

Haixin Tu

PHD IN COMPUTER SCIENCE · SOFTWARE ENGINEERING

81 Victoria Street, Singapore 188065, Singapore Management University

☎ (+65) 81766631 | ✉ haoxintu.2020@smu.edu.sg | 🌐 <https://haoxintu.github.io/> | 📄 <https://github.com/haoxintu> | 🐦 @tuhaoxin

“Stay hungry. Stay foolish.”

Research Interests

Software systems written by humans tend to be unreliable and insecure. My research interests focus on developing practical techniques and tools that can help improve the *reliability* and *security* of software systems (mainly targeting system software such as *compilers* and *Linux kernels*). I am quite interested in developing advanced automated approaches, based on program analysis techniques such as *fuzzing* and *symbolic execution*, to resolve labor-intensive engineering tasks, e.g., automatic bug/vulnerability detection and exploit generation.

Education

Singapore Management University (No.3 in Software Engineering on CSRanking)

Singapore

P.H.D IN COMPUTER SCIENCE (SUPERVISOR: LINGXIAO JIANG & XUHUA DING)

Aug. 2020 - Present

- Thesis topic: “Boosting Symbolic Execution for Software Reliability and Security”. (Proposed)

Dalian University of Technology (“985”, “211”)

Dalian, China

P.H.D IN SOFTWARE ENGINEERING (SUPERVISOR: HE JIANG)

Sep. 2019 - Dec. 2023

- Thesis topic: “Research on Test Program Construction Approaches for Compiler Testing and Debugging”.

Dalian University of Technology (“985”, “211”)

Dalian, China

MASTER IN SOFTWARE ENGINEERING

Sep. 2017 - Jul. 2019

Northeast Forestry University (“211”)

Harbin, China

BACHELOR IN ELECTRONIC INFORMATION ENGINEERING

Sep. 2013 - Jul. 2017

Skills

General Software GCC, LLVM, KLEE, Angr, S2E, Z3, Frama-C, etc
Programming C/C++, Python, Shell, MATLAB, etc
Language Chinese (Fluent), English

Publications

Conference Papers

- [Conference] **Haixin Tu**, Lingxiao Jiang, Debin Gao, and He Jiang, “**Beyond a Joke: Dead Code Elimination Can Delete Live Code**”, in International Conference on Software Engineering (ICSE-NIER 2024). [PDF] [Code(★1)]
 - A new problem to investigate and a new approach to tackle the problem.
- [CCS’23] Pansilu Pitigalaarachchi, Xuhua Ding, Haiqing Qiu, **Haixin Tu**, Jiaqi Hong, and Lingxiao Jiang, “**KRover: A Symbolic Execution Engine for Dynamic Kernel Analysis**”, in Conference on Computer and Communications Security, Research Track. [PDF] [Code(★1)]
 - A new flavor of kernel symbolic execution with binary intimacy, high speed, noise-free nature, and programmable invocation.
- [ICSE’23] **Haixin Tu**, “**Boosting Symbolic Execution for Heap-based Vulnerability Detection and Exploit Generation**”, in International Conference on Software Engineering, Doctoral Symposium Track. [PDF]
 - A new path exploration strategy, a new memory model, and a new environment modeling for boosting symbolic execution.
- [FSE’22] **Haixin Tu**, Lingxiao Jiang, Xuhua Ding, and He Jiang, “**FastKLEE: Faster Symbolic Execution via Reducing Redundant Bound Checking of Type-Safe Pointers**”, in Joint European Software Engineering Conference and Symposium on the Foundations of Software Engineering, Tool Demonstrations Track. [PDF] [Code(★16)]
 - Combine static analysis (Ccured) to reduce redundant pointer comparison checking for speeding up symbolic execution.
- [ISSRE’22] **Haixin Tu**, He Jiang, Xiaochen Li, Zhilei Ren, Zhide Zhou, and Lingxiao Jiang, “**RemGen: Remanufacturing A Random Program Generator for Compiler Testing**”, in International Symposium on Software Reliability Engineering, Research Track. [PDF] [Code(★5)]
 - Remanufacturing an old/tamed program generator to be new again (yield 56 bug reports for GCC and LLVM).

