Alenna Spiro

PhD Student, Computer Science

spiro.a@northeastern.edu · Boston, MA · 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
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)

LANGUAGES

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