*-Complexity Costs of Error Correction for Control Flow in Quantum Computation.* PLDI 2024
Charles Yuan, Michael Carbin.

Quantum Control Machine: The Limits of Control Flow in Quantum Programming. OOPSLA 2024
Charles Yuan, Agnes Villanyi, Michael Carbin.

Tower: Data Structures in Quantum Superposition. OOPSLA 2022
Charles Yuan, Michael Carbin. **Distinguished Artifact Award.**

Twist: Sound Reasoning for Purity and Entanglement in Quantum Programs. POPL 2022
Charles Yuan, Chris McNally, Michael Carbin.

HONORS AND AWARDS

CQE-LPS Doc Bedard Fellowship 2023–2025
RPI Rising Star in Quantum Computing 2024
Jane Street Graduate Research Fellowship Honorable Mention 2023
OOPSLA 2022 Distinguished Artifact Award 2022
NSF Graduate Research Fellowship Honorable Mention 2020
Allen Newell Award for Undergraduate Research Excellence (Best Undergraduate Thesis) 2019

ADDITIONAL PUBLICATIONS

Codesign of Error-Correcting Codes and Modular Chiplets in the Presence of Defects. ASPLOS 2024
Sophia Lin, Joshua Viszlai, Kaitlin Smith, Gokul Ravi, **Charles Yuan,** Frederic Chong, Benjamin Brown.

Semi-Symbolic Inference for Efficient Streaming Probabilistic Programming. OOPSLA 2022
Eric Atkinson, **Charles Yuan,** Guillaume Baudart, Louis Mandel, Michael Carbin.

Statically Bounded-Memory Delayed Sampling for Probabilistic Streams. OOPSLA 2021
Eric Atkinson, Guillaume Baudart, Louis Mandel, **Charles Yuan,** Michael Carbin.

PREPRINTS AND PEER-REVIEWED WORKSHOP PAPERS

Expressing and Analyzing Quantum Algorithms with Qualtran. arXiv: 2409.04643, 2024.
M. Harrigan, T. Khattar, **C. Yuan,** A. Peduri, N. Yosri, F. Malone, R. Babbush, N. Rubin.

Analyzing Quantum Programs Using the Power of Interaction. PLanQC at ICFP 2022
Agnes Villanyi, **Charles Yuan,** Chris McNally.

Probabilistic Inference for Quantum Programs. I2Q at ISCA 2021
Charles Yuan, Yipeng Huang, Michael Carbin.

BLT: Exact Bayesian Inference with Distribution Transformers. Technical Report, 2019
Charles Yuan, Jan Hoffmann. **Allen Newell Award for Best Undergraduate Thesis.**

TEACHING EXPERIENCE

Massachusetts Institute of Technology, Cambridge, MA.
6.1120: Dynamic Computer Language Engineering Fall 2023
Teaching Assistant for Prof. Martin Rinard. Class size: 20.

Carnegie Mellon University, Pittsburgh, PA.
15-312: Principles of Programming Languages Spring 2018–Spring 2019
Teaching Assistant for Profs. Robert Harper and Jan Hoffmann. Class size: 50.

98-317: Hype for Types Spring 2018–Spring 2019
Founding Instructor alongside Vijay Ramamurthy, Chris Grossack, Jeanne VanBriesen. Class size: 20.

15-210: Parallel and Sequential Data Structures and Algorithms Spring 2017–Fall 2017
Head Teaching Assistant for Profs. Guy Blelloch and Robert Harper. Class size: 200.

15-122: Principles of Imperative Programming Spring 2016–Fall 2016
Teaching Assistant for Profs. Rob Simmons, Illiano Cervesato, and Tom Cortina. Class size: 400.

TALKS AND SEMINARS

Tufts University	Medford, MA, December 2024
Harvard University	Boston, MA, October 2024
University of California, Los Angeles	Los Angeles, CA, August 2024
Stanford University	Stanford, CA, May 2024
Raytheon BBN Technologies	Cambridge, MA, May 2024
Northeastern University	Boston, MA, May 2024
University of California, San Diego	San Diego, CA, May 2024
Columbia University	New York, NY, April 2024
University of Chicago	Chicago, IL, April 2024

