

# LUKE BEDDOW

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## WORK EXPERIENCE

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### Doctoral Research, *University College London*

Oct 2020 - Sep 2024

- Developed and applied deep reinforcement learning grasping methods, on a novel robotic gripper I designed. Heavy focus on practical implementation, real world impact, solving engineering challenges.
- Extensively created and trained different machine learning models (bash scripting, HPC cluster), wrote and maintained an extensive codebase (4 years, > 40k SLOC), and deployed on real hardware with end-to-end integration (95%+ grasping reliability, state of the art performance vs related work).
- Required creative problem-solving, genuinely novel forward thinking ideas and solutions, and high-level technical communication to achieve publication of research at top robotics venues (see below).

### Postgraduate Teaching Assistant, *University College London*

Jan 2021 - Jan 2024

- Teaching robotics masters modules, including vision-based grasping using OpenCV (C++ and Python). Gave lectures, created tutorials, ran classes, developed courseworks, managed and worked in teams.
- Received exceptional feedback from module leaders, colleagues, and students on quality of disseminating complex topics, management and organisational skills, as well as approachable and friendly demeanour.

### Research & Development Intern, *Jacob Douwe Egberts*

Jul 2017 - Jul 2018

- Coffee machine development, patent analysis, prototyping, conducting experiments, presenting results.
- Highly collaborative team working, including three supplier visits abroad alongside different teams.

## EDUCATION

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### PhD Computer Science, *pending viva, University College London*

2020 - 2024

Research Topic: Learning-based robotic grasping of grocery items. Viva scheduled Nov. 2024.

### MEng Mechanical Engineering, *First Class (79%), University of Bath*

2015 - 2020

Dissertation: Computational mathematical modelling of flexure robots.

### A-Levels, *Alleyn's School*

2013 - 2015

4 A\*s in Maths, Further Maths, Physics, and Chemistry. 10 A\*s at GCSE, including German and French.

## SKILLS

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**Programming:** Python, C/C++, MATLAB, Bash, Make, CMake, Unix (all 4+ years)

**Software tools:** PyTorch, NumPy, SciPy, Git, ROS, Pybind11, MuJoCo, Sun Grid Engine

**Machine Learning:** Supervised and reinforcement learning, computer vision and image processing, physics-based and numerical modelling, autoencoders, advanced linear algebra

**Applied ML:** Expert knowledge of current research, 4 years applied ML experience in robotics

**Conscientiousness:** Very disciplined, self-motivated, organised, and effective (PhD, side projects)

**Teamwork:** Collaborative (PhD, R&D), friendly (teaching), team-orientated (work, hobbies)

**Attitude:** Passionate learner, takes significant initiative and responsibility (PhD, hobbies)

**Communication:** Highly adept technical communicator (papers, posters, international presentations), received excellent feedback on teaching (delivering lectures and running tutorials)

**Creativity:** Produced novel research and new ML methods, exceptional problem solver having integrated complex robotic grasping pipeline, innovative designer (CAD/workshop)

## RESEARCH PUBLICATIONS

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### **Reinforcement learning grasping with force feedback from modeling of compliant fingers, IEEE/ASME Transactions on Mechatronics, 2024**

L. Beddow, H. Wurdemann and D. Kanoulas

Designed a novel gripper, created a mathematical model in a physics simulator (MuJoCo), and developed a reinforcement learning method, learning to grasp 42 real groceries with 95.0% success rate.

### **Evaluating a movable palm in caging inspired grasping using a reinforcement learning-based approach, IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), 2024**

L. Beddow, H. Wurdemann and D. Kanoulas

Applied a reinforcement learning approach to optimise gripper design parameters, and demonstrate an improvement from using a movable palm. Showed 96.0% grasp success rate in the real world.

### **Reinforcement learning-based grasping via one-shot affordance localization and zero-shot contrastive languageimage learning, IEEE/SICE International Symposium on System Integration (SII), 2024**

X. Long\*, L. Beddow\*, D. Hadjivelichkov, A. M. Delfaki, H. Wurdemann and D. Kanoulas (\*equal contribution)

Combined a reinforcement learning grasping approach with a visual affordance model (AffCors) and object identification, using CLIP. Showed 72.0% real world grasp success rate in moderate clutter.

### **A caging-inspired gripper using flexible fingers and a movable palm, IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), 2021**

L. Beddow, H. Wurdemann and D. Kanoulas

Presented a novel gripper design and grasping concept which combined compliant fingers and a movable palm, to cage objects, which is suited to grasping grocery items.

## AWARDS AND ACHIEVEMENTS

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### **2016 – BP Centurion Prize**

University of Bath

*£1000 prize for top three academic placement in cohort.*

### **2017 - 2020 – Academic commendations**

University of Bath

*Received university commendation for outstanding performance in each of 2nd, 3rd, and 4th year of degree.*

### **2009 - 2014 – School scholarship and prizes**

Alleyns School

*Academic scholarship at 11+, prizes for academic achievement 2011, 2012, 2014.*

## COMMUNITY OUTREACH

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- Reviewer for top robotics conferences and journals: ICRA, IROS, RAL.
- Fundraising and running events as part of Jacob Douwe Egberts Banbury charity committee.
- Volunteer lecture teaching robotics to school girls as part of Bio-Robots: Crawl, Jump, and Slither!
- Local tennis coaching, children ages 5-14 over three years, and London Youth Games volunteering.

## INTERESTS

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- I am passionate about applied machine learning, as shown by my PhD topic and research.
- I am an avid programmer, which includes writing my own chess engine in both Python and C++.
- I enjoy sport, having represented school and university for team sports (football, hockey, frisbee).
- I love music, I am self-taught at bass and guitar, have achieved Grade 8 trumpet, and play in a band.