

Ali Baheri

Curriculum Vitae

Research Interests

Theory	Reinforcement learning, Bayesian optimization, machine learning, decision making under uncertainty
Application areas	Autonomous systems, robotics, energy systems

Position

2023–onward	Assistant Professor (tenure-track) , <i>Rochester Institute of Technology</i>
2022–2023	Visiting Scholar , <i>Stanford University</i>
2019–2022	Assistant Professor (research-track) , <i>West Virginia University</i>
2018–2019	Postdoctoral Fellow , <i>University of Michigan Ann Arbor</i>

Education

2015–2018	Ph.D. , <i>University of North Carolina at Charlotte</i> Specialized in machine learning and control theory
2012–2014	M.S. , <i>University of Louisiana at Lafayette</i> Specialized in Mechanical Engineering - systems, dynamics, and control
2002–2006	B.S. , <i>Sharif University of Technology</i> Specialized in Mechanical Engineering - solid design

Honors and Awards

2023	AAAI-23 New Faculty Highlights
2022	National Science Foundation EPSCoR Fellowship
2018	Ford Motor Company Postdoctoral Fellowship
2018	SigOpt Inc. Graduate Research Fellowship

Research Funding

2022-2024	RII Track-4: NSF: Safety Validation of Autonomous Systems from Multiple Sources of Information , NSF- \approx \$200K, Single PI
2021-2023	Safety Verification Framework for Learning-based Aviation Systems (SVF-LAS) , <i>Federal Aviation Administration</i> - \$400K, Lead PI
2021-2022	Fault Diagnosis for Safety-Critical Autonomous Systems using Reinforcement Learning , NASA- \$100K, Lead PI
2021-2022	Black-Box Verification of Autonomous Systems Using Modular Reinforcement Learning , NASA WV Space Grant Consortium- \approx \$30K, Single PI

- 2021-2022 **Verification of Multi-Agent Autonomous Planning and Control**, *West Virginia University Research Office Program-* $\approx \$25K$, Single PI
- 2020-2021 **Robust Autonomy Through Experimentally Infused Decision Making with the Application to Planetary Mars Rover**, *NASA WV Space Grant Consortium-* $\approx \$23K$, Single PI

Internal Funding

- 2024 **HARMONY: Hierarchical Anchored Representation for Multidomain Operability in Next-gen Systems**, *Rochester Institute of Technology Research Office-* $\$5K$, Single PI
- 2021-2022 **Verification of Multi-Agent Autonomous Planning and Control**, *West Virginia University Research Office Program-* $\approx \$25K$, Single PI

Publications

Journal Publications

- [J11] K. Hayes, M. Fouts, **Ali Baheri**, D. Mebane, Forward Variable Selection Enables Fast and Accurate Dynamic System Identification with Karhunen-Loève Decomposed Gaussian Processes. *PLOS ONE*, 2024.
- [J10] J. Yancosek, **Ali Baheri**, BEACON: A Bayesian Evolutionary Approach for Counterexample Generation of Control Systems. *IEEE ACCESS*, 2024.
- [J9] P. Razzaghi, A. Tabrizian, W. Guo, S. Chen, A. Taye, E. Thompson, A. Bregeon, **Ali Baheri**, P. Wei, A survey on reinforcement learning in aviation applications. *Engineering Applications of Artificial Intelligence*, Vol. 135, 2024.
- [J8] L. Yifru, **Ali Baheri**, Concurrent Learning of Control Policy and Unknown Safety Specifications in Reinforcement Learning. *IEEE Open Journal of Control Systems*, Vol. 3, pp. 266-281, 2024.
- [J7] **Ali Baheri**, Exploring the role of simulator fidelity in the safety validation of learning-enabled autonomous systems. *AI Magazine*, Vol. 44, pp. 453-459, 2023.
- [J6] **Ali Baheri**, Safe Reinforcement Learning with Mixture Density Network, with Application to Autonomous Driving. *Results in Control and Optimization*, Vol. 6, 2022.
- [J5] **Ali Baheri**, C. Vermillion, Combined Plant and Controller Design Using Batch Bayesian Optimization: A Case Study in Airborne Wind Energy Systems. *ASME Journal of Dynamics, Measurement, and Control*, Vol. 141, Issue 9, 2019.
- [J4] S. Bin-Karim, A. Bafandeh, **Ali Baheri**, and C. Vermillion, Spatiotemporal Optimization Through Gaussian Process Based Model Predictive Control: Case Study in Airborne Wind Energy. *IEEE Transactions on Control Systems Technology*, Vol. 27, Issue 2, pp. 798-805, 2019.
- [J3] **Ali Baheri**, P. Ramaprabhu, and C. Vermillion, Iterative 3D Layout Optimization and Parametric Trade Study for a Reconfigurable Ocean Current Turbine Array Using Bayesian Optimization. *Renewable Energy*, Vol. 127, pp. 1052-1063, 2018.
- [J2] A. Bafandeh, S. Bin-Karim, **Ali Baheri**, and C. Vermillion, A Comparative Assessment of Hierarchical Control Structures for Spatiotemporally Varying Systems, with Application to Airborne Wind Energy. *Control Engineering Practice*, Vol. 74, pp. 71-83, 2018.

