Haoxin **Tu**

PhD in Computer Science and Software Engineering

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"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 - Dec. 2024 (Expected)*

- 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 (Expected)*

- 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

Programming	C/C++, Python, Shell, MATLAB, etc
General	GCC, LLVM, KLEE, Angr, S2E, vim, awk, grep, etc
Language	Chinese (Fluent), English

Publications

Conference Papers

- [CCS'23] Pansilu Pitigalaarachchi, Xuhua Ding, Haiqing Qiu, **Haoxin 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] **Haoxin 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] **Haoxin 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] **Haoxin 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

- [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).

Under Review Papers

- [TSE] **Haoxin Tu**, Lingxiao Jiang, Jiaqi Hong, Xuhua Ding, and He Jiang, ***"Concretely Mapped Symbolic Memory Locations for Memory Error Detection"***, Submitted to IEEE Transactions on Software Engineering (Major Revision).
  - A new modeling of memory address and several new bug-detection strategies based on symbolic address.
- [TSE] **Haoxin Tu**, Zhide Zhou, He Jiang, Imam Nur Bani Yusuf, Yuxian Li, and Lingxiao Jiang, ***"LLM4CBI: Taming LLMs to Generate Effective Test Programs for Compiler Bug Isolation"***, Submitted to IEEE Transactions on Software Engineering (Major Revision). [Pre-print]
  - Static program analysis for prompt generation and reinforcement learning for prompt selection.
- [Conference] **Haoxin Tu**, and others, ***"Beyond a Joke: Dead Code Elimination Can Delete Live Code"***, Submitted to a Top-tier Conference in Software Engineering (Under Review).
  - A new problem to investigate and a new approach to tackle the problem.

Practical Impacts

The list of bugs and vulnerabilities found through my research (counted by Sep. 30, 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: 1 (in total) / 1 (fixed) Links: [GNU Coreutils Bugzilla]
- Angr Bug Reports: 2 (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 ...

Work Experience

Huawei Technologies Co. Corp. *Beijing, China*

Software Engineer (Summer Intern) *Jun. 2018 - Sep. 2018*

- Android JNI developing: built a library component of an Android application that allows Java applications running in the Java Virtual Machine (JVM) to call native applications and libraries written in languages such as C, C++, and Assembly.

Teaching Experience

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 *Singapre*

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

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.