Thomas Pitcher

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Education

Bachelor of Engineering (Honours) – Mechatronics | University of Queensland — Graduated Nov 2023

- **Awarded Best Software Project** at the UQ innovation showcase for my thesis; Reinforcement Learning for Active Search and Grasp in Clutter, where I implemented custom Deep Reinforcement Learning algorithms to optimise a Franka robot arms manipulation in cluttered environments when searching for a target object. See **Projects** for more detail.
- **Deans Commendation for Academic Excellence** | Awarded for having a minimum GPA of 6.6/7 in a semester.
- **UQ EAIT Ambassador** (Engineering, Architecture, and Information Technology) | Engaging prospective students through events, high school workshops and social media channels.
- **UQ Leaders @ EAIT** from 2020-2023.

Experience

Software Engineer – Autonomy | Caterpillar Inc. — Nov 2023 – Present

- Expanding the capabilities of autonomous mining developing Caterpillar's industry leading MineStar software in an agile environment (Java, Python, C/C++).
- Problem solving with colleagues worldwide from Carnagie Mellon Robotics to UQ's Smart Machines group.
- Successfully pitched for funding and currently leading a research project exploring the use of Multi Agent Reinforcement Learning (MARL) in autonomous mining (Python, ray (RLLib), PyTorch, Docker).

Undergraduate Mechatronics Engineer | Cyborg Dynamics — Aug 2023– Nov 2023

- Developing autonomous robotic software in C/C++ and Python for applications in mining, defence, and research.
- Development of simulation environments for unmanned autonomous underwater and ground vehicles in Unity and Gazebo Sim with Implementation of custom physics engine for tracked vehicles.
- Development, implementation, and optimization of camera control over radio.

Academic Tutor | The University of Queensland — Feb 2023 – Nov 2023

- Leading tutorials and laboratory exercises for 3rd year electrical engineering students in ELEC3004: Signals, Systems, and Control and METR4202: Robotics and Automation.
- Creating content for teaching concepts such as path planning, reinforcement learning, digital signal processing in **Python, MATLAB** and **embedded system programming**. Setting up physical robots for hardware demonstrations and simulation tasks.

Undergraduate Engineer | Herrenknecht Australia — Aug 2022 – Aug 2023

- Provided high-quality engineering services for multiple major tunnelling projects across Australia.
- Responsible for contributing to mechanical design and prototyping using **CAD**, designing electrical systems, programming **PLCs**, procuring off the shelf and manufactured parts, and effectively communicating with clients to ensure project success.

Projects

Reinforcement Learning for Active Search and Grasp in Clutter | Published **IROS 2024**

github.com/Pitcherrr/active_search | www.youtube.com/watch?v=ArpU77NbIxY

- Engineering honours thesis project in UQ's Robotics Perception Planning and Leaning lab under the supervision of Prof. Jen-Jen Chung titled Reinforcement Learning for Active Search and Grasp in Clutter.
- Developed and applied Deep Reinforcement Learning to efficiently search for a fully occluded target object in cluttered, unstructured environments. Generalized to new environments outperforming other learning and heuristic based methods by learning to value actions generated from grasp and view networks created from depth images.
- Implemented on Franka Research 3 utilising a wrist mounted RealSense depth camera and AI pipeline running on Nvidia GPU trained in custom loop built using PyTorch, PyBullet sim.
- Presented this work on multiple occasions to senior staff and company representatives resulting in funding for the lab.

Technical Skills

Programming Languages: Python, C/C++, Java, MATLAB | **Packages:** PyTorch, ray (RLLib), OpenCV, Open3d | **Software:** ROS/2, Nvidia Omniverse, Bullet Sim, Simulink, Redis, Docker | **Hardware:** STM32, ESP32, Raspberry Pi 4, Networking, LiDAR, GPS, IMU, General analog/digital sensors, 3D Printing.