- [J1] **Ali Baheri**, S. Bin-Karim, A. Bafandeh, and C. Vermillion, Real-Time Control Using Bayesian Optimization: A Case Study in Airborne Wind Energy Systems. *Control Engineering Practice*, Vol. 69, pp. 131-140, 2017.
- Journal Publication (Under Review)**
- [UR2] Z. Shahrooei, M. Kochenderfer, and **Ali Baheri**, Optimizing Falsification for Learning-Based Control Systems: A Multi-Fidelity Bayesian Approach. 2024 (under revision)
- Conference and Workshop Publications**
- [C21] Z. Shahrooei, **Ali Baheri**, Optimal Transport-Assisted Risk-Sensitive Q-Learning. *Towards Safe Autonomy: Emerging Requirements, Definitions, and Methods* workshop, RSS 2024.
- [C20] **Ali Baheri**, C. Alm, LLMs-Augmented Contextual Bandit. *Optimal Transport and Machine Learning* workshop, NeurIPS 2023.
- [C19] **Ali Baheri**, Understanding Reward Ambiguity Through Optimal Transport Theory in Inverse Reinforcement Learning. *Optimal Transport and Machine Learning* workshop, NeurIPS 2023.
- [C18] **Ali Baheri**, Risk-Aware Reinforcement Learning Through Optimal Transport Theory. *3rd RL-CONFORM* workshop, IROS 2023.
- [C17] **Ali Baheri**, Safety validation of learning-based autonomous systems: a multi-fidelity approach. *Proceedings of the AAAI Conference on Artificial Intelligence*, Vol. 37, Issue 13, pp. 15432-15432, 2023.
- [C16] **Ali Baheri**, Policy Refinement with Human Feedback for Safe Reinforcement Learning. *RL Workshop Series Bridging the Gap Between AI Planning and Reinforcement Learning*, ICAPS 2023
- [C15] L. Yifru, **Ali Baheri**, Joint Learning of Policy with Unknown Temporal Constraints for Safe Reinforcement Learning. *PRL Workshop Series Bridging the Gap Between AI Planning and Reinforcement Learning*, ICAPS 2023.
- [C14] Z. Shahrooei, M. Kochenderfer, and **Ali Baheri**, Falsification of Learning-Based Controllers through Multi-Fidelity Bayesian Optimization. *In European Control Conference*, Bucharest, Romania, 2023.
- [C13] **Ali Baheri**, H. Ren, B. Johnson, P. Razzaghi, and P. Wei, A Verification Framework for Certifying Learning-based Safety-Critical Aviation Systems. *In AIAA*, Chicago, IL, 2022.
- [C12] **Ali Baheri**, Safe Reinforcement Learning with Mixture Density Network: A Case Study in Autonomous Highway Driving. *In Robotics: Science and Systems*, Corvallis, OR, 2020.
- [C11] **Ali Baheri**, S. Nageshrao, I. Kolmanovsky, A. Girard, E. Tseng, and D. Filev, Deep Reinforcement Learning with Enhanced Safety for Autonomous Highway Driving. *In 31st IEEE Intelligent Vehicles Symposium*, Las Vegas, NV, 2020.
- [C10] **Ali Baheri**, I. Kolmanovsky, A. Girard, E. Tseng, and D. Filev, Vision-Based Autonomous Driving: A Model Learning Approach. *In American Control Conference*, Denver, CO, 2020.
- [C9] **Ali Baheri**, C. Vermillion, Waypoint Optimization Using Bayesian Optimization: A Case Study in Airborne Wind Energy Systems. *In American Control Conference*, Denver, CO, 2020.
- [C8] **Ali Baheri**, S. Nageshrao, I. Kolmanovsky, A. Girard, E. Tseng, and D. Filev, Deep Q-Learning with Dynamically-Learned Safety Module: A Case Study in Autonomous Driving. *In Neural Information Processing Systems*, Vancouver, Canada, 2019.

