Xuanrui (Ray) Qi

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Education

May 2019 (expected) — **M.S. in Computer Science**, *Tufts University*, Medford, MA, USA.
Advisors: Samuel Z. Guyer, Cyrus Omar (University of Chicago, unofficial)

May 2018 — **B.S. in Computer Science, *magna cum laude*, with honors in thesis**, *Tufts University*, Medford, MA, USA.
second major: international relations, **minor**: mathematics
GPA: 3.72/4.0
Advisor: Samuel Z. Guyer

June 2014 — **High School Diploma**, *Shenzhen Middle School*, Shenzhen, Guangdong, China.

Research Interests

Dependently-typed programming languages, interactive proof assistants, program verification, certified compilation, mechanized metatheory, typed functional programming languages, logical methods in computer science.

Research Experience

September 2018 – — **Master's Research**, *Department of Computer Science, Tufts University*, Medford, MA, USA.
Doing research independently for my master's degree.

June 2018 – August 2018 — **Research Visitor**, *Graduate School of Mathematics, Nagoya University*, Nagoya, Japan.
Hosted and advised by Professor Jacques Garrigue.

March 2017 – May 2018 — **Research Assistant**, *Department of Computer Science, Tufts University*, Medford, MA, USA.
Research assistant under Professor Sam Guyer, working in the RedLine Systems Research Group.

Research Projects

Dependent Hazel: dependently-typed programming and theorem proving with first-class typed holes
Working on extending the bidirectionally typed structure editor calculus Hazelnut to support dependently-typed programming with Cyrus Omar (University of Chicago).

Formal verification of dynamic compact data structures
This is the project I worked on during my research visit at Nagoya University. We extended a previous Coq formalization and verification of properties of compact data structures — namely efficient bit vectors — by adding and verifying dynamic operations to the said data structures.

Elephant Tracks II: high-performance GC tracing toolkit

This is the research project leading to my senior honors thesis at Tufts University. Elephant Tracks II is a dynamic analysis framework for memory in managed programming languages which works by generating a memory trace, i.e. record of object allocations, pointer updates, and object deaths. With a team of researchers from Google and the Australian National University, we aspire to bring the utility of memory tracing to more programmers, and to make memory tracing even greater. I am in charge of most of the implementation in C++ and Java.

JumboViz: visualizing GC traces

A visualization toolkit for Elephant Tracks (and Elephant Tracks II) GC traces, aiming to generate visualizations useful for programmers. This is a collaboration with a team at Tufts University.

Research Publications

Research Papers

1. Reynald Affeldt, Jacques Garrigue, **Xuanrui Qi**, and Kazunari Tanaka. Proving Tree Algorithms for Succinct Data Structures. In *Proceedings of the 35th Conference of the Japan Society for Software Science and Technology (JSSST 2018)*. (Revised version to be submitted to the 10th Conference on Interactive Theorem Proving (ITP 2019).)
2. **Xuanrui (Ray) Qi**. Elephant Tracks II: Practical, Extensible Memory Tracing. Senior Honors Thesis, Tufts University, 2018. *Thesis committee*: Sam Guyer (chair), Kathleen Fisher.

Drafts, Talk Material & Presentations

1. **Xuanrui (Ray) Qi**. From Tactics to Structure Editors for Proofs. Off the Beaten Track 2019 (*OBT '19*).
2. **Xuanrui (Ray) Qi**. A Practical and Extensible Framework for Garbage Collection Tracing. SPLASH 2018 Student Research Competition.

Teaching Experience

Teaching Assistant

○ Concurrent Programming (COMP 50CP), Fall 2017 & 2018, Tufts University

Non-Technical Courses

○ Peer instructor (instructor of record), Spring 2018, Experimental College @ Tufts University

Other Work Experience

2016 **Intern**, *Institute of Automation, Chinese Academy of Sciences*, Beijing, China.
Interned at the State Key Laboratory of Control and Management of Complex Systems, working on computer vision.

Other Activities

○ Oregon Programming Languages Summer School 2017
○ Student Volunteer, POPL 2018