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Education

Ph.D. Computer Science, Iowa State University, Ames, IA, USA 2016– ongoing

M.S.E. Embedded Systems, University of Pennsylvania, Philadelphia, PA, USA 2013–2015

B.E. Instrumentation and Control, University of Delhi, New Delhi, India 2009–2013

Experience

Research Assistant, Iowa State University Aug 2015 – present
Symbolic Model Checking of Large Design Spaces
Mentor: Kristin Yvonne Rozier

1. Designing algorithms for checking "sets" of models and properties, and
2. Developing novel extensions to the NuSMV model checker, and new model-set checkers.

Research Intern, IBM, Austin, TX Aug 2018 – May 2019
Formal Verification of Multi-Property Testbenches
Mentors: Jason Baumgartner and Alexander Ivrii

1. Developed techniques to group and partition properties for formal verification, and
2. Added multiple property verification support to IBM's model checker.

Formal Verification Engineer Intern, Apple, Cupertino, CA May 2018 – Aug 2018
Software Verification using Theorem Proving
Mentor: John Matthews

1. Formally verified C code using Isabelle/HOL theorem prover, and
2. Developed a custom SMT tactic for word-level and non-linear integer arithmetic.

Research Intern, Fondazione Bruno Kessler, Trento, Italy May 2015 – Aug 2015
Formal Verification of NextGen Air Traffic Controller
Mentor: Alessandro Cimatti

1. Added extensions to include asymmetric information sharing between aircraft,
2. Developed a contract-based design case-study of a sample railroad system, and
3. Analyzed extraction of SMV models from LLVM bitcode and control flow graphs.

Embedded Systems Programmer, University of Pennsylvania Jan 2014 – Apr 2015
Wireless and Invasive Brain-Computer Interfaces
Mentor: Jan Van der Spiegel

1. Designed a wireless brain-sensor interface system to control prosthetics, and
2. Researched the use of compressive sensing and learning to minimize data outflow.

Undergraduate Intern, Texas Instruments, New Delhi, India Dec 2011 – Apr 2013
ARM-based Microcontroller Development Platforms
Mentor: Dhananjay Gadre

1. Responsible for complete hardware/software design of ARM-based learning kits,
2. Commercially launched two learning kits, Stellaris Guru and Stellaris Shuru, and
3. Composed pedagogy materials and co-authored an undergraduate lab manual.

Publications

Peer-Reviewed Conferences

C1 Rohit Dureja, Jason Baumgartner, Alexander Ivrii, Robert Kanzelman, and Kristin Y. Rozier. Boosting Verification Scalability via Structural Grouping and Semantic Partitioning of Properties. In *Proceedings of Formal Methods in Computer-Aided Design (FMCAD)*, San Jose, California, October 2019. IEEE/ACM

C2 Rohit Dureja, Jianwen Li, Geguang Pu, Moshe Y. Vardi, and Kristin Y. Rozier. Intersection and Rotation of Assumption Literals Boosts Bug-Finding. In *Proceedings of Verified Software: Theories, Tools, and Experiments (VSTTE)*, New York, USA, July 2019. Springer, Cham

C3 Jianwen Li, Rohit Dureja, Geguang Pu, Kristin Y. Rozier, and Moshe Y. Vardi. SimpleCAR: An Efficient Bug-Finding Tool Based On Approximate Reachability. In *Proceedings of Computer Aided Verification (CAV)*, Oxford, United Kingdom, July 2018. Springer, Cham

C4 Rohit Dureja and Kristin Y. Rozier. More Scalable LTL Model Checking via Discovering Design-Space Dependencies (D^3). In *Proceedings of Tools and Algorithms for the Construction and Analysis of Systems (TACAS)"*, Thessaloniki, Greece, April 2018. Springer, Cham

C5 Rohit Dureja and Kristin Y. Rozier. FuseIC3: An Algorithm for Checking Large Design Spaces. In *Proceedings of Formal Methods in Computer-Aided Design (FMCAD)*, Vienna, Austria, October 2017. IEEE/ACM. Talk video: `https://goo.gl/Gs92G2`

Journals

J6 Rohit Dureja and Kristin Y. Rozier. Incremental Design-Space Model Checking via Resuable Reachable State Approximations. *(under submission)*

J7 Rohit Dureja and Kristin Y. Rozier. A Case Study in Safety, Security, and Availability of Wireless-Enabled Aircraft Communication Networks. *(under submission)*

J8 Dhananjay V. Gadre and Rohit Dureja. An Inexpensive Approach to Integrate Physical Computing Curriculum in the Classroom. *(in preparation)*

