



# Nathan L. Butler

## Graduate Research Assistant

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### EDUCATION

#### Oregon State University

M.S. in Robotics; minor in Artificial Intelligence

Sep. 2023 - Present

#### Iowa State University

B.S. in Mechanical Engineering; minors in Computer Science and Cyber-Physical Systems  
GPA: 3.94/4.00

Aug. 2018 - May 2023

### RELEVANT COURSEWORK

Deep Learning; Sequential Decision Making; Multiagent Systems; Learning-Based Control; Intelligent Agents and Decision Making; Kinematics, Dynamics, and Controls; Machine Learning for Cyber-Physical Systems; Principles of Artificial Intelligence; Cyber-Physical Systems Applications; System Dynamics and Control; Linear Algebra

### EXPERIENCE

#### Graduate Research Assistant, [Robotic Decision Making Lab](#), Oregon State Univ.

Sep. 2023 – Present

- Collaborating on multi-university grant to develop coordination algorithms for teams of underwater robots
- Enhancing distributed multi-robot coordination in communication-restricted domains using learned team specializations
- Developed hybrid decentralized planning algorithm that enables robots to switch between global and local plans to adapt to local disturbances

#### Undergraduate Research Assistant, [ABE Automation and Robotics Lab](#), Iowa State Univ.

Jan. 2022 - Jul. 2023

- Updated design of data collection robot by introducing modular components to eliminate downtime during recharging
- Developed weather-resistant casing for custom stereo camera with LED array, integrated 12 units into field robots
- Mounted robotic arm into existing field robot system to support complex data sampling techniques

#### Systems Director, [Cardinal Space Mining Club](#)

Aug. 2018 - May 2023

- Oversaw systems engineering activities including requirements development, interface tracking, trade-off studies, and verification testing, leading to 1<sup>st</sup> place performance at [NASA Lunabotics 2023](#)
- Led development of new regolith storage and offload subsystems for 2022 robot, resulting in TRL 9 system
- Designed, implemented, and deployed mining control loop to achieve 1<sup>st</sup> place mining competition performance
- Communicated systems engineering activities to NASA Lunabotics competition judges in written technical reports that placed 2<sup>nd</sup> (2021, 2022) and 1<sup>st</sup> (2023) nationally

#### Mechanical Engineering Co-Op, Seed Tech. and Innovation Team, [Corteva Agriscience](#)

May 2021 - Dec. 2021

- Upgraded capabilities of product verification station with faster indexing and computer vision to process 8X more units
- Utilized CAD and 3D-printing skills to develop solutions for grasping and manipulating components of irregular geometry
- Collaborated with innovation and safety teams to test and refine ergonomic product packaging machine

#### Intern, Intelligent Control & Autonomy Group, [NASA Glenn Research Center](#)

Jan. 2021 - May 2021

- Modeled physical responses of electrical hardware components as Simulink blocks and added components to NASA's [Electrical Modeling and Thermal Analysis Toolbox](#) for use in realistic digital twins of electric aircraft propulsion systems
- Developed multiple example Simulink models with accompanying tutorial documentation to reduce learning curve for new toolbox users

## ADDITIONAL PROJECTS

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**MERL for Constrained Coordination:** Multiagent Evolutionary RL for training agents in tightly coupled tasks with sparse rewards

**Bravo MPC:** Model Predictive Control for Reach Bravo robotic arm

**Multiagent Routing as COP:** Constraint Optimization Problem formulation with solver for multiagent orienteering

**DQN for Task Scheduling:** Deep Q-Network for multi-robot task scheduling

**Crop Row Robot Steering:** AE+CNN approach for robot steering commands from visual data within crop rows

**Danfoss Lettuce Harvester:** Robotic lettuce harvester concept developed in collaboration with national multidisciplinary team

## VOLUNTEERING

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### FIRST Robotics Programs

**Fall 2018 - Present**

- Mentoring multiple middle/high school-level FIRST Tech Challenge robotics teams in topics such as mechanical and software design, research and engineering processes, and team business strategy
- Advised >20 FIRST Lego League teams in potential research projects for 2024 competition through online webinar

### MATE ROV Competition

**Apr. 2024**

- Provided engineering and presentation feedback to high school underwater robot teams as engineering project judge

## SKILLS & TOOLS

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**Algorithms & Control:** Deep Learning, Reinforcement Learning, Genetic Algorithms, Path Planning, MPC, PID, Inverse Kinematics

**Software:** Python, Java, Robot Operating System, SolidWorks, MATLAB/Simulink

**Mechanical:** Rapid Prototyping, 3D Printing, Metal Fabrication, Wood Fabrication

**Soft Skills:** Research & Analysis, Algorithm Design, Software Design, Mechanical Design, Systems Engineering, Project Management, Technical Communication