

# Wenxi Wang

Ph.D. Candidate

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## Research Interests

Fusion of [Software Engineering and Security](#), [Formal Methods](#), and [Machine Learning](#), with an emphasis on enhancing the efficiency and robustness of automated logical reasoning tools, and improving the security and reliability of software systems.

## Education

2018–Present **Doctor of Philosophy**, *The University of Texas at Austin (UT Austin)*.

*Research Areas:* Software Engineering, Formal Methods, Machine Learning

*Advisor:* [Sarfraz Khurshid](#)

2017 **Master of Philosophy**, *The University of Melbourne (UoM)*.

*Research Areas:* Automated Logical Reasoning

*Thesis:* A Bit-Vector Solver Based on Word-Level Propagation [\[PDF\]](#)

*Advisor:* [Peter J. Stuckey](#) and [Harald Sondergaard](#)

2014 **Bachelor of Engineering**, *Dalian University of Technology (DUT)*.

*Major:* Computer Science and Technology

*Advisor:* Yanming Shen

## Publications

Published 15 refereed conference papers and 2 refereed journal papers. My papers were accepted at top-tier venues in software engineering (ICSE, ESEC/FSE, ASE, ESEC/FSEDemo), formal methods (TACAS, SAT), programming languages (PLDI), machine learning (ICLR) and automated reasoning (CPAIOR, JAR)

- [1] **Wenxi Wang**, Yang Hu, Mohit Tiwari, Sarfraz Khurshid, Kenneth L. McMillan, Risto Miikkulainen. “NeuroBack: Improving CDCL SAT Solving using Graph Neural Networks.” In *The 12th International Conference on Learning Representations (ICLR 2024)*. [\[PDF\]](#)
- [2] Yang Hu<sup>\*1</sup>, **Wenxi Wang**<sup>\*1</sup>, Sarfraz Khurshid, Kenneth L. McMillan, Mohit Tiwari. “Fixing Privilege Escalations in Cloud Access Control with MaxSAT and Graph Neural Networks.” In *The 38th IEEE/ACM International Conference on Automated Software Engineering (ASE 2023)*. [\[PDF\]](#)
- [3] Armin Biere, Nils Froleyks, **Wenxi Wang**. “CadiBack: Extracting Backbones with CaDiCal.” In *The 26th International Conference on Theory and Applications of Satisfiability Testing (SAT 2023)*. Tool Paper. [\[PDF\]](#)
- [4] **Wenxi Wang**, Yang Hu, Kenneth L. McMillan, Sarfraz Khurshid. “SymMC: Approximate Model Enumeration and Counting Using Symmetry Information for Alloy

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<sup>1\*</sup> denotes that these authors contribute equally to the paper.

