Josh Wallin
Curriculum Vitæ

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Research Interests

Runtime verification for safety-critical systems
Reuse techniques & feature tracking for product lines of safety-critical systems
Formalization of software requirements in logic as a tool to improve project efficiency
Formal Methods for specifying, verifying, and validating safety-critical systems
Benchmark generation techniques for evaluating and validating runtime monitors of safety-critical systems

Education

2019 **Northeastern University (In Progress)** Ph.D. in Computer Science
Advisor: *Pete Manolios*

2019 **Iowa State University** B.S. in Computer Engineering and Spanish
GPA: 3.60/4.00
Honors Thesis: *Benchmark Generation for Mission-Time LTL Properties via SAT and SMT*

2018 **Universidad Carlos III de Madrid** Exchange Student (Spring)
Courses/Cursos:
Literatura Contemporánea de Hispanoamérica, Historia Contemporánea de España (Humanidades, Getafe Campus); Teoría Avanzada de la Computación, Artificial Intelligence (Ingeniería, Leganes Campus)

Research Publications

Josh Wallin and Kristin Rozier. "Herra: A Prototype Tool for Online Runtime Verification Benchmark Generation", 4th International Runtime Verification Competition, November 2018.
To Appear. **(Received first prize in MTL Category)**

Abdullah Alnaqeb, Yifei Li, Yu-Hui Lui, Priyank Pradeep, Joshua Wallin, Chao Hu, Shan Hu, and Peng Wei. "Real-time Prediction of Battery Power Supply and Estimation of Future Power Demand for Electrical Rotorcraft", 2018 AIAA Aerospace Sciences Meeting, AIAA SciTech Forum.

Technical Presentations

Poster: "Benchmark Generation for Mission-Time LTL Properties via SAT and SMT", Honors Poster Session, Iowa State University, 2019

"Generating System-Agnostic Runtime Verification Benchmarks from MLTL Formulas", The Tenth Midwest Verification Day(s) Workshop, 2018

"Formal Methods and Requirements Writing", ES51, Space Launch System Requirements Team, NASA Marshall Space Flight Center, 2017

Poster: "Testing, Evaluation, and Integration of a Data Analysis Tool for ES51", Intern Poster Session, NASA Marshall Space Flight Center, 2017

Employment

09/19 - Present **Graduate Student Research Assistant, Formal Methods Group**
Khoury College of Computer Sciences, Northeastern University, Boston, MA
• Explore techniques for training neural networks to perform symbolic regression using PyTorch and Keras libraries

- Study and report on current techniques in artificial intelligence to support formal verification
- Model systems and algorithms using the ACL2s theorem prover for rigorous proofs

06/18 - 09/19 **Engineering Intern, Trusted Systems Group (Advanced Technology Center)**
Collins Aerospace (Rockwell Collins), Cedar Rapids, Iowa
- Develop models and mathematical proofs of system properties for distributed drone surveillance algorithms
- Update and maintain an internal tool for formal verification and test generation of flight control system logic using the JKind model checker and various backend SMT solvers
- Transition stable tool to Rockwell Collins flight control systems development team, with support for learning and tool change requests

08/17 - 05/19 **Research Assistant to Dr. Kristin Rozier, Laboratory for Temporal Logic**
Department of Aerospace Engineering, Iowa State University, Ames, Iowa
Funded Partially via NASA Iowa Space Grant Consortium Research Grant (Fall 2017)
- Study, develop, and implement algorithmic methods for automatic generation of benchmarks for runtime monitors in verification (R2U2)
- Test and modify existing autopilot software for unmanned aerial systems using techniques including model checking and simulation (OpenUAS)
- Evaluate and select relevant hardware components and open-source software for use onboard unmanned aircraft (OpenUAS)

05/17 - 08/17 **Engineering Intern, ES51 - Software Systems Engineering Branch**
NASA Marshall Space Flight Center, Huntsville, Alabama
Funded via NASA Iowa Space Grant Consortium Intern Award (Summer 2017)
- Conceived and presented pilot project on the use of lightweight formal methods by software requirements and design teams
- Tested and evaluated a data analysis tool for the automatic verification of correct software behavior
- Supported team members on a variety of tasks for the conception and implementation of flight software tests for NASA Space Launch System (SLS)

