Everardo Gonzalez

Robotics PhD Student

everardog.github.io gonzaeve@oregonstate.edu

Summary

I am a Robotics PhD student at Oregon State University researching multiagent learning in Dr. Kagan Tumer's lab. My current research focuses on designing reward shaping techniques to apply multiagent learning to coordinating large swarms of robots. I am more broadly interested in bringing my robotics and machine learning background to improving the autonomy of underwater vehicles. This long term focus interests me because of the direct applications to studying and combating climate change in our oceans with the help of underwater robots. Alongside my technical research, I seek to contribute to diversity, equity, and inclusion within robotics.

Education

Oregon State University	Corvallis, OR	Ongoing
Doctor of Philosophy in Robotics		GPA: 3.61
Oregon State University	Corvallis, OR	Projected July 2023
Master of Science in Robotics		GPA: 3.61
Olin College of Engineering	Needham, MA	May 2021
Bachelor of Science in Engineering: Concentration in Robotics		GPA: 3.96
Universidad de Sevilla	Sevilla, Spain	Spring 2020

Spent a semester studying flamenco, photography, painting, and cooking

Skills

Software:	C++ • Python • Pytorch • Numpy • ROS • Arduino • Github
Design:	Solidworks • Onshape
Manufacturing:	3D Printer • Laser Cutter • Drill Press • Bandsaw
Collaboration:	Rapid Skill Acquisition • Self Management • Co-design • Leadership
Research:	Neural Networks • Coevolutionary Algorithms • Learning Based Control Underwater Autonomy • Swarm Coordination • Emergent Behavior

Honors and Awards

Oregon State University **Fall 2021 - Summer 2022**

Provost's Distinguished Graduate Fellowship

Olin College of Engineering **Fall 2017 - Spring 2021**

4-year Half-Tuition Academic Merit Scholarship

Allegheny Conference Case Competition **Summer 2020**

• Teamed with four engineering interns at Argo AI to enter Case Competition

• Tackled category to find ways to enrich college social life despite COVID Restrictions

• Won 3rd place and $1k total for Virtual-Reality (VR) solution to port social events to VR

Publications

[6] **Everardo Gonzalez**, and Kagan Tumer. 2023. "**Reward Shaping for Intelligent Swarm Coordination**". In International Symposium on Multi-Robot & Multi-Agent Systems (MRS). *Planned Submission*

[5] Nick Zerbel, **Everardo Gonzalez**, and Kagan Tumer. 2023. "**Counterfactual Perception Shaping for Supervised Multi-Robot Systems**". In International Symposium on Multi-Robot & Multi-Agent Systems (MRS). *Planned Submission*

[4] Gaurav Dixit, **Everardo Gonzalez**, and Kagan Tumer. 2022. **Diversifying behaviors for learning in asymmetric multiagent systems**. In Proceedings of the Genetic and Evolutionary Computation Conference (GECCO '22). Association for Computing Machinery, New York, NY, USA, 350–358. https://doi.org/10.1145/3512290.3528860

[3] **Everardo Gonzalez**, Lucie Houel, Radhika Nagpal, and Melinda Malley. 2022. **Influencing Emergent Self-Assembled Structures in Robotic Collectives Through Traffic Control**. In Proceedings of the 21st International Conference on Autonomous Agents and Multiagent Systems (AAMAS '22). International Foundation for Autonomous Agents and Multiagent Systems, Richland, SC, 1601–1603.

[2] E. J. Martin, Benjamin Erwin, Kakani Katija, Amy Phung, **Everardo Gonzalez**, Susan Von Thun, Heidi Cullen, and Steven H.D.Haddock, "**A Virtual Reality Video System for Deep Ocean Remotely Operated Vehicles**," *OCEANS 2021: San Diego – Porto*, San Diego, CA, USA, 2021, pp. 1-6, doi: 10.23919/OCEANS44145.2021.9705810.

[1] Aviv Elor, Tiffany Thang, Benjamin Paul Hughes, Alison Crosby, Amy Phung, **Everardo Gonzalez**, Kakani Katija, Steven H. D. Haddock, Eric J. Martin, Benjamin Eric Erwin, and Leila Takayama. 2021. **Catching Jellies in Immersive Virtual Reality: A Comparative Teleoperation Study of ROVs in Underwater Capture Tasks**. In Proceedings of the 27th ACM Symposium on Virtual Reality Software and Technology (VRST '21). Association for Computing Machinery, New York, NY, USA, Article 17, 1–10. https://doi.org/10.1145/3489849.3489861

Work Experience

Oregon State University **Fall 2021 - Ongoing**

- Graduate Research Assistant (2022-23), Graduate Research Fellow (2021-22)
- Researcher investigating novel reward shaping techniques for intelligent swarm coordination
  - Created a simulator for running a Cooperative Coevolutionary Algorithm (CCEA) on a swarm of robots with a leader-follower structure
  - Performed extensive literature review on swarm shepherding and reward shaping to identify research gap in learning in a leader-follow swarm
  - Working on paper validating novel reward shaping technique for publication [6]
- Collaborating with labmate to valid their learning-based method on hardware [5]
- Collaborated with labmate to write paper on learning in asymmetric teams [4]
- Researched how to get reliable emergent behavior for structure formation in self-assembling swarms and presented poster remotely at AAMAS 2022