- [C7] **Ali Baheri**, C. Vermillion, Context-Dependent Bayesian Optimization in Real-Time Optimal Control: A Case Study in Airborne Wind Energy Systems. *In Neural Information Processing System, NIPS Workshop on Bayesian Optimization*, Long Beach, CA, 2017.
- [C6] **Ali Baheri**, J. Deese, and C. Vermillion, Combined Plant and Controller Design Using Bayesian Optimization: A Case Study in Airborne Wind Energy Systems. *In ASME Dynamic Systems and Control Conference*, Tysons Corner, VA, 2017.
- [C5] **Ali Baheri**, P. Ramaprabhu, and C. Vermillion, Iterative In-Situ 3D Layout Optimization of a Reconfigurable Ocean Current Turbine Array Using Bayesian Optimization. *In ASME Dynamic Systems and Control Conference*, Tysons Corner, VA, 2017.
- [C4] **Ali Baheri**, C. Vermillion, Altitude Optimization of Airborne Wind Energy Systems: A Bayesian Optimization Approach. *In American Control Conference*, Seattle, WA, 2017.
- [C3] **Ali Baheri**, J. Vaughan, Concurrent Design of Unity-Magnitude Input Shapers and Proportional-Derivative Feedback Controllers. *In American Control Conference*, Chicago, IL, 2015.
- [C2] **Ali Baheri**, J. Vaughan, Robust Concurrent Design of Input and Proportional-Derivative Feedback Controllers. *In International Symposium on Flexible Automation*, Awaji-Island, Japan, 2014.
- [C1] **Ali Baheri**, J. Vaughan, Concurrent Command and Mechanical System Design to Limit Transient and Residual Vibration. *In International Conference on Motion and Vibration Control*, Sapporo, Japan, 2014.

Non-Peer-Reviewed Publications

- [NPR3] **Ali Baheri**, M. Kochenderfer, The Synergy Between Optimal Transport Theory and Multi-Agent Reinforcement Learning, 2024. <https://arxiv.org/abs/2401.10949>
- [NPR2] **Ali Baheri**, M.Kochenderfer, Joint Falsification and Fidelity Settings Optimization for Validation of Safety-Critical Systems: A Theoretical Analysis, 2023. <https://arxiv.org/abs/2305.06111>
- [NPR1] S. Jacobs, R. Butts, **Ali Baheri**, Y. Gu, and G. Pereira, A Framework for Controlling Multi-Robot Systems Using Bayesian Optimization and Linear Combination of Vectors, 2022. <https://arxiv.org/abs/2203.12416>

