# JAKE GONZALES

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## RESEARCH INTERESTS

My research lies at the intersection of control theory, machine learning, optimization, uncertainty quantification, and game theory, with a specific focus on decision-making in multi-agent systems. I am particularly interested in developing theoretical frameworks and principled algorithms that enable AI systems to reason about uncertainties, interact safely with other agents, and adapt effectively in dynamic, open-world environments.

## EDUCATION

**University of Washington** Sept. 2023 – Present
*Ph.D., Electrical Engineering* Seattle, WA
Advisors: Prof. Lillian Ratliff and Prof. Behçet Açıkmeşe
Collaborate closely with: Prof. Karen Leung

**University of New Mexico** Aug. 2019 – May 2023
*Bachelor of Science in Electrical Engineering* Albuquerque, NM
Advisor: Prof. Meeko Oishi

## HONORS AND AWARDS

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| NSF Graduate Research Fellowship | 2025 |
| Invited to the first ever AI Startup School conference | 2025 |
| Amazon Ph.D. Fellowship, UW Amazon Science Hub [announcement] | 2024 - 2025 |
| Amazon Robotics Elevate Fellowship Funds ($10,000 award) | 2024 |
| GEM Ph.D. Fellowship | 2023 |
| Department of Defense (DoD) Secret Security Clearance | 2023 |
| Department of Energy (DOE) Top Secret (Q) Security Clearance | 2021 |
| Hispanic Scholarship Fund (HSF) Scholar | 2021, 2022 |
| UNM Dean's List | 2021, 2023 |

## PUBLICATIONS

1. **Jake Gonzales**, Max Horwitz, Eric Mazumdar, Lillian Ratliff. "Finite-Sample Guarantees for Risk Sensitive Multi-Agent Q-learning with Linear Function Approximation," *The Conference on Uncertainty in Artificial Intelligence (UAI)*, (in preparation to be submitted), 2026.

2. **Jake Gonzales**, Kazuki Mizuta, Karen Leung*, Lillian Ratliff*. "Safe Probabilistic Planning for Human-Robot Interaction using Conformal Risk Control," *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, 2025, [Project Website]

3. Oswin So, Zachary Serlin, Makai Mann, **Jake Gonzales**, Kwesi Rutledge, Nicholas Roy, Chuchu Fan. "How to Train Your Neural Control Barrier Function: Learning Safety Filters for Complex Input-Constrained Systems," *IEEE International Conference on Robotics and Automation (ICRA)*, 2024, [Paper Link]

4. Adam J. Thorpe, **Jake A. Gonzales**, Meeko MK Oishi. "Data-Driven Stochastic Optimal Control Using Kernel Gradients," *American Control Conference (ACC)*, 2023, [Paper Link]

5. Sofie W. Schunk, Shane McMurray, **Jake A. Gonzales**. "Advancing Model Credibility for Linked Multi-Physics Surrogate Models within a Coupled Digital Engineering Workflow of Nuclear Deterrence Systems," *Model Validation and Uncertainty Quantification, Proceedings of the 41st IMAC*, 2023, [Paper Link]

6. Kelsey Wilson, Ruby Ta, **Jake Gonzales**, Seethamble S. Mani, Casey Noll, Wesley Krueger, William Gruner, Timothy Wisley. "Visualization of Model-based Systems Engineering Datasets in an Interactive 3D Game Engine," *Western States Regional Conference INCOSE*, Sept. 2022.

## Research Experience

**PhD Researcher** Sept. 2023 – Present
*University of Washington* Seattle, WA

- Research in risk-averse decision-making in multi-agent reinforcement learning using convex risk measures for robust generalization to out of distribution situations and new opponents in games.
- Developing principled methods for robust preference optimization for alignment of LLMs using game-theoretic techniques.
- Developing novel techniques for uncertainty quantification in embodied AI systems using conformal risk control.

**Undergraduate Researcher** Aug. 2021 – May 2023
*University of New Mexico* Albuquerque, NM

- Research in non-parametric methods for approximating solutions to stochastic optimal control problems using the theory of kernel embeddings of distributions resulting in efficient controller synthesis for uncertain, nonlinear systems.
- Developed kernel gradient-based optimization algorithms for refining solutions to stochastic optimal control problems.

**Undergraduate Researcher** Aug. 2022
*Stanford University* Palo Alto, CA

- Short summer research program working with the Autonomous Systems Lab under Prof. Marco Pavone.
- Developed deep learning models for perception-based autonomous navigation through a hand-made driving course.

## Work Experience

**Amazon Robotics** June 2025 – Sept. 2025
*Applied Scientist II Intern* North Reading, MA

- Research and development in enabling uncertainty quantification for safe and reliable human detection systems.
- Developed generative models trained on real-world data for out-of-distribution detection and system robustness.
- Deployed models on real-world hardware systems, demonstrating capabilities to company leadership.

