

Postdoctoral Research Associate in Reinforcement Learning and Predictive Control for Autonomous Systems

Job Ref: **REQ230116**

As part of the University's ongoing commitment to redeployment, please note that this vacancy may be withdrawn at any stage of the recruitment process if a suitable redeployee is identified.

We are looking for a Postdoctoral Research Associate on a full-time basis, to support the Engineering and Physical Sciences Research Council funded grant: Learning of safety critical model predictive controllers for autonomous systems (AutoMPC). The Research Associate will be based in the Control Systems Research Group within the Wolfson School of Mechanical, Electrical and Manufacturing Engineering.

The AutoMPC project will run from May 2023 until April 2026 and aims to develop theory and algorithms for reinforcement learning of safe predictive motion control and obstacle avoidance controllers for autonomous vehicles such as autonomous cars and motorcycles. The primary role of the Research Associate will be to implement reinforcement learning and model predictive control algorithms in a suitable environment such as MATLAB or PyTorch. In the later stages of the project, the Research Associate will be expected to collaborate with colleagues at the University of Padova, Italy to deploy controllers to their prototype self-balancing bike.

Job Description

Job Grade: Specialist and Supporting Academic Grade 6

Job Purpose: This role is responsible for implementing reinforcement learning methods for safe motion control and obstacle avoidance, tested in simulation and on the Padova self-balancing electric bike prototype.

Job Duties:

Specific and Technical

- To implement reinforcement learning methods for design of predictive controllers.
- To aid in development of relevant theory of stability, recursive feasibility, constraint satisfaction of controllers.
- To carry out simulations to test motion controller designs.
- To develop and document a software library of novel reinforcement learning and predictive control algorithms.
- To collaborate with engineers at the university of Padova for implementation on the self-balancing electric bike.
- To collaborate with colleagues.
- To contribute to funding applications.

General Technical

- To formulate detailed plans for the project based on broad guidance from the project team.
- To work closely with colleagues and collaborating partners from academia and industry, to prepare and carry out theoretical, simulation and experimental work.

- To develop hardware-in-the-loop experimental demonstrators.
- To provide a professional point of contact for external partners and to liaise effectively with colleagues throughout the School and collaborators from the partner universities.
- To produce and present technical reports at project meetings as required.

Teaching

- To supervise/co-supervise UG and MSC student projects.
- As required, to assist research students in their use of the lab spaces and equipment.
- To assist with software and hardware labs in taught classes.

Other

- To make a practical contribution to discussions on the future technical activities and future direction of the AutoMPC project.
- To collaborate with colleagues on the AutoMPC project in the creation of new knowledge and techniques.
- To share responsibility for the daily maintenance and upkeep of equipment and laboratory space.
- To ensure that a safe working environment is maintained at all times through compliance with Health and Safety at Work Regulation and the University's Operational Procedures.
- To take responsibility as requested for the sourcing and procurement of stock and specialist items to support AutoMPC's work.
- To write and assist in writing conference and journal papers. To actively participate in appropriate conferences.
- To participate in outreach projects relating to the AutoMPC project.
- To participate in training as required.
- To carry out specific duties as may be reasonably requested by the project leader and that are commensurate with the nature and grade of the post.

Points to Note

The purpose of this job description is to indicate the general level of duties and responsibility of the post. The detailed duties may vary from time to time without changing the general character or level of responsibility entailed.

Special Conditions

All staff have a statutory responsibility to take reasonable care of themselves, others and the environment and to prevent harm by their acts or omissions. All staff are therefore required to adhere to the University's Health, Safety and Environmental Policy & Procedures.

All staff should hold a duty and commitment to observing the University's Equality & Diversity policy and procedures at all times. Duties must be carried out in accordance with relevant Equality & Diversity legislation and University policies/procedures.

Successful completion of probation will be dependent on attendance at the University's mandatory courses which include Respecting Diversity and, where appropriate, Recruitment and Selection.

Organisational Responsibility

Reports to Dr James Fleming, AutoMPC's Principal Investigator.

Person Specification

Your application will be reviewed against the essential and desirable criteria listed below. Applicants are strongly advised to explicitly state and evidence how they meet each of the essential (and desirable) criteria in their application. Stages of assessment are as follows:

- 1 – Application
- 2 – Test/Assessment Centre/Presentation
- 3 – Interview

Essential Criteria

Area	Criteria	Stage
Experience	Previous experience of working within a University engineering, mathematics or computer science department, or similar research environment	1, 3
	Postgraduate research experience in an area related to reinforcement learning, model predictive control or autonomous systems	1, 3
	Authoring original work for academic journal papers and conference presentations	1, 3
Skills and abilities	Applied experience in the use of MATLAB and/or Python	1, 3
	Proven ability to develop and implement mathematical models	1, 3
	Ability to produce written research reports	1, 3
	Demonstrable ability to work with efficiency and accuracy to deadlines	1, 3
	Professional manner with excellent interpersonal and communication skills	1, 3
	Ability to show initiative and work independently but also make a full contribution as a team player	1, 3
	Training	Be prepared to undertake further training both internally and externally
Qualifications	PhD (or near completion) in a topic related to reinforcement learning, model predictive control or autonomous systems	1
Other	To observe the University's Equal Opportunities policy at all times	3
	To comply with Health and Safety regulations	3
	Commitment to maintain confidentiality at all times	3
	Be available to start at Loughborough in summer 2023	1, 3

Desirable Criteria

Area	Criteria	Stage
Experience	Current relevant work experience at a postdoctoral level in an academic or industrial environment	1, 3
	Evidence of publishing in high quality journals	1, 3
	Formal/informal supervision of UG students	1, 3
	Experience of reinforcement learning tools such as the MATLAB Reinforcement Learning toolbox or PyTorch	1, 3
	Experience in developing or applying model predictive controllers (MPC)	1, 3
Skills and abilities	Understanding of current Health and Safety legislation, risk management and COSHH regulations	1, 3
	Proven ability to build experimental setups including electronics and software interfaces	1, 3

	Willingness to travel	3
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Conditions of Service

We have one full time position with a fixed term of 3 years. The applicant must start at Loughborough in 2023. Salary will be on Research Grade 6, £32,348 to £34,308 per annum, at a starting salary to be confirmed on offer of appointment.

The appointment will be subject to the University's normal Terms and Conditions of Employment for Technical staff, details of which can be found <http://www.lboro.ac.uk/services/hr/a-z/conditions-of-service.html>.

The University is committed to enabling staff to maintain a healthy work-home balance and has a number of family-friendly policies which are available at <http://www.lboro.ac.uk/services/hr/a-z/family-leave-policy-and-procedure---page.html>.

We also offer an on-campus nursery with subsidised places, subsidised places at local holiday clubs and a childcare voucher scheme (further details are available at: <http://www.lboro.ac.uk/services/hr/a-z/childcare-information---page.html>

In addition, the University is supportive, wherever possible, of flexible working arrangements. We also strive to create a culture that supports equality and celebrates diversity throughout the campus. The University holds a Bronze Athena SWAN award which recognises the importance of support for women at all stages of their academic career. For further information on Athena SWAN <http://www.lboro.ac.uk/services/hr/athena-swan/>.