Shawn Meier

Curriculum Vitae

https://plv.colorado.edu/shawn/   https://linkedin.com/in/shawn-meier

EDUCATION

Ph.D.	**University of Colorado at Boulder**, Computer Science	2024
	Advisor: Prof. Bor-Yuh Evan Chang	
	Thesis: Message History Logics and Callback Control Flow Models for Automatic Event-Driven Application Analysis	
Master of Science	**University of Colorado at Boulder**, Computer Science	2016
BS	**Colorado School of Mines**, Geophysical Engineering	2009

RESEARCH PROJECTS

Synthoria: Abducing temporal models of event-driven frameworks with app-only (in)correctness
Writing framework models by hand for verifying event-driven applications is hard. This work builds on Historia (discussed next) to automatically abduce a framework model sufficient to prove a safety property in an event-driven application using program synthesis. This work addresses two key challenges: avoiding unsound framework models and reducing the search space of framework models. In order to reduce the chances of finding unsound framework models, this technique ensures that known reachable locations in a dataset of applications remain reachable in the resulting framework model. This reachability is ensured by a novel extension of incorrectness logic. We reduce the search space for framework models by constraining the hypothesis space of framework models using a novel application only analysis.

(with Bor-Yuh Evan Chang, Sergio Mover, and Gowtham Kaki)

Historia: Refuting Callback Reachability with Message-History Logics A major challenge in sound and precise static analysis of event driven apps is modeling and abstracting the framework which dispatches events in the form of callbacks. In this work, we present a goal-directed static analysis that starts by assuming nothing about event order and allows a program analyst to refine the framework model as needed to avoid false alarms. Such modeling reduces the difficulty and chances for errors during the modeling process. The model is specified using a domain specific language based on first-order past-time linear temporal logic (LTL) which is designed to maintain decidability within the static analysis. A prototype for this project is implemented to analyze Android applications and utilizes SMT solvers, separation logic, and abstract interpretation.

(with Bor-Yuh Evan Chang, Sergio Mover, and Gowtham Kaki)

Verivita: Dynamic Lifestate Verification of Event-Driven Apps
This project creates a practical method of verifying Android applications for defects relating to misuse of the Android API. Traditional techniques have difficulty reasoning about the complex underlying framework which invokes callbacks in response to external events. This project addresses these problems with a novel method of modeling the Android framework with Lifestate rules.

(with Bor-Yuh Evan Chang and Sergio Mover)

Fixr: Mining and Understanding Bug Fixes to Address Application-Framework Protocol Defects
The Fixr project is a part of the DARPA program Mining and Understanding Software Defects (MUSE). The goal of this project is to utilize bugs and fixes in the large amounts of available open source code to detect and repair software defects. `http://plv.colorado.edu/projects/fixr/`

(with Bor-Yuh Evan Chang, Pavol Cerny, Sergio Mover, Sriram Sankaranarayanan, Kenneth M. Anderson, and Tom Yeh)

DroidStar: callback typestates for Android classes The precise behavior of callbacks for an Android class is complex and depends on both methods invoked and asynchronous behavior. In this project we automatically learn an automaton of callbacks and methods that may be invoked which we call a "callback typestate". This is accomplished with a modified version of the L* learning algorithm.

(with Arjun Radhakrishna, Nicholas V. Lewchenko, Sergio Mover, Krishna Chaitanya Sripada, Damien Zufferey, Bor-Yuh Evan Chang and Pavol Cerny)

Refereed Publications

Shawn Meier, Sergio Mover, Gowtham Kaki, and Bor-Yuh Evan Chang. Historia: Refuting Callback Reachability with Message-History Logics (OOPSLA 2023)

Shawn Meier, Sergio Mover, and Bor-Yuh Evan Chang. Lifestate: Event-Driven Protocols and Callback Control Flow. (ECOOP 2019)

Arjun Radhakrishna, Nicholas Lewchenko, **Shawn Meier**, Sergio Mover, Krishna Chaitanya Sripada, Damien Zufferey, Bor-Yuh Evan Chang, and Pavol Černý. DroidStar: Callback Typestates for Android Classes (ICSE 2018)

Technical Reports

Shawn Meier, Aleksandar Chakarov, Maxwell Russek, Sergio Mover, Bor-Yuh Evan Chang Abstracting Event-Driven Systems with Lifestate Rules. Technical Report CU-CS-1093-12, Dec 2016.

Experience

University of Colorado (Boulder, CO)   Aug 2020 - 2024
Graduate Research Assistant Static analysis of event driven systems. (Functional programming, concurrency, SMT solvers, abstract interpretation)

Google (Boulder, CO, remote)   May 2020 - Aug 2020
Deep Dive Intern Designed and implemented static analysis to detect security vulnerabilities in Android applications.

University of ColoradoBoulder, CO   December 2019 - May 2020
Teaching Assistant - Principles of Programming Languages Assisted in teaching a course about implementing program interpreters, functional programming, and programming languages theory.

University of Colorado (Boulder, CO)   May 2019 - December 2019
Graduate Research Assistant - Fixr Project
Assisted in research to be able to utilize information from open source software to automatically detect and repair Android software defects.

Google (Sunnyvale, CA)   May 2019 - August 2019
Deep Dive Intern Designed and implemented static analysis to detect health issues and security vulnerabilities in Android applications.

University of Colorado (Boulder, CO)   2014 - May 2019
Graduate Research Assistant - Fixr Project

Trimble (Broomfield, CO)   2014
Software Engineering Intern Automatic deployment of integration testing for web services written in C# and PowerShell using Amazon Web Services.

University of Colorado (Boulder, CO)   January 2014 - May 2014
Principles of Programming Languages Learning Assistant Teaching students concepts underlying programming languages through implementation of a JavaScript interpreter. This includes judgment forms, context free grammars, Scala implementation, and Functional Programming.

Level 3 Communications (Broomfield, CO)   2013
Software Engineering Intern Developed RESTful services for business logic in Java. This including trouble ticketing, CDN, and other API functions.

GeosHelix LLC (Boulder, CO)   2012
Contractor/Owner Worked on a variety of projects. Simulation of thermal oil recovery, finite element analysis, SolidWorks design, transportation system design, and teaching software development.

Aleph Objects (Loveland, CO)   2012
Contractor Researched and constructed open source 3d printers.

Neva Ridge Technologies (Boulder, CO)   June 2009 - July 2011
Research Scientist Wrote signal processing software for synthetic aperture radar in C, Java, and Matlab.

Professional Service and Volunteering

Community volunteer work: **Make4Covid**   2020
Developed web service backend for tracking statistics and coordinating manufacturing of personal protective equipment. Manufactured parts for over 120 face shields for medical workers using 3d printing. (Web services, REST, Docker, Python, SQLite, and Pandas)

Journal reviewing: **Formal Methods in System Design**   2017

Conference reviewing:

Static Analysis Symposium (SAS)   2016

Asian Symposium on Programming Languages and Systems (APLAS)   2016

Awards and Honors

Outstanding Research Paper Award   2024
Awarded by the CU Boulder Computer Science Department for "Historia: Refuting Callback Reachability with Message-History Logics".

Outstanding Teaching Assistant - PhD   2019 - 2020 Academic Year

I facilitated the transition from in-person to online teaching for the principles of program analysis course as COVID-19 initially spread across the United States. This transition involved creating video lectures and creating homework assignments to fit the online lecture format. Additionally, I excelled at helping students with coursework as well as technologies used in the course. These technologies included Scala, Jupyter Notebook, and the Intellij IDE.

CITIZENSHIP

United States of America