

NATHAN LUDLOW

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Education

Carnegie Mellon University

Masters of Science in Robotics

Advised by Dr. Katia Sycara

Expected Jul. 2026

Pittsburgh, PA

GPA: 4.00/4.00

Brigham Young University

Bachelor of Science in Mechanical Engineering

Emphasis in Dynamic Systems, Controls, and Robotics

Minor in Computer Science

Minor in Mathematics

Apr. 2024

Provo, UT

GPA: 3.79/4.00

Research Experience

CMU Advanced Agent Robotics Technology (AART) Lab

September 2024 – Present

Research Assistant (with Dr. Katia Sycara)

Pittsburgh, PA

- Developed Knowledge Graph-Augmented Reinforcement Learning (KG-RL) methods that leverage semantic relationships to improve agent learning efficiency on complex tasks. *Led to first-author paper submission at AAMAS 2026.* Collaborative research with Honda Research Institute.
- Investigating Temporal Knowledge Graph representations for reinforcement learning, enabling agents to reason over dynamic state evolutions and temporal dependencies.

BYU Crop Biomechanics Laboratory

September 2023 – April 2024

Capstone Research Project Team Lead (with Dr. Douglas Cook)

Provo, UT

- Led research team developing automated robotic system for measuring maize stalk stiffness. Designed novel strain gauge sensor package and data processing algorithms to convert strain measurements into stiffness metrics. Implemented autonomous navigation and data collection control algorithms for robotic platform. *Publication at MDPI Sensors 2025.*

CMU Driverless Intelligent Vehicles Lab (DRIVE) Lab

August 2023 – August 2024

Research Assistant (with Dr. John M. Dolan)

Pittsburgh, PA/Remote

- Developed risk-aware Voronoi cell approach inspired by control barrier functions for safe multi-agent navigation under motion uncertainty. Enables collision-free path planning around dynamic obstacles including humans, unknown agents, and moving objects with uncertain trajectories.

CMU Robotics Institute Summer Scholars (RISS)

June 2023 – August 2023

RISS Research Fellow (with Dr. John M. Dolan)

Pittsburgh, PA

- Developed behavioral model for simulating human drivers in autonomous vehicle testing frameworks. Introduced forward-looking Gaussian risk metric incorporating social pooling-based trajectory prediction with learned parameters. *RISS Fellowship project; first-author publication at ICRA 2024.*

BYU Robotics And Dynamics (RAD) Laboratory

February 2022 – June 2023

August 2023 – June 2024

Research Assistant (with Dr. Marc Killpack and Dr. John Salmon)

Provo, UT

- Developed dynamic control methods for physical human-robot co-manipulation enabling cooperative swinging, throwing, and tossing of large objects.
- Designed ROS software architecture and implemented robust control algorithms for omnidirectional mobile platform for safe human-robot interaction and physical co-manipulation. *UCUR 2023 workshop presentation.*
- Built VR experimental platform with force/torque sensing for analyzing human-human interaction dynamics during cooperative manipulation tasks.

Publications and Presentations

Conference Publications

- **N. Ludlow**, V. Tadiparthi, H. N. Mahjoub, Y. Xie, W. Kim, K. Sycara, S. Stepputtis, "Knowledge Graph-Augmented Reinforcement Learning" 2026 Conference on Autonomous Agents and Multi-Agent Systems (AAMAS) (In review)
- **N. Ludlow**, Y. Lyu and J. Dolan, "Hierarchical Learned Risk-Aware Planning Framework for Human Driving Modeling," 2024 IEEE International Conference on Robotics and Automation (ICRA), Yokohama, Japan, 2024, pp. 2223-2229, doi: 10.1109/ICRA57147.2024.10610354

Journal Publications

- C. Noh, K. Smith, C. Shamo, J. Porter, K. Steele, **N. Ludlow**, R. Hall, M. Holst, A. Williams, D. Cook, "Measurement of Force and Position Using a Cantilever Beam and Multiple Strain Gauges: Sensing Principles and Design Considerations." MDPI Sensors 2025, 25, 6561. PMID: 41228787

Workshop Presentations

- **N. Ludlow**, M. D. Killpack, J. L. Salmon, "Mobile Base for Physical Human-Robot Interaction and Co-manipulation," 2023 Utah Conference for Undergraduate Research (UCUR), 2023

Professional Experience

Altitude AI

May 2022 – June 2023

August 2023 – September 2023

Robotics Software Engineer

Salt Lake City, UT

- Designed perception, path planning, and control algorithms for automated pork belly skin removal using industrial robotic arms with electric cutting tools.
- Developed domain-specific programming language enabling LLMs to generate executable code for industrial robotic arms from natural language instructions, enabling rapid prototyping of manipulation tasks.

Awards

CMU Robotics Institute Graduate Research Assistantship

Winter 2025 – Fall 2026

NSF Graduate Research Fellowship Program
(GRFP) Honorable Mention

2024

BYU Full Tuition Scholarship Recipient

2021 – 2022

Technical Skills

Programming: Python, C++, C, MATLAB, Java, Julia, Rust

Robotics: ROS, Gazebo, MuJoCo, PyBullet, OpenCV, RealSense SDK

ML/RL: PyTorch, TensorFlow, RLlib, Weights & Biases, OpenAI Gym

Robot Platforms: Yaskawa, XArm, Universal Robots, Franka Panda, KUKA, Farm-ng

Tools: Linux, Git, Docker, LaTeX

Languages: English (Native), Spanish (Fluent)

Service and Leadership

Ecclesiastical Leader for Church of Jesus

Oct 2025 – Current

Christ of Latter-day Saints

- Coordinate volunteer programs including youth activities, missionary support, and community outreach for 150+ member congregation.

Carnegie Mellon University Robotics Institute
RoboLaunch Outreach Program

August 2023 – February 2024

- Participated in outreach with students in Chile and the US to promote RoboLaunch and RISS.
- Managed email campaign and website for the 2023 CMU RoboLaunch program.

BYU Mechatronics Club Team Lead

September 2021 – April 2022

- Designed competition materials for club competitions.
- Led trainings in software, electrical, and mechanical design for robotic systems and controls.

**Full Time Volunteer Representative for The Church
of Jesus Christ of Latter-day Saints**

May 2019 – May 2021

BYU Mars Rover Robot Arm Design Team

September 2018 – April 2019

BYU SAE Baja Off-Road Vehicle Design Team

September 2018 – April 2019

FIRST Robotics Team Mentor

September 2018 – April 2019