MANASVI SAXENA

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RESEARCH INTERESTS

Programming Language Semantics, Runtime Verification, Safe Hybrid Systems, Language Independent Static and Dynamic Analysis

EDUCATION

Ph.D. Computer Science, University of Illinois – Urbana Champaign **December 2024**

- **Relevant Coursework - Advanced Programming Language Semantics, Programming Verification, Embedded Systems Verification**

M.S. Computer Science, University of Illinois – Urbana Champaign **May 2018**

- **Relevant Coursework - Formal Methods of Software Development, Runtime Verification, Logic in Computer Science, Computer and Cryptocurrency Security**

B.S. Computer Science, University of Illinois – Urbana Champaign **May 2015**

- **Relevant Coursework - Programming Languages and Compilers, Fundamental Algorithms, Theory of Computation, Computer Networking, Artificial Intelligence**

EXPERIENCE

Formal Systems Laboratory, University of Illinois **May 2018 - Present**
Research Assistant ***Urbana, IL***

- **Leading the design and development of the MediK Framework (`https://github.com/medik-framework`). The core of MediK is a new domain specific language for expressing guidelines in medicine formally as finite state machines. MediK is a part of a multi year effort to safely capture semantics of medical guidelines formally to derive correct-by-construction decision support systems for use in healthcare.**
- **Lead developer of RV-Monitor, a language independent monitoring that supports rich formalisms for expressing properties.**

S3 Automated Reasoning Group, Amazon Web Services (AWS) **Summer 2021**
Applied Scientist Intern

- **Developed a tool for measuring effectiveness of a test suite against a property expressed in RV-Monitor (`https://github.com/runtimeverification/rv-monitor`).**
- **Tool reported code coverage w.r.t. regions of the code important for an RV-Monitor safety specification, helping ensure test suite exercises important regions of the codebase, and was optimized to handle millions of lines of highly concurrent code.**

S3 Automated Reasoning Group, Amazon Web Services (AWS) **Summer 2020**
Applied Scientist Intern

- **Developed tooling to ensure S3 codebase adhered to desired safety properites such as serializability.**
- **Improved RV-Monitor, an academic tool, to handle millions of lines of code, and support expressing complex properties relevant to concurrent systems such as read after write consistency and serializability efficiently.**

Formal Systems Laboratory, University of Illinois **August 2016 - May 2018**
Research Assistant ***Urbana, IL***

- **Implementing a Proof Assistant (called the K Debugger) for the K Semantics Framework.**
- **K (`https://github.com/kframework/k`) is a rewrite based semantics framework in which programming languages can be defined using configurations, computations and rules. Proof Assistant will be used to prove program correctness, using the implementation of Matching Logic in K.**
- **Implementing the semantics of the ethereum Abstract Binary Interface (ABI) as a part of the KEVM (`http://github.com/kframework/evm-semantics`) project. The KEVM ABI abstraction exposes a higher-level language like layer for smart contract verification.**

Runtime Verification Inc., Urbana, Illinois **July 2015 - May 2016**
Software Engineer ***Urbana, IL***

- Worked on a team developing a dynamic analysis tool for finding undefined behavior in C programs, using formal semantics of C.
- Worked on improving tool's performance, and evaluated its applications on large codebases.

Formal Systems Laboratory, University of Illinois **August 2014 - May 2015**
Undergraduate Research Assistant ***Urbana, IL***

- Developed a Semantics based Debugger for the K Semantics Framework.
- Debugger helps users find bugs in formal semantics defined in K. Allows users to step through the execution of their program, examine the state space, configurations, and rules among other features.

Coordinated Science Lab, University of Illinois **Summer 2014**
Undergraduate Research Assistant ***Urbana, IL***

- Worked on visualization of a large dataset containing records of faulty medical devices by the Food and Drug Administration (FDA).
- Created an interactive web application that displays the visualizations using PHP/Javascript.

TEACHING EXPERIENCE

Teaching Assistant, CS 427 **Fall 2020**
University of Illinois ***Urbana, IL***

- Helped prepare course materials, and assisted instructor during lectures when needed.
- Held weekly office hours

PROJECTS

The MediK Framework **github.com/medik-framework**

- Lead development of the semantics of the MediK language for expressing computer interpretable medical guidelines.

RV-Monitor **github.com/runtimeverification/rv-monitor**

- Part of core team that maintains and develops RV-Monitor - a language agnostic monitor framework.

KEVM - Semantics of the EVM in K **github.com/kframework/evm-semantics**

- Worked on formalizing the EVM in K. Worked on capturing the semantics of the Ethereum ABI, as an extension to the original semantics.

PUBLICATIONS

Manasvi Saxena, Shuang Song, and Lui Sha. MediK: Towards Safe Guideline-based Clinical Decision Support. In *2023 Formal Methods in Computer-Aided Design (FMCAD)*, pages 306–317. IEEE, 2023

Everett Hildenbrandt, Manasvi Saxena, Nishant Rodrigues, Xiaoran Zhu, Philip Daian, Dwight Guth, Brandon Moore, Daejun Park, Yi Zhang, Andrei Stefanescu, et al. KEVM: A complete formal semantics of the Ethereum Virtual Machine. In *2018 IEEE 31st Computer Security Foundations Symposium (CSF)*, pages 204–217. IEEE, 2018

Daejun Park, Yi Zhang, Manasvi Saxena, Philip Daian, and Grigore Rosu. A formal verification tool for ethereum VM bytecode. In Gary T. Leavens, Alessandro Garcia, and Corina S. Pasareanu, editors, *Proceedings of the 2018 ACM Joint Meeting on European Software Engineering Conference and Symposium on the Foundations of Software Engineering, ESEC/SIGSOFT FSE 2018, Lake Buena Vista, FL, USA, November 04-09, 2018*, pages 912–915. ACM, 2018

Manasvi Saxena, Nishant Rodrigues, Xiaohong Chen, and Grigore Rosu. Formal Semantics of Hybrid Automata. `http://hdl.handle.net/2142/97207`

Manasvi Saxena, Xiahong Chen, Shuang Song, Shaoyu Meng, Lui Sha, and Grigore Rosu. Rewriting-Based Computer-Interpretable Clinical Practice Guidelines. https://hdl.handle.net/2142/116016

Dwight Guth, Chris Hathhorn, Manasvi Saxena, and Grigore Rosu. Rv-match: Practical semantics-based program analysis. In *Computer Aided Verification - 28th International Conference, CAV 2016, Toronto, ON, Canada, July 17-23, 2016, Proceedings, Part I*, volume 9779 of *LNCS*, pages 447–453. Springer, July 2016

Philip Daian, Dwight Guth, Chris Hathhorn, Yilong Li, Edgar Pek, Manasvi Saxena, Traian Florin Serbanuta, and Grigore Rosu. Runtime verification at work: A tutorial. In *Runtime Verification - 16th International Conference, RV 2016 Madrid, Spain, September 23-30, 2016, Proceedings*, volume 10012 of *Lecture Notes in Computer Science*, pages 46–67. Springer, September 2016