Machina Labs **Summer 2021**

Robotics Manufacturing Startup

- Robotics Intern working independently under supervisor on novel sheet metal manufacturing
  - Designed method to generate robot arm tip paths for sheet metal manipulation
  - Operated two industrial Kuka robot arms for experiments to validate methodology
  - Documented research findings and applied my novel methodology on a customer part
  - Created a test piece demonstrating the utility of my new manufacturing technique that now sits in the showroom to generate excitement in potential customers and investors

Monterey Bay Aquarium Research Institute (MBARI) **Fall 2020 - Spring 2021**

Senior Capstone Project in Engineering, Olin College

- Researcher on team of 5 students developing year-long project sponsored by Dassault Systemés
  - Built a Virtual Reality-based ROV control room for enhanced ROV operation [2]

- Co-designed and created virtual reality overlay for ROV tether twist data
- Collaborated with researchers at MBARI and UCSC (University of California Santa Cruz) to demonstrate efficacy of VR control with user studies [1]

Argo AI **Pittsburgh, PA** **Summer 2020**

Full Stack Autonomous Vehicle Startup

- Onboard Infrastructure Software Intern working under supervisor on team of 15 engineers
  - Developed features in C++ to improve autonomous vehicle configuration software
  - Led an interdisciplinary team to improve access to key in-house data

Dexai Robotics **Greentown Labs, Somerville MA** **Summer 2019**

Commercial Kitchen Automation Startup

- Robotics Software Intern working on core team of 20 interns and full-timers
  - Built up machine learning infrastructure to improve robot arms' scooping capabilities
  - Created Python data API for easily interacting with robot data

Olin College **Needham, MA** **Fall 2018**

First-Year Modeling and Simulations Course, Olin College

- Course Assistant (CA) working with 10 CAs and 3 faculty to teach 90 students
  - Performed regular check-ins with students during class; held office hours to assist with homework; advised on open-ended projects

Harvey Mudd College (HMC) Claremont, CA **Summer 2018**

Research Experience for Undergraduates in Computer Science

- CS Education researcher working with a partner and co-advised by Olin and HMC faculty
  - Researched current impacts of and potential improvements for Olin's computing curriculum
  - Interviewed 35 stakeholders including current students, faculty, and alumni
  - Presented stakeholder research at REU Poster Session at University of Southern California

Project Highlights

Credit Assignment for Multiagent Leader-Based Learning **Winter 2023**

Oregon State, Multiagent Systems Course, Final Project, 9 weeks

- Worked on team of 3 students developing reward shaping for leader-follower multiagent system
  - Pitched a new reward shaping method and multiagent structure it to my teammates
  - Designed experiments to demonstrate the utility of my new method in simulation

Analysis of Q-Learning on Robotics Hardware **Fall 2022**

Oregon State, Mobile Robotics Course, Final Project, 7 weeks

• Worked on team of 3 students implementing a Q-Learner on Turtlebot3 Burger hardware
  • Pitched analysis of Q-Learning versus Potential Fields on hardware as project direction
  • Designed our experiments and tested Q-Learner on hardware

Dodge Balls via Neural Network **Fall 2020**

Olin College, Computational Robotics Course, Final Project, 5 weeks

• Worked on team of 3 students developing an open-ended computational robotics project
  • Created a neural network to take in ball states and output a velocity command to dodge balls
  • Used supervised learning to mimic how a human would drive the robot to dodge balls
  • Built a visualizer to test edge cases and view outcomes with ease

Localization via Particle Filter **Fall 2020**

Olin College, Computational Robotics Course, Localization Project, 3 weeks

• Worked with a student partner developing a particle filter for robot localization in simulation
  • Integrated visualizations in ROS for each step for convenient debugging
  • Successfully localized robot with large uncertainty in initial position

Telemetric Robot Hand **Fall 2019**

Olin College, Principles of Engineering, Course Final Project, 7 weeks

• Managed team of five students prototyping a robot hand that copies a user's hand movements
  • Supported various tasks, including teaching teammates software and electrical skills
  • Designed an electrical system linking IMU and bend sensors to servo and stepper motors
  • Developed a controller for robot hand to copy human wrist movement

Convolutional Neural Network (CNN) for Lego Classification **Fall 2019**

Olin College, Machine Learning Course, Neural Networks Project, 3 weeks

• Worked with a student partner developing a CNN to classify between 6 unique Lego bricks
  • Successfully classified Lego bricks based on images with 82% accuracy
  • Visualized data and activation gradients to demonstrate inner workings of the model

Kinetic Sculpture of Orpheus and Eurydice **Spring 2019**

Olin College, Mechanical Prototyping Course, Final Project, 4 weeks

• Worked on team of 4 students prototyping a kinetic sculpture of Orpheus and Eurydice myth

