



## **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 Neil Urquhart (Email: [n.urquhart@napier.ac.uk](mailto:n.urquhart@napier.ac.uk))
- 2<sup>ND</sup> SUPERVISOR: tbc

**Subject Group:** Computer Science

**Research Areas:** Urban Planning, Artificial Intelligence, Machine Learning, Operational Research

**Project Title:** Improving city mobility with AI

#### **Project description:**

The ability to move around a city and access resources (e.g. leisure, retail, health or education) has a massive impact on the quality of life for residents. This project aims to use AI, optimisation and data science techniques to improve the design of cities and their mobility networks for the benefit of all. By using AI to analyse existing patterns of travel and lifestyle possible improvements may be identified. One of the major constraints that must be respected is the need to combine improvements with existing infrastructure. This project will examine how cities may be analysed, through existing data sets and through other means of data capture. The project will need to devise utility functions that will allow suggested improvements can be evaluated against multiple criterion including environmental impact, costs, lifestyle impact and disruption to existing structures. Mechanisms will be developed that allow suggested improvements to be evaluated by experts and through public

consultation. Feedback from experts and the public being used to support the final selection of improvements by policy makers.

**References:**

Neil Urquhart, Emma Hart:  
Improving the Size and Quality of MAP-Elites Containers via Multiple Emitters and Decoders for Urban Logistics. *EvoApplications@EvoStar 2023*: 35-52

Milan Wittpohl, Per-Arno Plötz, Neil Urquhart:  
Real Time Optimisation of Traffic Signals to Prioritise Public Transport. *EvoApplications 2021*: 162-177

Neil Urquhart, Silke Höhl, Emma Hart:  
Automated, Explainable Rule Extraction from MAP-Elites Archives. *EvoApplications 2021*: 258-272

## **Candidate characteristics**

**Education:**

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

**Subject knowledge:**

Software Development, Artificial Intelligence

**Essential attributes:**

- A desire to improve the lives of those who live in cities
- An interest in the application of AI and related technologies to real-world problems
- The ability to work independently when necessary
- Excellent written and oral communication skills

**Desirable attributes:**

- A basic knowledge of optimisation techniques, such as evolutionary algorithms and illumination algorithms