

# Humphrey Munn

*PhD Candidate in Robotics & Machine Learning*

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## Education

- Feb 2023–June 2026 **(Expected)**, *Doctor of Philosophy (PhD)*, The University of Queensland & CSIRO Data61, Brisbane
- 2026 ○ **Topic:** Multi-objective reinforcement learning for whole-body robot controllers.
- **Principal Advisors:** Marcus Gallagher, David Howard.
- **Associate Supervisors:** Brendan Tidd, Peter Böhm.
- 2019–2022 **Bachelor of Computer Science (Honours)**, *The University of Queensland*, Brisbane
- **Major:** Machine Learning.
- **GPA:** 6.875 / 7.0 (High Distinction Average).
- **Thesis:** *Does Structural Modularity in Neural Networks Lead to Compositional Functionality?*
- **Award:** First Class Honours.

## Publications

- Under Review **RAPT: Model-Predictive Out-of-Distribution Detection and Failure Diagnosis for Sim-to-Real Humanoid Robots**  
**H. Munn**, B. Tidd, P. Böhm, M. Gallagher, D. Howard.
- Developed RAPT, a lightweight, self-supervised deployment-time monitor for 50 Hz humanoid control.
- Enables reliable online OOD detection and post-hoc root-cause diagnosis via gradient-based temporal saliency and zero-shot LLM reasoning.
- May 2026 **Scalable Multi-Objective Robot Reinforcement Learning through Gradient Conflict Resolution**, *ICRA 2026*, Accepted  
**H. Munn**, B. Tidd, P. Böhm, M. Gallagher, D. Howard. *IEEE International Conference on Robotics and Automation*.
- Proposed GCR-PPO, a scalable multi-objective extension to actor-critic RL that explicitly resolves conflicts between objective-wise gradients.
- Demonstrated improved scalability and robustness across high-dimensional IsaacLab manipulation and locomotion benchmarks.
- Nov 2025 **Whole-Body Dynamic Throwing with Legged Manipulators**, *ACRA 2025*  
**H. Munn**, B. Tidd, P. Böhm, M. Gallagher, D. Howard. *Australasian Conference on Robotics and Automation*.
- Optimized full-body RL policies to exploit momentum and coordinated dynamics for throwing tasks.
- Achieved successful sim-to-real transfer to physical humanoid and quadruped platforms.

2023 **Towards Understanding the Link Between Modularity and Performance in Neural Networks for Reinforcement Learning, IJCNN 2023**

- H. Munn, M. Gallagher. *International Joint Conference on Neural Networks*, pp. 1–7.
- Investigated the relationship between network modularity and performance in RL using MAP-Elites.
  - Demonstrated that optimal modularity depends on complex interactions between structure, task, and optimization dynamics.

2022 **Assessing Evolutionary Terrain Generation Methods for Curriculum Reinforcement Learning, GECCO 2022**

- D. Howard, H. Munn, D. Dolcetti, J. Kannemeyer, N. Robinson. *Proceedings of the Genetic and Evolutionary Computation Conference*, pp. 377–384.
- Evaluated the impact of terrain generation methods (CPPNs vs GANs) on curriculum learning for humanoid locomotion.

## Robotics Systems Experience

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|------------|------------------------------------------------------------------------------------------------------------------------|
| Platforms  | Sim-to-real deployment on physical humanoids (Unitree G1, In-house systems) and quadrupeds (Spot, ANYmal C, Spot Arm). |
| Simulation | IsaacLab, MuJoCo (RL training for locomotion and manipulation).                                                        |
| Control    | Whole-body RL policies, momentum-exploiting dynamic behaviours.                                                        |
| Deployment | Real-time control (50 Hz), domain shift identification, failure monitoring, diagnosis, and recovery.                   |

## Research & Teaching Experience

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|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Mar 2022–Aug 2022 | <b>Research Assistant</b> , CSIRO's Data61, Brisbane, Supervisor: Dr. David Howard                                                                                                                                                                                                                                                                                               |
|                   | <ul style="list-style-type: none"><li>○ Extended custom robotics frameworks and implemented novel curriculum learning methods for legged locomotion.</li><li>○ Contributed to the publication of findings in GECCO '22.</li></ul>                                                                                                                                                |
| Feb 2022–Nov 2024 | <b>Academic Tutor</b> , The University of Queensland, Brisbane                                                                                                                                                                                                                                                                                                                   |
|                   | <ul style="list-style-type: none"><li>○ Taught <i>Machine Learning</i> (COMP4702), <i>Compilers &amp; Interpreters</i> (COMP4403), and <i>Machine Learning for Data Scientists</i> (DATA7703).</li><li>○ Responsible for lesson planning, assessment marking, and facilitating advanced technical tutorials.</li></ul>                                                           |
| Summers 2020–2022 | <b>Summer Research Intern</b> , CSIRO's Data61, Brisbane                                                                                                                                                                                                                                                                                                                         |
|                   | <ul style="list-style-type: none"><li>○ Developed a research project enabling simulated robot curriculum learning on non-parameterizable environments.</li><li>○ Achieved a &gt;56% improvement in robot locomotion performance through a novel curriculum learning variant.</li><li>○ Tasks included Python programming, statistical testing, and data visualization.</li></ul> |

## Technical Skills

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|--------------|-------------------------------------------------------------------|
| Programming  | Python, PyTorch, C++, C, MATLAB, Bash.                            |
| RL & Control | PPO, TD3, Actor–Critic, Multi-Objective RL, Sim-to-Real Transfer. |
| Robotics     | Legged Locomotion, Whole-Body Control, Humanoid Systems.          |
| Simulation   | IsaacLab, MuJoCo.                                                 |
| Tools        | Linux, Git, ROS 2, Apptainer, HPC.                                |