Invited Talk and Presentations

- Mar 2024 Evolving AI Decision-Making: From Safe Reinforcement Learning to Intelligent Systems with Language Models, RIT Center for Human-aware AI (CHAI) Seminar
- Feb 2023 On the Role of Fidelity in the Safety Evaluation of Learning-Based Autonomous Systems, RIT Graduate Seminar
- Feb 2023 On the Role of Fidelity in the Safety Evaluation of Learning-Based Autonomous Systems, AAAI-23 New Faculty Highlights Program
- May 2022 Safety Verification of Autonomous Systems: a Multi-Fidelity Reinforcement Learning Approach, ICRA 2022 Workshop on the Verification of Autonomous Systems (VAS)
- Apr 2022 Safe Decision Making in Evolving Environments for Safety-Critical Autonomous Systems, The University of North Texas
- Mar 2022 Lessons from Safe Learning and Safety Validation Research for Autonomous Systems in the Wild, Rochester Institute of Technology

Aug 2020 Safety Learning in Autonomous Driving, Ford Motor Company
 Feb 2020 Safe and Human-like Decision Making for Autonomous Systems, University of New Mexico
 Nov 2018 Guest Invited Lecture, Deep Reinforcement Learning, University of North Carolina at Charlotte
 Oct 2017 ASME Dynamic Systems and Control Conference
 May 2017 American Control Conference
 July 2015 American Control Conference

Teaching Experience

- [T4] Developed new graduate level course entitled **Understanding Reinforcement Learning**, Fall 2024
- [T3] MECE: **System Dynamics** (RIT), Spring 2024 (class size: 19, SEI: 4.4/5.0)
- [T2] Developed and taught new graduate level course entitled **Reinforcement Learning and Control** (WVU), Spring 2021 (class size: 18, SEI: 4.6/5.0)
- [T1] MAE 460: **Automatic Control** (WVU), Summer 2021, 2022 (class size: 45, SEI: 4.7/5.0)

Professional Services

- Panel National Science Foundation: DCSD, 2021, 2023, 2024 (twice)
- Panel National Science Foundation: CPS, 2022
- Panel National Science Foundation: SLES, 2023 (twice)
- Panel National Science Foundation: FMITF, 2024
- Panel National Science Foundation: SBIR/STTR, 2024
- Program Committee “Foundation Models for Decision Making workshop at NeurIPS” 2023, 2024
- 2023-present Senior Personnel “NSF AWARE-AI NRT” at RIT (Co-lead the Software track)
- Served as a mentor for NSF REU Site at WVU Summer 2021, Summer 2022
- Co-organize “Machine Learning for Autonomous Driving (ML4AD) workshop at NeurIPS” 2021, 2022
- Co-organize “Fault Diagnosis for Safety-Critical Autonomous Spacecraft Systems” workshop, 1st Meeting of the Mid-Atlantic Space Grant Data Science Consortium funded by NASA
- Co-organize “Robotics Seminar Series” at West Virginia University

Reviewer Services

IEEE Transactions on Intelligent Vehicles
 IEEE Transactions on Vehicular Technology
 Sustainable Energy Technologies and Assessments
 IEEE Aerospace and Electronic Systems
 Journal of Aerospace Information Systems
 IEEE Robotics and Automation Letters
 Energies
 IEEE Transactions on Vehicular Technology

International Conference on Intelligent Robots and Systems (IROS)
Robotics: Science and Systems (RSS)
Conference on Decision and Control (CDC)
American Control Conference (ACC)
European Control Conference (ECC)
ASME Dynamic Systems and Control Conference
IEEE Intelligent Vehicles Symposium (IV)
IEEE International Conference on Intelligent Transportation Systems

Advising Experience

2024-present Chirayu Salgarkar, Ph.D. Student
2023-present Zahra Shahrooei, Ph.D. Student
2021-2024 Lunet Yifru, M.S. Student
2021-2024 Joshua Yancosek, M.S. Student
2023-2024 Aniket Narendra Patil, M.S. Student (Co-advised with Prof. Cecilia Alm)
2023-2024 Kaustubh Gaikwad, M.S. Student (Co-advised with Prof. Cecilia Alm)

Ph.D. Thesis Committe Member

2023 Rogerio Rodrigues Lima, West Virginia University
2022 Robert Tempke, West Virginia University
2021 Jared Strader, West Virginia University

Memberships

2024-present ASME Member
2023-present IEEE Member