



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

PHD STUDENT PROJECT

Funding and application details

Funding status: Fully funded project (worldwide)

Application instructions:

Detailed instructions are available at <https://www.napier.ac.uk/research-and-innovation/research-degrees/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: Emma Hart (Email: E.Hart@napier.ac.uk)
- 2ND SUPERVISOR: Kevin Sim

Subject Group: Computer science

Research Areas: Artificial Intelligence

Project Title: Continual Learning in Black-Box Optimisation

Project description:

Optimisation problems are ubiquitous across many sectors. In a typical scenario, instances arrive in a continual stream and a solution needs to be quickly produced. Meta-heuristic search techniques have proved useful in providing high-quality solutions, but it is challenging to select the correct solver for a particular instance and/or tune it to optimise performance. If the characteristics of instances change over time, it is also possible that at some future point, instances are sufficiently novel that there is no appropriate solver known or the selector is incapable of choosing the best algorithm. This project will focus on one or more aspects of tackling this issue; for instance developing novel algorithm-selection methods that are capable of selecting the most appropriate method; using algorithm-generation

methods (e.g. genetic programming) to generate or tune algorithms to work well on instances that occur in novel regions of the instance space; developing methods that are capable of learning from experience, i.e. continually improving selection methods or generation methods over time as knowledge is learned from solving past instances. The project is likely to mix techniques from meta-heuristic optimisation, automated algorithm generation and machine-learning, particularly borrowing ideas from the transfer learning or continual learning literature.

References:

- [1] Emma Hart, Ian Miguel, Christopher Stone, and Quentin Renau. 2023. Towards optimisers that 'Keep Learning'. In Proceedings of the Companion Conference on Genetic and Evolutionary Computation (GECCO '23 Companion). Association for Computing Machinery, New York, NY, USA, 1636–1638. <https://doi.org/10.1145/3583133.3596344>

Candidate characteristics

Education:

A second class honour degree or equivalent qualification in Computer Science, Operations Research, Mathematics (assuming a good level of programming skills)

Subject knowledge:

- Programming (ideally Python or C++)
- Machine-learning
- Optimisation techniques if possible, e.g. randomised search heuristics (meta-heuristics)

Essential attributes:

- Programming skills
- Excellent writing skills
- Ability to work independently
- Good knowledge of basic statistics/data analysis

Desirable attributes: