Wenxi Wang

Ph.D. Candidate
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Research Interests

Fusion of Software Engineering, 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

2014–2017 **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

2009–2014 **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*[1], **Wenxi Wang***[1], 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*

[1] * 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]**

Paper Submissions & Preprints

[18] Yang Hu*[2], **Wenxi Wang***[2], 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.

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.

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

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%)

Teaching Experiences

Teaching Assistant:

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

[2]* 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.

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

References

Sarfraz Khurshid, *Advisor*
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