**MIT Lincoln Laboratories** June 2023 – Sept. 2023
*Research Intern* Boston, MA

- Developed algorithms for safe multi-agent control of nonlinear, high-dimensional systems with input constraints using neural control barrier functions.

**Sandia National Laboratories** March 2021 – July 2023
*Undergrad Year-Round Intern* Albuquerque, NM

- Worked on challenging problems related to the advancement of digital engineering for nuclear deterrence applications.
- Developed reduced-order multi-physics models of subcomponents of nuclear deterrence systems.
- Applied Sobol' sensitivity analysis to complex, nonlinear physical systems for uncertainty quantification.
- Built interactive VR environments that integrated various datasets for decision-makers to become experts on ND models.

## Technical Presentations

- Decision-Theoretic Uncertainty Adaptation in Multi-Agent Systems: Algorithms with Provable Guarantees
  *Qualifying Exam*, Committee: Sam Burden (chair), Maryam Fazel, and Karen Leung, May 2025. [Slides]
- Hierarchical Framework for Scalable Multi-Agent Autonomous Mobility
  *Lightning Talk at ECE Research Showcase*, University of Washington, March 2024. [Poster Link]
- Systems Engineering Leveraging a Commercial Gaming Platform
  *Western States Regional Conference INCOSE*, Denver, CO, Sept. 2022.
- Fusing of Model-Based Systems Engineering and Virtual Reality
  *Sandia National Labs' 4th Annual XR Conference*, virtual, July 2022.

## Teaching Experience

**EE 406 Teaching Engineering** Spring 2024
Teaching Assistant, University of Washington Seattle, WA

- Graded homework and class projects for 45+ students and delivered a demonstration on effective presentation techniques.

**ECE 238 Computer Logic Design** Spring, Fall 2022
Teaching Assistant, University of New Mexico Albuquerque, NM

- Led lab sessions for 50+ students per semester and delivered short lectures on course topics.

**ECE 101 Introduction to Electrical Engineering** Spring, Fall 2021
Teaching Assistant, University of New Mexico Albuquerque, NM

- Led remote lab sessions and assisted 50+ students per semester with homework during COVID-19.

## Professional Service

- Reviewer for ICRA, IROS, CoRL (SAFE-ROL workshop) 2025

## Relevant Coursework

$*$ indicates graduate-level courses

**Control Theory:** classical control theory, design of feedback control systems, linear systems theory$*$, linear multivariable control$*$, nonlinear control systems$*$

**Mathematics:** probability theory, advanced calculus$*$, convex optimization$*$, mathematical foundations of systems theory$*$, fundamental concepts in analysis*, advanced probability (measure-theoretic)*

**Learning and Robotics:** machine learning$*$, deep learning$*$, reinforcement learning$*$, autonomous mobile robots$*$, decision-making and control for safe interactive autonomy$*$

## Mentorship & Outreach

**Research Mentor**, University of Washington Fall 2025 - Present

- Max Horwtiz, UW ECE & Pure Math undergraduate.

**Research Mentor**, Tesla STEM High School Fall 2025 - Present

- Mentoring a high school student using control theory and AI for time-series prediction in financial markets.

**PhD Student Volunteer**, University of Washington Fall 2023, 2024, 2025

- Provided feedback to underrepresented prospective PhD students applying to UW ECE through a graduate application support program.

**PhD Student Member**, University of Washington Fall 2024 - Spring 2025

- Served an academic term on the UW ECE DEI advisory committee to provide input on faculty/staff searches and advocate for initiatives promoting department inclusion.

**Math Mentor**, Prison Mathematics Project 2023 - 2025

- Mentored an inmate rehabilitating himself through mathematics.

**Research Mentor**, Tesla STEM High School Fall 2023 - Spring 2024

- Mentored high school students using machine learning to model mercury pollution in aquatic ecosystems.

**Peer Mentor**, UNM Student Success Center Fall 2022 - Spring 2023

- Mentored five new undergrad engineering students from traditionally underrepresented groups to provide help and guidance with challenges of being a first-year engineering student.

**Chess Coach**, Learners Chess Academy 2021-2023

- Taught chess at local K-8 schools in Albuquerque, NM to 100+ students.

## TECHNICAL SKILLS

**Programming**: Python, C++, C
**Scientific Computing**: CVXPY, JAX, MATLAB/Simulink, NetworkX
**ML Frameworks/Libraries**: PyTorch, TensorFlow, scikit-learn
**Software & Tools**: ROS2, Unity, Gazebo, Docker, Arduino

## REFERENCES

**Prof. Lillian Ratliff**
Associate Professor
Department of Electrical and Computer Engineering
University of Washington
Email: ratliffl@uw.edu

**Prof. Karen Leung**
Assistant Professor
Department of Aeronautics and Astronautics
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