William Eiers

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PhD Candidate
Verification Lab
University of California Santa Barbara

RESEARCH INTERESTS

Automated reasoning, formal methods, constraint solving, model counting, access control, symbolic quantitative policy analysis

EDUCATION

DOCTOR OF PHILOSOPHY IN COMPUTER SCIENCE   FALL 2017 - CURRENT
University of California Santa Barbara

BACHELOR OF SCIENCE IN COMPUTER SCIENCE   SPRING 2016
University of California Santa Barbara
Distinction in Major, Honors

ASSOCIATE OF SCIENCE IN COMPUTER SCIENCE   SPRING 2014
American River College
Honors

PUBLICATIONS

William Eiers, Ganesh Sankaran, Tevfik Bultan. "Quantitative Policy Repair for Access Control on the Cloud." *Proceedings of the 32nd International Symposium on Software Testing and Analysis (ISSTA 2023)*

William Eiers, Ganesh Sankaran, Albert Li, Emily O'Mahoney, Ben Prince, Tevfik Bultan. "Quacky: Quantitative Access Control Permissiveness Analyzer." *Tool Paper. Proceedings of the 37th IEEE/ACM International Conference on Automated Software Engineering (ASE 2022)*

William Eiers, Ganesh Sankaran, Albert Li, Emily O'Mahoney, Ben Prince, Tevfik Bultan. "Quantifying Permissiveness of Access Control Policies." *Proceedings of the 44th International Conference on Software Engineering (ICSE 2022)*

William Eiers, Seemanta Saha, Tegan Brennan, Tevfik Bultan. "Subformula Caching for Model Counting and Quantitative Program Analysis." *Proceedings of the 34th IEEE/ACM International Conference on Automated Software Engineering (ASE 2019)*

Seemanta Saha, **William Eiers**, Ismet Burak Kadron, Lucas Bang, Tevfik Bultan. "Incremental Attack Synthesis." *Proceedings of JPF 2019 Java PathFinder Workshop*

Abdulbaki Aydin, **William Eiers**, Lucas Bang, Tegan Brennan, Miroslav Gavrilov, Tevfik Bultan, Fang Yu. "Parameterized Model Counting for String and Numeric Constraints." *Proceedings of the 26th ACM SIGSOFT International Symposium on the Foundations of Software Engineering (FSE 2018)*

Seemanta Saha, Ismet Burak Kadron, **William Eiers**, Lucas Bang, Tevfik Bultan. "Attack Synthesis for Strings using Meta-Heuristics." *Proceedings of JPF 2018 Java PathFinder Workshop*

HONORS AND AWARDS

COMPUTER SCIENCE OUTSTANDING GRADUATE STUDENT, SPRING 2021 (UNIVERSITY OF CALIFORNIA SANTA BARBARA)

Sole graduate student in the computer science program selected to receive this award for the 2020-2021 academic year. This award is given in recognition of a Ph.D. student who has excelled in both research and either department service or teaching.

COLLEGE OF ENGINEERING OUTSTANDING TEACHING ASSISTANT IN COMPUTER SCIENCE, SPRING 2019 (UNIVERSITY OF CALIFORNIA SANTA BARBARA)

Sole teaching assistant in the computer science program selected to receive this award for the 2018-2019 academic year. The selection is chosen by the graduating seniors in the program.

OUTSTANDING TEACHING ASSISTANT, SPRING 2018 (UNIVERSITY OF CALIFORNIA SANTA BARBARA)

One of three teaching assistants to receive the outstanding teaching assistant award for the 2017-2018 academic year in the computer science program at UCSB. This award is given to a select few teaching assistants to recognize their exceptional performance and willingness to go beyond what is required.

RESEARCH PROJECTS

ABC/MT-ABC

https://github.com/vlab-cs-ucsb/ABC

Automata-based model counter (ABC) is a constraint solver and model counter for both string and integer arithmetic theories. Given a combination of string and linear integer arithmetic constraints, ABC computes a model that characterizes the solution set in the form of a deterministic finite automaton. After taking over lead development of ABC, I extended ABC to use multi-track automaton (MT-ABC), greatly increasing its precision and performance.

Quacky

https://github.com/vlab-cs-ucsb/Quacky

Quacky is a tool for quantifying permissiveness of access control policies in the cloud. Given a policy, Quacky translates it into a SMT formula and uses a model counting constraint solver to quantify permissiveness. When given multiple policies, Quacky can not only determine which policy is more permissive, but can also quantify the relative permissiveness between the policies. Quacky supports access control policies written in Amazon's AWS Identity and Access Management (IAM), Microsoft's Azure, and Google Cloud Platform (GCP) policy languages.