- Specifications.*" In *The 30th ACM Joint European Software Engineering Conference and Symposium on the Foundations of Software Engineering (ESEC/FSE 2022)*. [\[PDF\]](#)
- [5] Chengpeng Li, Chenguang Zhu, **Wenxi Wang**, August Shi. "Repairing Order-Dependent Flaky Tests via Test Generation." In *The 44th International Conference on Software Engineering (ICSE 2022)*. [\[PDF\]](#)
  - [6] **Wenxi Wang**, Pu Yi, Sarfraz Khurshid, Darko Marinov. "Initial Results on Counting Test Orders for Order-Dependent Flaky Tests using Alloy." In *The 33rd IFIP International Conference on Testing Software and Systems (ICTSS 2021)*. Note: Short Paper. [\[PDF\]](#)
  - [7] Yang Hu, **Wenxi Wang**, Casen Hunger, Riley Wood, Sarfraz Khurshid, Mohit Tiwari. "ACHyb: A Hybrid Analysis Approach to Detect Kernel Access Control Vulnerabilities." In *The 29th ACM Joint European Software Engineering Conference and Symposium on the Foundations of Software Engineering (ESEC/FSE 2021)*. [\[PDF\]](#)
  - [8] Jiayi Yang, **Wenxi Wang**, Darko Marinov, Sarfraz Khurshid. "AlloyMC: Alloy Meets Model Counting." In *The 28th ACM Joint European Software Engineering Conference and Symposium on the Foundations of Software Engineering (ESEC/FSE 2020)*. Tool Demo. [\[PDF\]](#)
  - [9] Muhammad Usman, **Wenxi Wang**, Sarfraz Khurshid. "TestMC: Testing Model Counters using Differential and Metamorphic Testing." In *The 35th IEEE/ACM International Conference on Automated Software Engineering (ASE 2020)*. [\[PDF\]](#)
  - [10] **Wenxi Wang**, Muhammad Usman, Alyas Almaawi, Kaiyuan Wang, Kuldeep S. Meel, Sarfraz Khurshid. "A Study of Symmetry Breaking Predicates and Model Counting." In *International Conference on Tools and Algorithms for the Construction and Analysis of Systems (TACAS 2020)*. [\[PDF\]](#)
  - [11] Muhammad Usman, **Wenxi Wang**, Kaiyuan Wang, Cagdas Yelen, Nima Dini, Sarfraz Khurshid. "A Study of Learning Likely Data Structure Properties using Machine Learning Models." In *International Journal on Software Tools for Technology Transfer (STTT 2020)*. [\[PDF\]](#)
  - [12] Muhammad Usman, **Wenxi Wang**, Kaiyuan Wang, Marko Vasic, Haris Vikalo, Sarfraz Khurshid. "A Study of the Learnability of Relational Properties (Model Counting Meets Machine Learning)." In *The 41st ACM SIGPLAN Conference on Programming Language Design and Implementation (PLDI 2020)*. [\[PDF\]](#)
  - [13] Muhammad Usman, **Wenxi Wang**, Kaiyuan Wang, Cagdas Yelen, Nima Dini, Sarfraz Khurshid. "A Study of Learning Data Structure Invariants Using Off-the-shelf Tools." In *The 26th International SPIN Symposium on Model Checking of Software (SPIN 2019)*. [\[PDF\]](#)
  - [14] **Wenxi Wang**, Kaiyuan Wang, Milos Gligoric, Sarfraz Khurshid. "Incremental Analysis of Evolving Alloy Models." In *International Conference on Tools and Algorithms for the Construction and Analysis of Systems (TACAS 2019)*. [\[PDF\]](#)
  - [15] **Wenxi Wang**, Kaiyuan Wang, Mengshi Zhang, Sarfraz Khurshid. "Learning to Optimize the Alloy Analyzer." In *The 12th IEEE International Conference on Software Testing, Verification and Validation (ICST 2019)*. [\[PDF\]](#)

- [16] **Wenxi Wang**, Harald Sondergaard, Peter J. Stuckey. “Wombit: A Portfolio Bit-Vector Solver using Word-Level Propagation.” In *Journal of Automated Reasoning (JAR 2018)*. [\[PDF\]](#)
- [17] **Wenxi Wang**, Harald Sondergaard, Peter J. Stuckey. “A Bit-Vector Solver with Word-Level Propagation.” In *Integration of AI and OR Techniques in Constraint Programming (CPAIOR 2016)*. [\[PDF\]](#)

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## Paper Submissions & Preprints

- [18] Yang Hu<sup>\*2</sup>, **Wenxi Wang**<sup>\*2</sup>, Sarfraz Khurshid, Mohit Tiwari. “Interactive Grey-box Penetration Testing for Cloud Access Control using IAM Modeling and Deep Reinforcement Learning.” *arXiv preprint arXiv:2304.14540*, 2023. [\[PDF\]](#)
- [19] Sicong Che, Jiayi Yang, **Wenxi Wang**, Sarfraz Khurshid. “Findings on the Learnability of Graph Neural Networks to Capture Graph Structures.” 2023.

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## Patents

- [20] Amit Goel, Dejan Jovanovic, Neha Rungta, **Wenxi Wang**. (alphabetical order) “Optimizing SMT problem encoding for application-specific workloads with machine learning.” *U.S. Patent Application, Pending*, 2023.

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## Work Experiences

- 5/2022–8/2022 **Applied Scientist Intern**, *Automated Reasoning Group*, Amazon Web Services.  
*Host*: Dejan Jovanovic  
*Project*: Optimizing SMT problem encoding for application-specific workloads with Graph Neural Networks
- 5/2019–8/2019 **Research Intern**, *Software Quality & Security Lab*, Fujitsu Research of America.  
*Host*: Hiroaki Yoshida  
*Project*: Automated program repairs for static analysis violations
- 9/2017–8/2018 **Research Intern**, *Department of Computing*, Hong Kong Polytechnic University.  
*Host*: Max Yu Pei  
*Project*: Mutation-based fault localization with minimal unsatisfiable core analysis

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## Scholarships and Awards

- 2023–2024 George J. Heuer, Jr. Ph.D. Endowed Graduate Fellowship, UT Austin
- 2022 MIT EECS Rising Stars
- 2014–2016 Melbourne International Research Scholarship, UoM
- 2014–2016 Melbourne International Fee Remission Scholarship, UoM
- 2014 Province Excellent Graduates Award, Liaoning Province, China (top 1%)
- 2012–2013 China National Scholarship, Ministry of Education of China (top 1%)
- 2010–2014 Outstanding Student Awards, DUT (top 3%)

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## Teaching Experiences

### Teaching Assistant:

- Fall 2022 Software Testing (ECE 360T), Undergraduate Level, UT Austin

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<sup>2\*</sup> denotes that these authors contribute equally to the paper.

