Robert L. Reed

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Education

University of Colorado Boulder Boulder, CO

Ph.D. in Aerospace Engineering (In Progress) expected Aug 2026

Master of Science in Aerospace Engineering May 2024

- Thesis Statement: Machine learning techniques can be utilized to enable the formal verification and control of high-dimensional systems that act under complex and unknown dynamics
- Committee: Morteza Lahijanian (Advisor), Alireza Doostan, Zachary Sunburg, Sriram Sankaranarayanan, Georgios Fainekos, Luca Laurenti

Massachusetts Institute of Technology Cambridge, MA

Bachelor of Science in Aerospace Engineering June 2018

Peer-Reviewed Publications

Learning-Based Shielding for Safe Autonomy under Unknown Dynamics

American Control Conference 2025

DOI: 10.23919/ACC63710.2025.11108000

- Expanded shielding guarantees to continuous-state systems by generating a shield on a learned finite-state model that is guaranteed to capture the behaviors of the true continuous state system

Error Bounds for Gaussian Process Regression Under Bounded Support Noise with Applications to Safety Certification

Association for the Advancement of Artificial Intelligence 2025

DOI: https://doi.org/10.1609/aaai.v39i19.34220

- Derived novel error bounds on the predictions of a Gaussian Process Model learned from a dataset with non-Gaussian noise and defined how to use these error bounds to provide safety guarantees through Stochastic Barrier Functions

The Promises of Deep Kernel Learning for Control Synthesis

IEEE Control Systems Letters 2024

DOI: 10.1109/LCSYS.2023.3340995

- Utilized Deep Kernel Learning for a data-driven control synthesis framework based on abstraction techniques to provide hard guarantees on the satisfaction of tasks and safety while enabling efficiency and scalability

Shielded Deep Reinforcement Learning for Complex Spacecraft Specifications

American Control Conference 2024

DOI: 10.23919/ACC60939.2024.10644855

- Defined how to automatically construct reward functions from formal specifications for Earth imaging tasking while also providing safety guarantees during deployment through shields constructed on an empirical, data-driven, finite-state model of the system

Google Scholar: https://scholar.google.com/citations?user=rs1YtXsAAAAJ&hl=en

Work Experience

University of Colorado Boulder Boulder, CO

Graduate Researcher Sept 2021 – Present

ARIA Systems Group, https://ariasystems.group/

- Develop and implement Deep Kernel Learning architectures in PyTorch, combining neural network feature extraction with Gaussian Process rigorous uncertainty quantification
- Conduct research in data-driven formal reasoning under uncertainty, demonstrating scalability through machine learning techniques like autoencoders and kernel methods
- Construct shielded deep reinforcement learning agents and incorporate formal methods in reinforcement learning, specifically as applied to space craft control

Johns Hopkins University Applied Physics Lab (APL) Laurel, MD

Associate Professional Staff Jan 2019- June 2021

Tactical Boost Glide (TBG), Operational Fires (OpFires), High Speed Strike Weapon (HSSW)

- Worked with C++ based 6DOF simulations, incorporating a multi-stage booster model, a thrust vector control algorithm, and guidance algorithms
- Evaluated the robustness of autopilot designs and guidance algorithms through classical margin analysis and empirical analysis
- Acted as GNC technical lead for an interdisciplinary, multi-organization project and the main point of contact for government sponsors on GNC related questions

Massachusetts Institute of Technology Cambridge, MA

Teaching Assistant 2015-2018

- Hosted weekly office hours, graded assignments, and proctored exams for the freshman level Mechanics and Electromagnetism courses

Undergraduate Researcher June 2017-Sept 2017

- Designed and manufactured sublimation sensors for electrospray thrusters to determine when they were safe to fire

Skills

Languages: Python, Julia, MATLAB, C++

ML and Statistical Methods: Gaussian Process Regression, Deep Kernel Learning, Reinforcement Learning, Autoencoders, Kernel Methods

Frameworks and Tools: PyTorch, GPyTorch, Scikit-learn, Docker, ROS, Simulink

Formal Methods and Control: Formal Verification, Optimization, Classical Control, Robust Control