Patents

P9 Rohit Dureja, Jason Baumgartner, Alexander Ivrii, and Robert Kanzelman. *Grouping and Partitioning of Properties for Logic Verification*. U.S. Patent Application 16/411193 *(Pending)*

Miscellaneous

M10 Rohit Dureja and Kristin Y. Rozier. From One to Many: Checking A Set of Models. In *Formal Methods in Computer-Aided Design (FMCAD) Student Forum*, Austria, Vienna, October 2017

M11 Rohit Dureja, Eric W. D. Rozier, and Kristin Y. Rozier. A Case Study in Safety, Security, and Availability of Wireless-Enabled Aircraft Communication Networks. In *Proceedings of AIAA Aviation Technology, Integration, and Operations Conference (AVIATION)*, Denver, Colorado, USA, June 2017. AIAA

M12 Rohit Dureja and Kristin Y. Rozier. Comparative Safety Analysis of Wireless Communication Networks in Avionics. In *Formal Methods in Computer-Aided Design (FMCAD) Student Forum*, Mountain View, California, USA, October 2016

Books and Book Chapters

B13 Dhananjay V. Gadre, Rohit Dureja, and Shanjit S. Jajmann. *Getting Started with Stellaris ARM Cortex-M Embedded Processors*. Universities Press, 2013

Technical Presentations

- "Grouping and Partitioning of Properties for Formal Verification", IBM, Austin, TX, May 7, 2019.
- "Formal Verification of Designs with Multiple Properties", IBM, Austin, TX, December 19, 2018.
- "Theoretical Foundations of the UAS in the NAS Problem." *Lightning Talk*, NSF CPS PI Meeting, Washington, DC, November 15, 2018.
- "Applied Formal Methods - Design-Space Analysis via SAT-based Model Checking." *Guest Lecture*, COMS 512 - Formal Methods in Software Engineering, Iowa State University, Ames, IA, February 20–22, 2018.
- "Scalable Design Space Analysis for Future Traffic Management." CPS Challenges for Unmanned and Autonomous Systems Workshop, Washington, DC, November 14, 2017.
- "Making Undecidable Problems Decidable in Practice." Software Engineering Seminar, Department of Computer Science, Iowa State University, Ames, IA, October 12, 2017.

Selected Course Projects

- *UAV Security Exploit.* Designed a one-click man-in-the-middle (MITM) attack with ARP poisoning to acquire unauthenticated control of a drone.
- *Modeling and Verification of a Pacemaker.* Modeled a pacemaker using UPPAAL and synthesized code to run on a 32-bit ARM microcontroller.
- *Veterinary Patient Records.* Gathered requirements for a patient record system; culminated in a complete requirements specification document, and a prototype.
- *Network Sniffer.* Designed a powerful network packet sniffer capable of collecting socket-connection information and data, SMTP messages and profile connections.
- *Viral Marketing.* Experimentally evaluated the correlation between social network and spread of influence models to maximize information spread.
- *US Presidential Elections.* Designed a predictor model to predict popular vote and electoral college winner of 2016 US presidential elections.

Skills

Languages & Software: C/C++, Python, LaTeX, Matlab.
Technologies: Git, CMake, HTML/CSS, SQL, MongoDB.

Professional Service

Artifact Evaluation Committee:

- Tools and Algorithms for Construction and Analysis of Systems (TACAS) 2018

Conference Review:

- Quantitative Evaluation of SysTems (QEST) 2019
- International Conference on Cyber-Physical Systems (ICCPS) 2019
- Design, Automation, and Test in Europe (DATE) Conference 2019
- NASA Formal Methods Symposium (NFM) 2019, 2018, 2016
- Tools and Algorithms for Construction and Analysis of Systems (TACAS) 2018, 2017

Journal Review:

- Innovations in Systems and Software Engineering (ISSE)
- Journal of Aerospace Information Systems (JAIS)

External Training

- Marktoberdorf School on Dependable Software Systems Engineering, 2016.
- SRI International Sixth Summer School on Formal Techniques, 2016
- RiSE & LogiCS Spring School on Logic and Verification, 2016

Awards and Honors

- National Science Foundation travel grant to Verification Mentoring Workshop (VMW) and Computer Aided Verification (CAV) Conference 2016, 2018.
- Travel grant to Formal Methods in Computer Aided Design (FMCAD) Conference 2016, 2017.
- Travel grant and registration waiver to Marktoberdorf School.
- Carnegie Mellon University travel grant to CPS V&V Workshop 2016.
- National Science Foundation travel grant to CPS Week 2016.
- *Best Design* and *Top 10 hack* at HackPrinceton 2013.
- University of Delhi academic scholarship, 2009–2013.