WORK EXPERIENCE

SOFTWARE DEVELOPER ENGINEER INTERN, AMAZON WEB SERVICES (AWS) AUTOMATED REASONING GROUP (ARG)

As an SDE intern at the formal methods group ARG at AWS, I conducted research into novel methods for automated analysis of access control policies. The automated reasoning group strives to provide provable security guarantees for security of the cloud and in the cloud. My research involved exploring how symbolic quantitative analysis techniques using model counting constraint solvers can provide further security guarantees for access control policies.

GRADUATE RESEARCH ASSISTANT, UCSB VERIFICATION LAB

Continued development of ABC. Collaborated with Vanderbilt University and Carnegie Mellon for the DARPA Space-Time Analysis for Cybersecurity (STAC) project, competing against other teams at DARPA headquarters. My research has progressed into applying symbolic quantitative analysis techniques to access control in the cloud, culminating in the Quacky tool, a quantitative access control permissiveness analyzer.

UNDERGRADUATE RESEARCH ASSISTANT, UCSB VERIFICATION LAB

Worked on ABC with focus of implementing multi-track automata into the tool. Overtook lead development of ABC in the beginning of 2017.

TEACHING EXPERIENCE

TEACHING ASSOCIATE, UNIVERSITY OF CALIFORNIA SANTA BARBARA

CS 190N Research Methods in Computer Science

CS 501 Teaching Assistant Training Seminar

GRADUATE TEACHING ASSISTANT, UNIVERSITY OF CALIFORNIA SANTA BARBARA
CS 138 Formal Languages and Automata
CS 170 Operating Systems
CS 154 Computer Architecture
CS 154 Computer Architecture
CS 160 Translation of Programming Languages

TALKS

"Quacky: Quantitative Access Control Permissiveness Analyzer"
Presented the Quacky Permissiveness Analyzer tool at Automated Software Engineering (ASE 2022), Oakland Center, Michigan, October 10-14th, 2022

"Quantifying Permissiveness of Access Control Policies"
Presented work on applying symbolic quantitative techniques to access control policy analysis at International Conference on Software Engineering (ICSE 2022), Pittsburgh, Pennsylvania, May 22-27th, 2022

"Subformula Caching for Model Counting and Quantitative Program Analysis"
Presented work on subformula caching at Automated Software Engineering (ASE 2019), San Diego, California, November 10-15th, 2019

"Parameterized Model Counting for String and Numeric Constraints"
Presented work on model counting mixed constraints at Foundations of Software Engineering (FSE 2018), Lake Buena Vista, Florida, November 4-9th, 2018

SERVICE

EARLY RESEARCH SCHOLARS PROGRAM TEACHER AND MENTOR, 2020-2021
(UNIVERSITY OF CALIFORNIA SANTA BARBARA)
I continued my service in the UCSB Early Research Scholars Program as the teacher and head mentor for the program. The program involved 20 undergraduate students (sophmores), split into 5 groups of 4, with each group having a department professor and a graduate student mentor. During this time, I taught the CS190N Research Methods in Computer Science course (which all students in the program take for units), and facilitated communication between the professors, mentors, and students within each group. Moreover, I was responsible for coordinating with multiple graduate student mentors and department professors in ensuring the success of each student within the program.

EARLY RESEARCH SCHOLARS PROGRAM GRADUATE MENTOR, 2019-2020
(UNIVERSITY OF CALIFORNIA SANTA BARBARA)

The UCSB Early Research Scholars Program is a dual-mentored, structured research apprenticeship experience for undergraduates in their second year. In this program, students are grouped into teams (usually of 4) and then matched with an active research group from a department. I served as a graduate mentor for one of the teams and was responsible for integrating them into the research process and mentoring the students throughout a year-long research project.

COMPUTER SCIENCE FACULTY RECRUITMENT COMMITTEE, 2019-2020
(UNIVERSITY OF CALIFORNIA SANTA BARBARA)

The faculty recruitment committee is in charge of recruiting new faculty for the computer science department. The process involves reviewing applications, selecting candidates to invite, and ultimately leads the discussion on which candidates to hire. As one of two graduate representatives on the committee, I was responsible for coordinating graduate student lunches with candidates and making sure the voice of our graduate students was heard during the recruitment process.

COMPUTER SCIENCE LEAD TEACHING ASSISTANT, 2018-2019
(UNIVERSITY OF CALIFORNIA SANTA BARBARA)

Selected as the sole lead teaching assistant (TA) for the computer science department. The lead TA acts as a mentor for all new and existing TAs and is responsible for teaching the TA training course which all new TAs must take.

COMPUTER SCIENCE GRADUATE AFFAIRS COMMITTEE REPRESENTATIVE, 2018-2019
(UNIVERSITY OF CALIFORNIA SANTA BARBARA)

The graduate affairs committee consists of several tenured professors which rule on matters pertaining to the computer science graduate program at UCSB. As the sole graduate student representative, I am the voice for all computer science graduate students in the committee.