08/16 - 05/19 **Teaching Assistant, CPR E 185 - Introduction to Problem Solving in C**
Department of Electrical and Computer Engineering, Iowa State University, Ames, Iowa
- Lead weekly lab sections, with hardware demonstrations, for first-year computer engineering students
- Grade and provide feedback on programming assignments focusing on lecture material
- Hold office hours to assist students in learning course material and completing lab activities

06/16 - 05/19 **Research Assistant to Dr. Robyn Lutz, Laboratory for Molecular Programming**
Department of Computer Science, Iowa State University, Ames, Iowa
- Develop a case study showing the use of family-oriented design methods in safety-critical software product line development for the broader research community
- Model relevant systems using formal verification tools, such as OSATE and AGREE, with an emphasis on automated analysis
- Produce design artifacts for various stages and components of the target safety-critical product line

05/16 - 07/16, **Research Assistant to Dr. Peng Wei, Intelligent Aerospace Systems Laboratory**
08/17 - 11/17 Department of Aerospace Engineering, Iowa State University, Ames, Iowa
- Created a tool for tracking Unmanned Aerial Systems (UAS) in real time using Apache and Android SDK
- Used custom tool to collect data for analysis and validation of UAS power-use model
- Assisted graduate student and professor in research leading to conference publication

02/16 - 05/16 **Tutor, Academic Success Center, Iowa State University, Ames, Iowa**
- Facilitated small group sessions on lecture and homework material
- Prepared lessons, exam reviews and activities to reinforce tutee learning
- Maintained communication with students about tutoring policies and campus resources

Awards and Honors

Northeastern Graduate Student Fellowship, Northeastern University, 2019
NASA Iowa Space Grant Consortium Scholarship, OpenUAS project under Dr. Kristin Rozier, 2017
NASA Iowa Space Grant Consortium Stipend, Internship at Marshall Space Flight Center, 2017
Roderick Seward, Flossie Ratcliffe & Helen M. Galloway Scholarship, Iowa State University, 2016
President's Award for Competitive Excellence, Iowa State University, 2015-2019
Cardinal Leadership Scholar Award, Iowa State University, 2015-2019

Research Projects

08/2018 - 05/2019   **R2U2: Intelligent Hardware-Enabled Sensor and Software Safety and Health Management for Autonomous UAS**
NASA Grant NNX16AR57G (Supervising PI: Dr. Kristin Yvonne Rozier)

05/2017 - 05/2019   **OpenUAS, Designing an open source UAS using COTS components**
NSF Grant #1552934 (Supervising PI: Dr. Kristin Yvonne Rozier)

06/2016 - 05/2019   **Advanced Traceability for Composing Product Line Safety Cases**
NSF Grant #1513717 (Supervising PI: Dr. Robyn Lutz)

08/2017 - 11/2017   **Real-time prediction of battery power supply and estimation of future power demand for electrical rotorcraft**
NSF Grant #1718420 (Supervising PI: Dr. Peng Wei)

02/2017 - 06/2017   **Developing a mathematical model for multi-conformational DNA origami**
NSF Grant #1247051 (Supervising Co-PI: Dr. Eric Henderson)

01/2016 - 07/2016   **Towards an Intelligent Low-Altitude UAS Traffic Management System**
NSF Grant #1565979 (Supervising PI: Dr. Peng Wei)

Professional Service

Volunteer, NASA Day in the Park, 2017. Taught members of Huntsville community about eclipse safety.

Extracurricular Activities

Tau Beta Sigma Honors Band Sorority
Treasurer (Spring 2016 - Spring 2017), Member (Spring 2016 - Fall 2018)
Iowa State University Women's Basketball Pep Band
Member (Fall 2015 - Spring 2017)
Iowa State University Marching Band
Section Leader (Spring 2017 - Spring 2018), Member (Fall 2015 - Spring 2018)
Iowa State Engineering Ambassadors and Mentors Program (TEAM)
Ambassador (Fall 2015 - Spring 2018). Provided tours for prospective students.
Iowa State University Honors Program
Member (Fall 2015 - Spring 2019)