Xuanrui Qi

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Education

August 2021 (expected) **M.S. in Mathematical Science**, *Nagoya University*, Nagoya, Japan.
Focus: theoretical computer science, algebraic topology

May 2019 **M.S. in Computer Science**, *Tufts University*, Medford, MA, USA.
Focus: functional programming & programming languages

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.

Experience

November 2019 – **Freelance Developer**, Nagoya, Japan & remote.
Currently open to freelance work for a range of customers.

November 2019 – May 2020 **Contractor**, *SiFive, Inc.*, Remote.
I worked on using the Kami verification framework and Coq proof assistant to verify a realistic RISC-V processor.

August 2019 – September 2019 **Intern**, *SiFive, Inc.*, San Mateo, CA, USA.
I worked on building and verifying a ring buffer in Coq, for use in a pipelined processor.

Jun – Aug 2018 **Research Visitor**, *Graduate School of Mathematics, Nagoya University*, Nagoya, Japan.
I was hosted by and worked with Professor Jacques Garrigue. My work resulted in a peer-reviewed conference publication.

Mar – 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. My work resulted in my senior honors thesis.

Jul – Aug 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.

Technical Skills

Programming Languages

Haskell, OCaml, Python, Ruby, Java, C/C++

Programming Language Engineering

Performance engineering (especially GC/runtime related), dynamic program analysis and instrumentation

Formal Methods & Verification

Interactive theorem proving (Coq, Agda), type systems, static analysis, program logics, formal methods for security

Other

Cryptography, binary analysis, packet analysis, Git version control system

Projects

Formal Verification of RISC-V processors
I worked on using Coq and the embedded Kami verification framework to verify a realistic RISC-V processor with a modern microarchitecture; I was responsible for several proof engineering efforts and verification of some hardware components.

Formal verification of dynamic compact data structures
I did part of the design, implementation and modeling in Coq. A paper about our formalization has been accepted for publication.
`https://github.com/affeldt-aist/succinct`

Elephant Tracks II: high-performance, extensible GC tracing framework
I did most of the design and implementation of a prototype in C++. The resulting system's performance increased more than 10× compared to our previous systems.
`https://github.com/ElephantTracksProject/et2-java`

JumboViz: visualizing GC traces
I did most of the JVM-related hacking in C++.
`https://github.com/HeapVisCapstone`

Dynamic, Distributed File Backup System
I collaborated with two colleagues in design and implementation in Erlang.
`https://github.com/DistBackup/dbscore`

Research Publications

1. Reynald Affeldt, Jacques Garrigue, **Xuanrui Qi**, and Kazunari Tanaka. Proving Tree Algorithms for Succinct Data Structures. The 10^{th} Conference on Interactive Theorem Proving (ITP 2019).
2. **Xuanrui (Ray) Qi**. Elephant Tracks II: Practical, Extensible Memory Tracing. Senior Honors Thesis, Tufts University, 2018.