Wen Fan

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RESEARCH SUMMARY

Ph.D. researcher in software verification and static analysis. I combine separation-logic–based verification and LLM-assisted specification generation for heap-manipulating programs, aiming to apply formal methods to security-critical and distributed systems.

EDUCATION

Ph.D., Electrical and Computer Engineering, Purdue University West Lafayette, Indiana, USA
- Advisor: Prof. Jenna DiVincenzo *Aug. 2022 – Aug. 2028 (Expected)*

B.S., Computer Science, University of Science and Technology of China (USTC) Hefei, Anhui, China
- GPA: 3.75/4.3 *Sept. 2018 – Jun. 2022*

PUBLICATIONS

- **Wen Fan**, Minh Tran, Sanya Dod, Xin Hu, Marilyn Rego, Danning Xie, Jenna DiVincenzo, Lin Tan
  An Empirical Study of LLM-Generated Specifications for VeriFast
  Under submission to **ISSTA 2026**
- Marilyn Rego*, **Wen Fan***, Xin Hu, Sanya Dod, Zhaorui Ni, Danning Xie, Jenna DiVincenzo, Lin Tan
  Evaluating the Ability of Large Language Models to Generate Verifiable Specifications in VeriFast
  FORGE @ ICSE 2025 [paper][code]

RESEARCH PROJECTS

Evaluating and Enhancing LLMs on Generating Specifications for Verifying Heap-manipulating programs Purdue University
Advisor: Prof. Jenna DiVincenzo *Sept. 2024 – Now*
- Built a benchmark based on 60 programs specified in VeriFast verifier
- Developed automated Python pipeline to to evaluate 10 LLMs on 2700+ outputs
- Led our team of 4 to inspect and categorize 1648 VeriFast errors from 450 sampled output functions
- Identified only 31.7% verification success; Over 87% functional behavior preserved; 71% of errors caused by tool-specific knowledge gaps; 47% of errors can be fixed by modifying simple auxiliary specifications
- Building the tool to improve the performance based on the empirical findings

Optimizing Gradual Program Verifier with Parallel Symbolic Execution Purdue University
Advisor: Prof. Jenna DiVincenzo *Jun. – Aug. 2024*
- Discovered the performance bottleneck in sequential execution by analyzing a program of 571 branches
- Designed and implemented parallel execution of branches, reducing static verification time by 41%

Consensus Protocol Optimization under Different Fault Models Purdue University
Advisor: Prof. Yongle Zhang *May. 2023 – Mar. 2024*
- Investigated 40+ consensus protocols in different fault models (e.g., ordered network, reduced node failures)
- Conducted a survey about 5+ synthesis techniques on distributed systems/protocols with 3 other team members
- Identified 8+ examples of improving the performance of Paxos under different fault models

Static Analysis For Failure Detection in Distributed Systems Purdue University
Advisor: Prof. Yongle Zhang *Jun. 2022 – Apr. 2023*
- Examined 100+ failure cases on Apache Jira to characterize cascading failures
- Implemented a static analyzer using the Soot framework to recognize 7 cases of retry in HBase

Optimizing static taint analyzer Remote research intern at UIUC
Advisor: Prof. Tianyin Xu *Jul. – Oct. 2021*
- Added flow information for each statement to solve the non-deterministic path reconstruction
- Implemented points-to analysis and field-use analysis to handle false positives

Index Optimization on Key-Value Storage Research intern at USTC

Advisor: Prof. Yongkun Li *Sept. 2020 – Dec. 2021*
- Co-designed and implemented the bloom filter and iterator in the LSM tree for a new indexing in LevelDB source code
- Used perf in Linux to evaluate the performance of the new indexing

COURSE PROJECTS

DSLAB (Sharded and Fault Tolerant Distributed Key-Value Store) CS505 course at Purdue University
- Implemented Primary-Backup, Paxos and Two Phase Commit protocols
- Passed more than 90% of tests by debugging on searching tests and corner cases

Tiny MIPS Pipelined CPU Computer Organization and Design course at USTC
- Built a 5-stage pipelined CPU of simplified MIPS instruction set, validated by simulation and FPGA testing

OSLAB Operating System course at USTC
- Simulated shell (by using pipes), malloc and a FAT file system (by using fuse)

Compiler Lab Compiler Principle course at USTC
- Implemented lexical analysis, parsing and intermediate representation generation for C- (a subset of C)

Simple Bank Management System Database course at USTC
- Implemented the CRUD features in a bank system using Django, where the E-R models are designed based on the user's requirement

TALKS

- Evaluating the Ability of Large Language Models to Generate Verifiable Specifications in VeriFast, FORGE @ ICSE 2025
- Optimizing Gradual C0 Program Verifier by Adding Parallelism, Purdue ECE Symposium 2024

MENTORING

I am lucky to work with Marilyn Rego, Sanya Dod and Minh Tran who are (were) excellent undergraduates at Purdue University.

TEACHING ASSISTANT EXPERIENCE

- Mathematical Logic USTC, *Spring 2021*
- CS252 Systems Programming Purdue University, *Fall 2022, Spring 2023, Spring 2024*
- CS251 Data Structures Purdue University, *Fall 2023*

AWARDS

Huawei Scholarship *Nov. 2020*

Huaxia Talent Program, USTC *Jun. 2022*

SKILLS

Programming Languages: C, C++, Python, Java, Scala, Go, Rust, OCaml, Verilog, SQL, MATLAB
Verification/Analysis: VeriFast, Dafny, Soot, LLVM
Systems/Tools: Linux, Git, Docker, Makefile, LaTeX, Django, Wireshark
Languages: English (fluent), Chinese (native)