- Spring 2020 Software Testing (ECE 382C), Graduate Level, UT Austin
- Fall 2019 Software Design & Implementation II (ECE 422C), Graduate Level, UT Austin
- Spring 2019 Algorithmic Foundations for Software Systems (ECE 382V), Graduate Level, UT Austin
- Fall 2016 Data Structure & Algorithms (COMP20003), Undergraduate Level, UoM
- Fall 2016 Engineering Computation (COMP20005), Undergraduate Level, UoM
- Guest Lecture:**
- Fall 2023 Software Testing (ECE 382V), Graduate Level, UT Austin  
Content: Introduction to automated vulnerability repair in cloud access control
- Fall 2023 Verification & Validation of Software (ECE 382C), Graduate Level, UT Austin  
Content: Introduction to model counting and enumeration with Alloy analyzer
- Spring 2019 Algorithmic Foundations for Software Systems (ECE 382V), Graduate Level, UT Austin  
Content: Java coding demonstration of classic data structures

## Mentoring Experiences

Mentored two Master's students, both from underrepresented groups, and one junior Ph.D. student

- Master's Student Sicong Che (2022–Present, co-authored paper [19])
- Master's Student Jiayi Yang (2019–Present, co-authored papers [8, 19])
- Ph.D. Student Muhammad Usman (2019–2021, co-authored papers [9, 10, 11, 12, 13])

## Committee Services

### Program Committee (PC):

- ASE 2024 PC member in IEEE/ACM International Conference on Automated Software Engineering
- ICML 2024 PC member in International Conference on Machine Learning
- ICLR 2024 PC member in International Conference on Learning Representations
- ECOOP 2023 Session chair of the “Verification and Testing” session and extended PC member in European Conference on Object-Oriented Programming
- NeurIPS 2023 PC member in Conference on Neural Information Processing Systems
- ICML 2023 PC member in International Conference on Machine Learning
- NeurIPS 2022 PC member in Conference on Neural Information Processing Systems

### Artifact Evaluation Committee (AEC):

- PLDI 2023 AEC member in Conference on Programming Language Design and Implementation
- ISSTA 2023 AEC member in International Symposium on Software Testing and Analysis
- ECOOP 2023 AEC member in European Conference on Object-Oriented Programming
- USENIX SEC 2023 AEC member in USENIX Security Symposium
- ISSTA 2022 AEC member in International Symposium on Software Testing and Analysis
- PLDI 2022 AEC member in Conference on Programming Language Design and Implementation
- PLDI 2021 AEC member in Conference on Programming Language Design and Implementation

## Professional Services

- External Reviewer TACAS 2022, ESEC/FSE 2021, ICST 2020, ASE 2020, ISSRE 2020, and ICSE 2019.

Seminar Organizer Co-organize the Joint UT-Cornell Software Engineering Seminar 2023–2024.  
Graduate Mentor Mentored six new graduate students in ECE Partner Program at UT Austin, Fall 2023.

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## Presentations

### Paper Presentation:

- 2023 Fixing Privilege Escalations in Cloud Access Control with MaxSAT and Graph Neural Networks [2], at the Joint UT-Cornell Software Engineering Seminar
- 2022 SymMC: Approximate Model Enumeration and Counting Using Symmetry Information for Alloy Specifications [4], at ESEC/FSE 2022
- 2021 Initial Results on Counting Test Orders for Order-Dependent Flaky Tests using Alloy [6], at ICTSS 2021
- 2020 A Study of Symmetry Breaking Predicates and Model Counting [10], at TACAS 2020
- 2019 Incremental Analysis of Evolving Alloy Models [14], at TACAS 2019
- 2019 Learning to Optimize the Alloy Analyzer [15], at ICST 2019
- 2016 A Bit-Vector Solver with Word-Level Propagation [17], at CPAIOR 2016

### Poster Presentation:

- 2022 Improving Constraint Solving and Model Counting, at EECS Rising Stars 2022

### Industrial Presentation:

- 2022 Improving SMT Solving with Graph Neural Networks, at Amazon Web Services
- 2019 Automated program repairs for static analysis violations, at Fujitsu Research of America