School of Computing, Engineering, and the Built Environment
Edinburgh Napier University

PHD STUDENT PROJECT

Application instructions:
Detailed instructions are available at :
https://www.napier.ac.uk/research-and-innovation/doctoral-college/how-to-apply

Prospective candidates are encouraged to contact the Director of Studies (see details below) to discuss the project and their suitability for it.

Project details

Supervisory Team:
- DIRECTOR OF STUDY: Dr Brian Davison (Email: b.davison@napier.ac.uk)
- 2ND SUPERVISOR: tbc

Subject Group: Computer Science

Research Areas: Artificial Intelligence, Computer Vision, Robotics

Project Title: Anticipatory navigation for autonomous robots

Project description:

Simultaneous Location And Mapping (SLAM) is a strategy that allows autonomous mobile robots to navigate their environment. Sensors on board the robot detect objects and obstacles and the sensor data is used to construct a representation of the robot's physical surroundings.

This project will build on existing work on 3D SLAM to create a richer map of the world that includes object identification and behaviour that incorporates realistic physics. The robot will draw on previous experience and stored knowledge to predict elements of the map with differing degrees of certainty. Certainty will increase over time as the predictions are confirmed or refuted by incoming sensor data.

The two main aims of the project are:
1. To develop a method for constructing a probabilistic map based on prior knowledge and minimal sensor data
2. To anticipate future states of a dynamic environment that includes moving

objects and to use that information as the primary reference for path planning and obstacle avoidance.

The work of the project will include robot hardware, sensors, software engineering and artificial intelligence techniques.

References:

Taniguchi, T., Murata, S., Suzuki, M., Ognibene, D., Lanillos, P., Ugur, E., Pezzulo, G. (2023). World models and predictive coding for cognitive and developmental robotics: frontiers and challenges. Advanced Robotics, 37(13), 780-806. https://doi.org/10.1080/01691864.2023.2225232

Candidate characteristics

Education:
A first degree (a minimum 2:1) in Computer Science

Subject knowledge:
Abstract problem modelling and AI

Essential attributes:
- Competent in software development
- Knowledge of mathematics
- Good written and oral communication skills
- Strong motivation, with evidence of independent research skills relevant to the project
- Good time management

Desirable attributes:
- Previous experience working with robot hardware or microprocessor systems will be a major benefit