Journal Papers

- [TSE'24] Haoxin Tu, Zhide Zhou, He Jiang, Imam Nur Bani Yusuf, Yuxian Li, and Lingxiao Jiang, **“Isolating Compiler Bugs by Generating Effective Witness Programs with Large Language Models”**, in IEEE Transactions on Software Engineering. [PDF] [Code(☆4)]
 - Static program analysis for prompt generation and reinforcement learning for prompt selection.
- [TSE'24] Haoxin Tu, Lingxiao Jiang, Jiaqi Hong, Xuhua Ding, and He Jiang, **“Concretely Mapped Symbolic Memory Locations for Memory Error Detection”**, in IEEE Transactions on Software Engineering. [PDF] [Code(☆2)]
 - A new modeling of memory address and several new bug-detection strategies based on symbolic address.
- [TR'22] Haoxin Tu, He Jiang, Zhide Zhou, Yixuan Tang, Zhilei Ren, Lei Qiao, and Lingxiao Jiang, **“Detecting C++ Compiler Front-end Bugs via Grammar Mutation and Differential Testing”**, in IEEE Transactions on Reliability. [PDF]
 - Combine grammar-aware C++ test program generation with differential testing (yield 131 bug reports for GCC and LLVM).

Workshops

- [KLEE'24] Haoxin Tu, Lingxiao Jiang, Xuhua Ding, and He Jiang, **“FastKLEE: Faster Symbolic Execution via Reducing Redundant Bound Checking of Type-Safe Pointers”**, in the 4th International KLEE Workshop on Symbolic Execution April 2024.
- [KLEE'24] Haoxin Tu, Lingxiao Jiang, Jiaqi Hong, Xuhua Ding, and He Jiang, **“Concretely Mapped Symbolic Memory Locations for Memory Error Detection”**, in the 4th International KLEE Workshop on Symbolic Execution, April 2024.

Practical Impacts

The list of bugs and vulnerabilities found through my research (counted on September 30th, 2023).

- GCC Bug Reports: 121 (in total) / 76 (confirmed or fixed) Links: in GCC Bugzilla
- LLVM Bug Reports: 137 (in total) / 88 (confirmed or fixed) Links: [GitHub issues from llvm-project]
- GNU Coreutils Bug Reports: 2 (in total) / 2 (fixed) Links: [GNU Coreutils Bugzilla]
- Angr Bug Reports: 3 (in total) / 2 (fixed) Links: [GitHub issues from Angr]
- S2E Bug Reports: 1 (in total) / 1 (fixed) Links: [GitHub issues from S2E]
- To be continued ...

Internship Experience

Max Planck Institute for Security and Privacy (MPI-SP)

RESEARCH INTERN

Bochum, Germany

May. 2024 - Sep. 2024

- Work on building practical symbolic execution-based solutions for compiler testing.

Teaching Experience

2024	Teaching Assistant for “CS706: Software Mining and Analysis”, Singapore Management University	Singapore
2022	Teaching Assistant for “CS443: System Security”, Singapore Management University	Singapore
2019	Teaching Assistant for “Operating Systems”, Dalian University of Technology	Dalian, China

Honors & Awards

2022	Excellent Postgraduate Students, Dalian University of Technology (Top 1%)	Dalian, China
2022	National Scholarship for Postgraduate Students, Dalian University of Technology (Top 1%)	Dalian, China
2020	PhD Full Scholarship, from Singapore Management University	Singapore
2019	Third Prize, National Software and Application Academic Conference (Proposition-based Competition)	Shanghai, China
2019	Third Prize, National Post-Graduate Mathematical Contest in Modeling (Top 20%)	Dalian, China
2017	Outstanding Graduates, Northeast Forestry University (Top 5%)	Harbin, China

Academic Service

2024	Reviewer, for Transactions on Software Engineering and Methodology (TOSEM)	
2023	Student Volunteer, for International Conference on Software Engineering (ICSE 2023)	Melbourne
2022	Reviewer, for IEEE Transactions on Reliability	
2022	External Reviewer, for ASE 2019, SANER 2022, QRS 2022/2023	

Hobbies

I am an avid tennis enthusiast.