Jake Gonzales

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Research Interests

My research interests are broadly at the intersection of control theory, machine learning, optimization, and game theory for developing safe and scalable decision-making algorithms for large-scale mutli-agent systems.

Education

University of Washington Sept. 2023 – Present
Ph.D., Electrical Engineering Seattle, WA
Advisors: Prof. Behcet Acikmese and Prof. Lillian Ratliff

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

Publications

- **Jake Gonzales**, Joey Sullivan, Samuel Burden, Lillian Ratliff, Daniel Calderone. "Decomposition and Learning Congestion for Multi-Agent Path Finding and Task Assignment," (In Preperation), *ACC*, 2024.
- 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
- Adam J. Thorpe, **Jake A. Gonzales**, Meeko MK Oishi. "Data-Driven Stochastic Optimal Control Using Kernel Gradients," *American Control Conference (ACC)*, 2023, Paper Link
- 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, Volume 3, Proceedings of the 41st IMAC*, 2023, Paper Link
- Kelsey Wilson, Ruby Ta, **Jake Gonzales**, Seethamble S. Mani, Casey Noll, Wesley Krueger, William Gruner, Timothy Wisley. "Visualization of MBSE Datasets in an Interactive 3D Game Engine," *Western States Regional Conference INCOSE*, Sept. 2022.

Research Experience

Graduate Researcher Sept. 2023 – Present
University of Washington, *Advisors: Profs Lillian Ratliff and Behcet Acikmese* Seattle, WA

- Working with Prof. Lillian Ratliff on a project funded by the UW + Amazon Science Hub.
- Research in developing hierarchical decision-making framework for large-scale autonomous mobility
- Combining congestion-aware routing game models with low-level search algorithms for efficient path planning and task assignment in large-scale multi-agent planning problems.

Undergraduate Researcher Aug. 2021 – May 2023
University of New Mexico, *Advisor: Prof. Meeko Oishi* 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.
- Developed gradient-based optimization algorithms for solving data-driven stochastic optimal control problems.

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

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

Work Experience

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

- Developed algorithms for safe multi-agent control of nonlinear, high-dimensional quadrotor systems using neural control barrier functions.
- Deployed the algorithms into a simulated hardware experiment for a two-quadrotor system with a dynamic obstacle.

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.
- Performed Sobol' sensitivity analysis on complex, nonlinear physical systems for uncertainty quantification.
- Built interactive VR environments that integrated varying datasets for decision-makers to become experts on ND models.

Technical Presentations

- Presented: "Hierarchical Framework for Scalable Multi-Agent Autonomous Mobility," *Lightning Talk at ECE Research Showcase*, University of Washington, March 2024. Poster
- Co-Presented: "Systems Engineering Leveraging a Commercial Gaming Platform," *Western States Regional Conference INCOSE*, Denver, CO, Sept. 2022.
- Co-Presented: "Fusing of Model-Based Systems Engineering and Virtual Reality," *Sandia National Labs' 4th Annual XR Conference*, virtual, July 2022.

Honors and Awards

GEM Fellowship	2023
Department of Defense (DoD) Secret Security Clearance	2023
Four Nominations for Employee Recognition Award at Sandia National Labs	2022
Department of Energy (DOE) Top Secret (Q) Security Clearance	2021
Hispanic Scholarship Fund (HSF) Scholar	2021, 2022
UNM Dean's List	2021, 2023

Teaching Experience

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

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

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

Service & Mentoring

Research Mentor, Tesla High School 2023 - Present

- Mentoring HS students using ML to model mercury pollution in aquatic ecosystems.

Math Mentor, Prison Mathematics Project 2023 - Present

- Mentoring an inmate rehabilitating himself through mathematics.

Graduate Student Volunteer, University of Washington Fall 2023

- Provided feedback to underrepresented prospective PhD students applying to UW ECE.

Chess Coach, Learners Chess Academy 2021-2023

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

Technical Skills

Languages: Python(NumPy, pandas, Matplotlib), C++, C
ML Frameworks: PyTorch, Tensorflow, scikit-learn
Software: MATLAB/Simulink, ROS, Unity, Arduino