

Matthew Budd

PhD Student in Robotics at the University of Oxford

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Research Interests

As a member of the Goal-Oriented Long-Lived Systems lab at the Oxford Robotics Institute, I am particularly interested in applying novel learning and reasoning algorithms to complex navigation and planning tasks in uncertain environments. Academic and industry references are available on request.

Education

My PhD Research Studentship is supported by an AWS Lighthouse Scholarship.

Master of Engineering in Engineering Science

2016 – June 2020

Pembroke College, University of Oxford

Oxford

- First class (average 81%, 87% for Master's project). Placed 5th in a cohort of ~160 students.
- Awards: recipient of the Head of Department's Prize for Excellent Performance (2020), the Paul Martins - BP Scholarship in Engineering (2019), Gibbs Prize - Practical (2017), college Scholarships (2017, 2018, 2019), and an IET Diamond Jubilee Scholarship (www.theiet.org/diamond).

A-Levels and GCSEs

2010 – 2015

Westminster School

London

- A-Level: 5 A*s in Maths, Further Maths, Physics, Chemistry and Electronics.
- GCSE: 10 A*s, A (highest grade) in Further Mathematics GCSE and A in English Literature.
- Awarded an Arkwright engineering scholarship (www.arkwright.org.uk) for both years of A-levels.

Research Experience

Research Assistant

July – October 2020

Autonomous planning - HUDSON project, orcahub.org/engagement/partnership-fund/hudson

- As the core researcher on the Oxford team, I was responsible for the modelling and planning approach to enable autonomous underwater vehicles to intelligently collect data from sensor networks.
- Our novel planning framework reasons about uncertainty in data availability, underwater navigation outcomes, acoustic communications performance and ensuring safe recovery of the vehicle.
- Took a lead role in coordinating work packages between teams of researchers at several institutions.

Master's Research Project

October 2019 – May 2020

“Safe Planning for Markov Decision Processes with Unknown State Features”

- This project investigated and developed planning strategies for hazardous environments where the agent must make predictions about uncertain aspects of environmental hazards that may harm it.
- Proposed a novel safe exploration approach, which outperforms the current state of the art and significantly widens the class of problems the safe exploration algorithm can be applied to.

MEng 3rd Year Group Design Project

October 2018 – May 2019

“A New Beam-Profile Monitor for the Large Hadron Collider at CERN”

- Research and design development for a proposed cutting-edge proton beam imaging instrument.
- Optimised the design of high-speed gas jet apparatus with a GPU-accelerated simulation regime.
- Travelled to CERN in Geneva to give a technical presentation to the LHC Beam Instrumentation Group, and submitted a report outlining the group's research conclusions and design proposals.

Publications

1. **Budd, M.,** Lacerda, B., Duckworth, P., West, A., Lennox, B., & Hawes, N. (2020, October). Markov Decision Processes with Unknown State Feature Values for Safe Exploration using Gaussian Processes. *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*.

Key Skills

- Confident with Python, C, C++, ROS, MATLAB, Simulink, Linux (inc. Embedded Linux), Git, embedded development toolchains, real-time operating systems (FreeRTOS), databases (SQL), electronic and mechanical prototyping, IPv4 and IPv6 network architectures, design of control systems.
- Working knowledge of FPGA design tools, containerised (Docker) and GPU-accelerated (CUDA) programming, web (Python backend, Javascript, HTML/CSS), 3D printing and UX/graphic design.
- Other tools: SOLIDWORKS mechanical CAD, KiCAD & Eagle electronic CAD, Wireshark network analysis, L^AT_EX, industrial computer vision systems, issue tracking and technical documentation.

Experience

Technology Scholar at Cambridge Consultants Ltd.

July – September 2019

Summer internship placement in a software and electronics group

Cambridge

- **Software engineer** on an inhaler test rig project.
 - Design, development and testing of embedded software (embedded C++ and a FreeRTOS-based framework) and the front-end user interface (JavaScript and Python with a Tornado webserver).
 - Responsible for modelling elastic light scattering from microscopic vapour particles. Designed and ran a CELES (github.com/disordered-photonics/celes) simulation regime with CUDA.

RoboCup 2019 competitor, Team ORIon

July 2019

International robotics competition, ori.ox.ac.uk/ori-at-robocup-2019/

Sydney, Australia

- **Competitor in the @Home league**, with our team's code running on a Toyota HSR robotics platform.
 - Researched and implemented robot manipulation behaviours - an integral part of the challenges.
 - Troubleshooted robot network communications, and succeeded in fixing two critical issues.
 - Presented the team's original research at the poster competition, alongside another teammate.

Control Engineering Intern at Archangel Lightworks

June – August 2018

Summer internship placement in a satellite optical communications start-up

Harwell, Oxfordshire

- **Pointing, Acquisition and Tracking (PAT) Prototype Development** for Free-Space Optical Comms.
 - Completed a literature review and requirements identification/justification for the PAT system.
 - Produced a project plan, cost analysis and interface definitions between systems.
 - Carried out integration of multiple hardware and software components (a custom FPGA-based controller, actuators, IMU/GPS, and imaging devices) to prototype a high-speed PAT system.

Micro-Intern at Ensoft Ltd.

December 2017

Week-long internship, adding functionality to the Ensoft intranet

Harpenden

- **Python web-app development with Django**, for the front- and back-end of the site.
 - Added new functionality to automatically handle desk allocation changes by updating large IP phone configuration files and mailing lists, and front-end interface design work for these features.

Technology Scholar at Cambridge Consultants Ltd.

September 2015 – July 2016, Summer 2017

Gap-year placement and summer internship in a software and electronics group

Cambridge

- **Embedded Low-Power Communications Engineer** and Linux Kernel Software Developer.
 - Network architecture research and design for full-fledged IPv6 communications on IoT devices.
 - Designed and implemented: Linux kernel-space software in C including kernel modules and adding functionality to the kernel network stack, user-space software in C and Python, embedded software in C for Cortex-M microcontrollers. Cross-compiled custom designed Embedded Linux distributions with Yocto and OpenEmbedded.

- **Electronics and Low-Level Software Lead** on an internal cross-disciplinary robotics project.
 - Successfully delivered a prototype robot arm system to be demonstrated in a company-wide meeting, despite significant time/budget constraints, and presented my work on the project.
 - Took a lead role in the engineering design process, from requirements specification onwards.
 - cambridgeconsultants.com/insights/robots-from-golden-fairy-to-iron-serf