- Designed and manufactured CAM system for moving heads of a mechanical Cerberus
- Collaborated with teammates to integrate CAM system with linkages and plasma cut body
- Assembled pieces of sculpture together, tweaking parts as necessary for assembly

Athletes with Disabilities Co-Design **Spring 2019**

Olin College, User Oriented Collaborative Design Course, Semester Project, 13 weeks

- Worked on team of 5 students designing big picture ideas to fit athletes' with disabilities needs
  - Brainstormed and co-designed ideas with diverse group of athletes with disabilities
  - Extracted insights from discussions with team to better understand athletes' needs
  - Presented pitch for sports league merging traditional sports and adapted sports at Olin's Expo

Autonomous Tugboat **Fall 2018**

Olin College, Fundamentals of Robotics Course, Final Project, 2.5 weeks

- Managed team of 4 students retrofitting an RC Tugboat with an autonomous system
  - Tracked and distributed tasks as project manager and supported various tasks
  - Integrated wireless communication and basic sensing into overall system
  - Designed and fine-tuned control algorithms for robot behaviors in C++

PID Control of Inverted Pendulum **Fall 2018**

Olin College, Quantitative Engineering Analysis, Inverted Pendulum Control Project, 2 weeks

- Worked with partner to research and implement PID controller on inverted pendulum robot
  - Wrote PID controller for robot pendulum utilizing Pole Plots and computational modeling
  - Exceeded expectations by tweaking controller to simultaneously stand and drive along a parametric curve

LQR Control of Simulated Inverted Pendulum **Fall 2018**

Olin College, Quantitative Engineering Analysis, Open-Ended Final Project, 3 weeks

- Worked with partner to implement Linear Quadratic Regulator (LQR) control in simulation
  - Created simulation of Inverted Pendulum in MATLAB for easier testing
  - Researched optimal control and chose to experiment with LQR
  - Successfully implemented LQR control in simulation

Diversity, Equity, Inclusion, Mentorship, and Outreach

Research Experience for Undergraduates (REU) Mentor **Summer 2022, 2023**

Mentor for students in the REU program for robotics research at Oregon State University

• Mentored a student in summer 2022 on a multiobjective learning based control project

• Contributed to outreach and reviewing applications for summer 2023 program

• Mentoring a student in summer 2023 on a multiagent learning project

Inspiration Dissemination Interview **Winter 2023**

I was interviewed in a live radio show by Inspiration Dissemination on my research

• Explained multiagent learning research to a public facing audience

Ask Me Anything (AMA) Host **Fall 2022**

Hosted a remote AMA for the MIX at Olin as a graduate student at Oregon State University

• Shared my experience pursuing a graduate degree as a Mexican American first generation college student

• Answered questions on life and grad school from about 25 undergraduate students with underrepresented backgrounds in robotics

Multicultural Innovators eXperience (MIX) at Olin **Fall 2020 - Spring 2021**

Member of group focused on promoting diversity, equity, and inclusion at Olin

• Helped host a diverse group of prospective students at Olin virtually

• Attended the SHPE (Society of Hispanic Professional Engineers) 2020 Conference to learn more about diversity equity and inclusion within engineering

***Revisiting American History* Publications** **Fall 2020**

Personal project for Olin's unofficial student-run newspaper, *Frankly Speaking*

• Researched history of race in America through Howard Zinn's *People's History of America*, NPR, and various online sources

• Published article series condensing hours of research into accessible stories for Olin community

• Encouraged discussion and reflection on the role of race in American history amongst peers

Racial and Ethnic Minorities at Argo AI (REMA) **Summer 2020**

Group focused on supporting diverse and underrepresented employees at Argo AI

• Researched history of race in America through 21 day sprint exploring 1 resource per day with coworkers

• Discussed findings of research with coworkers to explore various perspectives and experiences

• Compiled and organized notes from guest speakers to share internally at Argo

SIGCSE 2019 *Computer Science For All* Workshop **Spring 2019**

SIGCSE is a "Special Interest Group on Computer Science Education" that hosts research conferences focused on innovation in CS Education

- Co-presented a workshop on teaching computer science through the contexts of non-CS fields
- Helped demonstrate this approach makes CS more accessible to a diverse group of students

MIT Splash Teacher **Fall 2019**

Splash is a program at MIT where volunteer teachers teach 1-3 hour classes to 9-12 graders

- Designed and taught an introductory lesson in Image Convolution as part of an elective course at Olin, Teaching and Learning in Undergraduate Science and Engineering
- Co-taught an introductory lesson in Mathematical Modeling with student at MIT

Teaching English to Speakers of Other Languages (ESOL) **Fall 2018**

Olin Literacy Project Co-Curricular

- Joined 2 students and 2 staff to make ESOL lessons accessible to Olin staff
- Attended 5 workshops from external ESOL teacher to learn to teach English
- Taught English to Olin Dining hall staff in 1 hour sessions 1-2 times a week