University of Illinois Urbana-Champaign — Urbana, IL, April 2024
Carnegie Mellon University (seminar and guest lecture) — Pittsburgh, PA, October 2023
EPFL / Swiss Federal Institute of Technology — Lausanne, Switzerland, October 2023
ETH Zurich / Swiss Federal Institute of Technology — Zurich, Switzerland, October 2023
Imperial College London — London, United Kingdom, October 2023
Renssalaer Polytechnic Institute — Troy, NY, October 2023
TTI/Vanguard Rebooting Computing Conference — Montreal, Canada, June 2023
National Research Institute of Poland / NASK — Warsaw, Poland (virtual), March 2023
Tsinghua University — Beijing, China (virtual), October 2022
PLanQC 2022 (invited speaker) — Ljubljana, Slovenia, September 2022
University of Chicago — Chicago, IL (virtual), May 2022
Zapata Computing — Boston, MA (virtual), May 2022
IBM Quantum — Yorktown Heights, NY (virtual), March 2022
Implications of Quantum at SXSW — Austin, TX, March 2022
Stanford University — Stanford, CA (virtual), January 2022

INDUSTRY EXPERIENCE

Google, Venice, CA.

Research Intern, Quantum AI — May–August 2024

- Extended Qualtran framework for quantum programming in Python to support arithmetic over block encodings of matrices, enabling users to express leading algorithms for plasma physics simulation.
- Implemented optimizing compiler rewrites in Qualtran that asymptotically improve the performance of physical simulation, gaining several orders of magnitude of speedup at problem sizes of interest.

Hudson River Trading, New York, NY.

Core Developer, Trading Infrastructure — August 2019–August 2020

- Implemented regulatory compliance and risk management systems in a low-latency automated trading system based on C++ that processes a substantial fraction of daily volume on major capital markets.
- Extended trading system to connect with international markets in diverse and emerging asset classes.
- Enhanced primary interface used by firm traders to perform orders with market-impacting volume.

Two Sigma Investments, New York, NY.

Software Engineering Intern, Halite AI Challenge — May–August 2018

- Architected performant, cross-platform game engine in C++ featuring concurrent logic and command processing, as part of the latest iteration of the firm's Halite artificial intelligence challenge.
- Specified and prototyped metaprogramming DSLs in OCaml to foster broader participation in Halite.

Airbnb, San Francisco, CA.

Software Engineering Intern, Guest Growth — May–August 2017

- Designed search engine using Java, Scala, and Hive to suggest textual content for listing descriptions,

featuring custom term frequency functions, geographical queries, and parallel execution.
- Built NLP pipeline in Python for named entity recognition, PoS tagging, and sentiment analysis.
- Investigated unsupervised and supervised learning techniques in Python to derive semantic structure on textual data, and to recognize entities in multilingual texts using word vector models.

Google, Kirkland, WA.

Software Engineering Intern, Cloud Platform May–August 2016

- Implemented Stackdriver Trace in Cloud Console for iOS, enabling users to see latency profiles of web application endpoints, monitor performance over time, and be notified of significant latency shifts.
- Designed and implemented backend server logic and client API in Java supporting high-performance data queries by control and monitoring features on iOS and Android.

EXTERNAL SERVICE

ACM SIGPLAN Long-Term Mentoring Committee (SIGPLAN-M) Mentor 2023–Present
ACM *Transactions on Quantum Computing* Journal Reviewer 2024
Quantum Journal Reviewer 2024
ACM *Transactions on Programming Languages and Systems* Journal Reviewer 2024
OOPSLA 2024 Artifact Evaluation Committee Member 2024
ICFP 2023 Artifact Evaluation Committee Member 2023
PLDI 2023 External Reviewer 2023
PLDI 2023 Artifact Evaluation Committee Member 2023
POPL 2023 Artifact Evaluation Committee Member 2022
PLMW at OOPSLA 2022 Student Mentor 2022

INSTITUTIONAL SERVICE

CSAIL/EECS Student Buddy Program Mentor 2023–Present
EECS Resources for Easing Friction and Stress Member 2022–Present
EECS Faculty Search Student Advisory Group Member 2023
MIT School of Engineering Dean's Graduate Student Advisory Group Member 2022–2023
MIT Graduate Application Assistance Program Mentor 2021–2023
MIT School of Engineering and EECS Orientation Leader 2021–2022
Quantum Software Reading Group and PL Reading Group Coordinator 2021–2022
CSAIL Ahead Culture Committee Member 2020–2021

PRESS

"A blueprint for making quantum computers easier to program" — MIT News April 2024
"Meet Twist: MIT's Quantum Programming Language" — IEEE Spectrum February 2022
"A new language for quantum computing" — MIT News January 2022

REFERENCES

Michael Carbin
Department of Electrical Engineering and Computer Science
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