

Research Interests

My research focuses on designing, implementing, and using static program analysis techniques to automatically verify software and optimize existing toolchains. Currently, I am working on designing new abstract domains for scalable analysis while maintaining practical precision for verification tasks.

Education

- 2020–2026 **Ph.D., Electrical and Computer Engineering**, *University of Waterloo*, Waterloo, (Exp. May) Faculty of Engineering Grade - 87.75 / 100.00
Dissertation *Scalable Program Analysis: Abstract Interpretation Techniques and Practical Applications* (Adviser: Prof. Arie Gurfinkel)
- 2018–2020 **M.Sc., Computer Science**, *New York University*, New York, NY, Courant Institute of Mathematical Sciences GPA - 3.90 / 4.0
Dissertation *Data Flow Refinement Type Inference Tool: DRIFT²* (Adviser: Prof. Thomas Wies)
- 2015–2016 **B.Sc., Computer Science**, *University of Minnesota - Twin Cities*, Minneapolis, MN, College of Science and Engineering GPA - 3.66 / 4.0
- 2012–2014 **B.Sc., Computer Science and Technology (Dual degree)**, *University of Electronic Science and Technology of China*, Chengdu, China, School of Computer Science and Engineering GPA - 3.77 / 4.0

Publications

- Ongoing Y. Su, J. A. Navas, A. Gurfinkel. **Scalable Taint Analysis via Heap-Aware Propagation.**
- 2025 Y. Su, J. A. Navas, A. Gurfinkel. **Template DBM: A New Weakly Relational Domain for Efficient Memory-Access Validation** *17th International Conference on Verified Software: Theories, Tools, and Experiments (VSTTE 2025)*. *Best Tool Paper Award*
- 2025 Y. Su, J. A. Navas, A. Gurfinkel, I. Garcia-Contreras. **Automatic Inference of Relational Object Invariants.** *Verification, Model Checking, and Abstract Interpretation (VMCAI 2025)*. DOI: 10.1007/978-3-031-82700-6_10
- 2022 S. Priya, Y. Su, Y. Bao, X. Zhou, Y. Vizel, A. Gurfinkel. **Bounded Model Checking for LLVM.** *22nd Formal Methods in Computer-Aided Design (FMCAD 2022)*. DOI: 10.34727/2022/ISBN.978-3-85448-053-2_28
- 2021 S. Priya, X. Zhou, Y. Su, Y. Vizel, Y. Bao, A. Gurfinkel. **Verifying Verified Code.** *Automated Technology for Verification and Analysis (ATVA 2021)*. DOI: 10.1007/978-3-030-88885-5_13
- 2021 Z. Pavlinovic, Y. Su, T. Wies. **Data flow refinement type inference.** *Proc. ACM Program. Lang.* (POPL 2021). DOI: 10.1145/3434300

Conference Service

Subreviewer Tools and Algorithms for the Construction and Analysis of Systems (TACAS) '26, '23, '22; FMCAD '25, '22; International Symposium on Formal Methods (FM) '24, '23; NASA Formal Methods Symposium (NFM) '22

AEC Computer Aided Verification (CAV) '25; TACAS '26, '25
AEC = Artifact Evaluation Committee

Volunteer CAV '24

Professional Experience

Sep 2023 - **Associate Researcher (Part-time)**, *Huawei Technologies Canada*, Waterloo, Canada
Apr 2025

- Built a test-case generation tool using the binary analysis symbolic execution tool **angr**
- Integrated into the property-based testing framework **RapidCheck** for coverage-guided testing

May 2023 - **Associate Researcher (Intern)**, *Huawei Technologies Canada*, Waterloo, Canada
Aug 2023

- Applied the FMCAD 2022 tool **SEABMC** to verify memory and other safety properties of C programs

Sep–Dec 22 **Teaching Assistant**, *University of Waterloo*, Waterloo, Canada
+ Sep–Dec 21 ECE 351 - Compilers (Undergraduate)

Jan–May 20 **Recitation Leader and Grader**, *New York University*, New York City, USA
+ May–Aug 19 CSCI-GA.2110 - Programming Languages (Graduate)

Sep–Nov 2017 **Web Developer Intern**, *Harbin Institute of Technology*, Harbin, China
Ground Station TM/TC System - **Mun**

- Self-designed a TCP-WebSocket proxy client and built the **Tornado** web server
- Designed the web server architecture and completed the integration testing

Selected Projects

2021–Present **Crab - A lib for abstract interpretation-based Analysis**, *University of Waterloo*

- Designed and implemented a taint analysis based on existing abstract domains
- Designed and implemented an abstract domain to represent complex relational invariants
- Designed and implemented an abstract domain to verify spatial memory safety in LLVM IR
- Integrated **Crab** as a preprocessor in **SEABMC** pipeline

2020–2021 **DRIFT² - Data Flow Refinement Type Inference Tool**, *New York University*

- Implemented a data-flow refinement type inference tool based on abstract interpretation

Technical Skills

PLang. C/C++, Python, OCaml, Java, Rust, Scala, Scheme, MATLAB, Prolog, SQL

Verif. Tools **SeaHorn**, **angr**, **CBMC**, **KLEE**, **Liquid Haskell**, **SMACK**

Infrastructure LLVM, Docker, Git, Vagrant, VirtualBox, Linux/Unix systems

Dev. Tools Visual Studio, Xcode, Android Studio, Eclipse, SQL Server, PyQt, Vim, IntelliJ IDEA

Languages Mandarin (native), English (fluent), Spanish (beginner)

Honors and Awards

2020–present Graduate Research Studentship, University of Waterloo

2012–2014 National Endeavor Fellowship, University of Electronic Science and Technology of China

Leadership and Activities

Summer 2013 **Rutgers China Bridge Program in Engineering**, *Rutgers University*,
Direct Leadership Team, UESTC