

# Alenna Spiro

PhD Student, Computer Science

[spiro.a@northeastern.edu](mailto:spiro.a@northeastern.edu) · Boston, MA · [github.com/SavvySpiro](https://github.com/SavvySpiro) · [LinkedIn](#)

---

Computer Science PhD student at Northeastern University, working in the Northeastern Autonomy and Intelligence Laboratory with [Prof. Michael Everett](#). My research combines reinforcement learning, control theory, and decision-making under uncertainty to make autonomous systems more reliable when they fail, drawing on models of human learning and development for more efficient robot learning.

## EDUCATION

---

### Northeastern University Boston, MA

PhD, Computer Science · GPA 3.90 2024 – 2029 (expected)

- Khoury College of Computer Sciences.
- Northeastern Autonomy and Intelligence Laboratory (advisor: [Prof. Michael Everett](#)).

### University of Massachusetts Amherst Amherst, MA

MS, Computer Science · GPA 3.37 2022 – 2024

- Autonomous Learning Laboratory (advisor: [Prof. Bruno Castro da Silva](#)).

### University of Massachusetts Amherst Amherst, MA

BS, Computer Science · GPA 3.63 2019 – 2022

- Laboratory for Perceptual Robotics (advisor: [Prof. Roderic Grupen](#)).

## EXPERIENCE

---

### Northeastern University Boston, MA

Graduate Research Assistant Sep 2024 – Present

Northeastern Autonomy and Intelligence Laboratory, advised by [Prof. Michael Everett](#). Research on reliable decision-making and learning-based control for autonomous systems (see Selected Research).

### University of Massachusetts Amherst Amherst, MA

Graduate Research Assistant Sep 2022 – Sep 2024

Autonomous Learning Laboratory, advised by [Prof. Bruno Castro da Silva](#) (see Selected Research).

### University of Massachusetts Amherst Amherst, MA

Teaching Assistant Jan 2023 – Dec 2023

- Teaching assistant for two graduate courses under [Prof. Bruno Castro da Silva](#): COMPSCI 589 (Machine Learning, Spring 2023) and COMPSCI 687 (Reinforcement Learning, Fall 2023); graded hundreds of assignments and exams.

### University of Massachusetts Amherst Amherst, MA

Undergraduate Research Assistant Sep 2019 – Sep 2022

Laboratory for Perceptual Robotics (advisor: [Prof. Roderic Grupen](#)).

- Belief-space object recognition and mobile manipulation in the Roger simulator; second author on the resulting publication (ICDL 2022).

## SELECTED RESEARCH

---

### ENCORE: Environment-aware Cost-optimal Fault Recovery

First author (Spiro & Everett) · in preparation

- Built a recovery advisor for autonomous ground vehicles that decides whether a detected fault warrants physical repair or continued degraded operation by minimizing total mission cost, rather than the fixed safety thresholds used by prior self-assessment methods.
- Designed a learned, per-component repair-effectiveness model and a risk-sensitive (CVaR) action selector that weighs intervention cost against predicted post-repair performance, generalizing across fault types and compounding faults without fault-specific retraining.

- Evaluated in a custom differential-drive simulation across four hardware fault types and varied environments against do-nothing and full-repair baselines.

### [A Hybrid Framework for Efficient Koopman Operator Learning](#)

*Co-first author* (equal contribution) · CDC 2025 · delivered the oral presentation

- Combined semidefinite programming with deep learning to model nonlinear dynamical systems as linear Koopman operators.
- Used a small-scale SDP to derive the observable-space dimension, system order, and an approximate Koopman operator, then used that structure to initialize and train an autoencoder, removing hyperparameters that learning-only methods must otherwise guess and avoiding the quadratic scaling of SDP-only methods.
- Demonstrated lower prediction error and faster convergence than a learning-only baseline across four dynamical systems, including the chaotic Lorenz attractor.

### [SPARTA: Smooth Point-cloud Approach-angle Reasoning for Terrain Assessment](#)

*Contributing author* (4th of 7) · CoRL 2025

- Estimates angle-of-approach-dependent terrain traversability from point clouds, predicting a smooth Fourier-basis risk function over approach angle that can be queried cheaply during planning instead of re-running inference per angle.
- Improved boulder-field crossing success to 91% versus 73% for an elevation-based baseline in high-fidelity simulation, with hardware validation.

### **SACRED: Structure and Affordance-based Categorization of Related Environmental Descriptors**

*Master's research* · UMass Autonomous Learning Lab (advisor: [Prof. Bruno Castro da Silva](#))

- Trained a variational autoencoder to reconstruct environment images, then built per-action, class-conditional histograms over each latent dimension from successful versus failed executions (success defined as an effective change in the environment) — a generative model of how likely each action is to be effective in a given state.
- Scored candidate actions at decision time by encoding the current view into the VAE latent space and evaluating each action's success log-likelihood under this affordance model, surfacing the actions a state most affords.
- Used those affordance scores to guide exploration in a Q-learning agent navigating a room-based, image-observation world (doors, walls, cabinets, with open/close/move/turn actions), biasing exploration toward effective actions and substantially accelerating learning over undirected exploration.

## **PUBLICATIONS**

---

1. L. Jung, **A. Spiro**, A. Estornell, M. Everett, M. Sznaier. "A Hybrid Framework for Efficient Koopman Operator Learning." *IEEE Conference on Decision and Control (CDC), 2025* (Equal contribution: Jung, Spiro, Estornell. Oral presentation delivered by A. Spiro.)
2. Z. Dong, A. Papalia, L. Jung, **A. Spiro**, P. R. Osteen, C. S. Robison, M. Everett. "Learning Smooth State-Dependent Traversability from Dense Point Clouds." *Conference on Robot Learning (CoRL), 2025* [[arXiv:2506.04362](#)]
3. O. Youngquist, **A. Spiro**, K. Doctor, R. Grupen. "Evaluating Sensorimotor Abstraction on Curricula for Learning Mobile Manipulation Skills." *IEEE International Conference on Development and Learning (ICDL), 2022*
4. **A. Spiro**, M. Everett. "ENCORE: Environment-aware Cost-optimal Fault Recovery." *In preparation*

## **HONORS AND AWARDS**

---

**Khoury Distinguished Fellowship**, Northeastern University 2024

**Bay State Scholarship**, University of Massachusetts Amherst 2022–2024

**Chancellor's Award**, University of Massachusetts Amherst 2019–2022

**NASA Massachusetts Space Grant Consortium Research Grant** 2019

## **TECHNICAL SKILLS**

---

**Programming Languages:** Python, C/C++, Java, JavaScript, C#, MATLAB, HTML, CSS

**ML / RL:** PyTorch, TensorFlow, Gymnasium, Weights & Biases, NumPy, SciPy, pandas, scikit-learn, OpenCV, CVXPY

**Robotics:** ROS/ROS2, Gazebo, MuJoCo, custom simulator development

**Tools:** Git, Docker, LaTeX, Linux (Fedora, Ubuntu, Red Hat)

## **LANGUAGES**

---

**English:** Native · **Spanish:** A2 · **Arabic:** A1 (Modern Standard, Levantine, Egyptian; ongoing)