

## Postdoctoral Research Associate in reinforcement learning and predictive control for autonomous systems

Job Ref: REQ260277

### Project Description:

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 December 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 Family and 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 outlined in the document.

### **Organisational Responsibility**

Reports to the: AutoMPC's Principal Investigator.

## Person Specification

Your application will be assessed based on the essential and desirable criteria listed below.

Applicants are strongly encouraged to explicitly demonstrate how they meet each essential (and desirable) criteria at the application stage. The criteria that you need to demonstrate in your application will be listed as Stage 1 in the table below.

Stages of assessment are as follows:

- 1 – Criteria measured at Application
- 2 – Criteria measured at Test/Assessment Centre/Presentation
- 3 - Criteria measured at 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  |
|                      | Authorising original work for academic journal papers, conference papers or technical reports   | 1, 3  |
| Skills and abilities | 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  | 3     |
| Qualifications       | PhD (or near completion) in a topic related to reinforcement learning, model predictive control or autonomous systems                       | 1     |
| Other                | Uphold and actively contribute to the University's commitment to Equity, Diversity and Inclusion.   | 1,3   |
|                      | To comply with Health and Safety regulations  | 3     |
|                      | Commitment to maintain confidentiality at all times   | 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    |

## Conditions of Service

The appointment will be subject to the [University's Terms and Conditions of Employment](#) relevant to the job grade.

## Shared University Responsibilities

As a member of the Loughborough community, you are expected to:

- Take reasonable care of yourself, others and the environment, and to prevent harm by your acts or omissions. All staff are therefore required to adhere to the University's Health, Safety and Environmental Sustainability Policies & Procedures.
- Support and contribute to the University's commitment to Equity, Diversity, and Inclusion (EDI), while carrying out all duties in a way that respects these principles and upholds the right to free expression. Further information about EDI at Loughborough and our strategic aims is available on our website

## Our Purpose, Vision, and Values

Our purpose, Vision and Values underpin all that we do and shape how we work together at Loughborough.

We're proud to promote our values: **Adventurous, Collaborative, Creative, Authentic** and **Responsible**. Our people bring these values to life every day, and they are central to the positive and supportive culture that makes Loughborough unique.

If you join us, you'll be encouraged to bring these values to life in your own work and contribute to the positive, supportive culture that makes Loughborough unique.

Read more about our [vision and values](#).

## Our Accreditations



We 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.



We are proud to be a [Race Equality Charter Member](#). The Charter aims to improve the representation, progression and success of all minority ethnic staff and students within higher education and address issues of racism within higher education institutions (HEIs).



We are proud to be a Disability Confident Employer and have adopted a proactive approach to employing disabled people and to creating a more diverse workforce. We ensure that our recruitment processes are inclusive and accessible. We guarantee to offer an interview to all applicants who have declared themselves with a disability, provided they meet the essential criteria for a role. We proactively anticipate and provide reasonable adjustments and support existing employees who acquire a disability or long-term condition to thrive in the workplace.



We are a real living wage employer, and our Living Wage Employer Mark shows our commitment to paying our staff according to the cost of living.



We are proud supporters of the [City of Sanctuary movement](#) and delighted to be recognised as a University of Sanctuary. This national network brings together, university staff, lecturers, academics and students, who together work to make Higher Education institutions place of safety, solidarity and empowerment for people seeking sanctuary.

**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.**