Wenjie Ma

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EDUCATION

Nanjing University, *Nanjing, China*

B.S. in Computer Science and Technology *Sep. 2019 – Jun. 2023*

National Elite Program of Computer Science

GPA: 4.72/5.00 (94.4/100) **Rank**: 1^{st} /213 **TOEFL**: 113

Highlight Courses: Operating Systems (99), Linear Algebra (99), Mathematical Logic (94), Formal Languages and Automata (94), Concurrency: Algorithms and Theories (96), Introduction to Machine Learning (95), Problem Solving (98), Software Engineering (98), Principles and Techniques of Compilers (100).

PUBLICATIONS

1. **Context Sensitivity without Contexts: A Cut-Shortcut Approach to Fast and Precise Pointer Analysis**

   Wenjie Ma, Shengyuan Yang, Tian Tan, Xiaoxing Ma, Chang Xu, Yue Li

   In Proceedings of the 44th ACM SIGPLAN Conference on Programming Language Design and Implementation (**PLDI 2023**), Orlando, FL, June 2023

PUBLICATIONS (UNDER REVIEW)

1. **Anvil: Verifying Liveness of Cluster Management Controllers**

   Xudong Sun, **Wenjie Ma**, Jiawei Tyler Gu, Zicheng Ma, Tej Chajed, Jon Howell, Andrea Lattuada, Oded Padon, Lalith Suresh, Adriana Szekeres, Tianyin Xu

   In submission to the 18th USENIX Symposium on Operating Systems Design and Implementation (**OSDI 2024**)

RESEARCH EXPERIENCE

Xlab, University of Illinois Urbana-Champaign, *Urbana-Champaign, IL*

Research Assistant, Distributed System Reliability *Mar. 2023 – Present.*

Advisor: Prof. Tianyin Xu

Collaborators: VMWare Research Group

- **Anvil: a formal verification framework for cluster management controllers**
  https://github.com/vmware-research/verifiable-controllers
  1. Anvil is a formal verification framework for developing practical cluster management controllers and mechanically proving the controller implementations satisfy a set of **liveness** and safety properties. We verified three representative and full-fledged Kubernetes controllers that manage critical systems: ZooKeeper, Rabbitmq and FluentBit.
  2. **Key contributions**: led the proof of liveness and safety properties of three controllers in a complex and dynamic environment with asynchrony and faults using TLA and Verus; contributed most of reusable lemmas and patterns that greatly reduced the proof-to-code ratio; implemented rich features for controllers; crafted models for several components: Kubernetes API server, third-party libraries, controllers.
  3. Second author on a paper submitted to OSDI 2024.

PASCAL group, Nanjing University, *Nanjing, China*

Research Assistant, Static Program Analysis *Mar. 2021 – Nov. 2022*

Advisors: Prof. Yue Li and Prof. Tian Tan

- **Traditional Whole Program Pointer Analysis**
  https://github.com/pascal-lab/Tai-e
  1. Proposed a new approach for pointer analysis, which is faster than context-insensitive analysis, 400x faster than traditional context-sensitive analysis in some cases and achieves precision comparable to context sensitive analysis.
  2. Independently designed detailed algorithms for program patterns like containers and field accesses, implemented the approach on a static analysis framework (Tai-e), evaluated it exhaustively on 10 large and complex real-world Java applications (e.g. Eclipse and Soot) which in total exceeded 2M lines of code.
  3. **First-author** paper published at PLDI 2023 as an **undergraduate**.
- **Co-review**: Science of Computer Programming.
- **Precise Interprocedural Dataflow Analysis**: Implemented IFDS/IDE frameworks on Tai-e.

TALKS

- (talk)"Context Sensitivity without Contexts: A Cut-Shortcut Approach to Fast and Precise Pointer Analysis", *PLDI 2023*

TEACHING EXPERIENCE

Teaching Assistant — *Static Program Analysis*
Nanjing University *Sep. 2022 – Feb. 2023*

- A course of static analysis for both graduates and undergraduates (180 students enrolled in).
- **My role**: Wrote documents and tests (https://tai-e.pascal-lab.net/en/intro/overview.html) for the course programming assignments that are registered by students from 140+ universities all over the world; helped students understand the courses and accomplish programming assignments; designed final exam papers.

WORK EXPERIENCE

University of Illinois Urbana-Champaign
Visiting Scholar of Computer Science Department *Jul. 2023 – Present.*

SKILLS

Programming Languages: Java, C++, C, Rust, Python, JavaScript, Coq, Assembly, Verilog