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

PHD STUDENT PROJECT

Funding and application details

Funding status: Self funded students only

Application instructions:
Detailed instructions are available at https://blogs.napier.ac.uk/scebe-research/available-phd-student-projects/

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: Peter Chapman (Email: P.Chapman@napier.ac.uk)
- 2ND SUPERVISOR: Kevin Sim

Subject Group: Computer science

Research Areas: Artificial Intelligence, Human-Computer Interaction

Project Title: Using Generative AI to Draw Diagrams

Project description:

Designing algorithms for human-readable, effective diagrams is difficult. The algorithm must be able to handle a broad range of datasets, some of which will not readily lend themselves to visualisation. Moreover, even when a successful algorithm is developed, personal preference may increase barriers to usage amongst the intended user group. In this project, you will explore the ability of artificial intelligence, specifically genetic programming, to develop diagrammatic representations of set-based data. The use of genetic programming is novel. Whilst genetic algorithms have been used to fine-tune existing diagrammatic algorithms, in this project the algorithm will be developed wholly by the genetic program. Moreover, one of the crucial fitness functions that guides the development will be

users' personal preferences: these will be co-produced diagrams, which could look very different for different users.

The target domain is set-based data. Existing visualisations for this domain include tree-based representations, graph-based representations, region-based representations (for example, Euler and Venn diagrams), and others. One of the complexities is the scalability of the diagrams: the number of possible intersections, and thus potential datapoints to visualise, doubles with every additional set. Interactivity is one solution to this problem: the user can highlight, obfuscate, or abstract the data to reduce the visualised data items. A secondary aspect of this project will be determining the most effective way of guiding the generation process so that interactivity can be easily, or even automatically, added to the resulting visualisations.

The ideal candidate would have a strong background in computer science, artificial intelligence, mathematics, or data science. Prior knowledge of visualisation techniques would be an advantage, but not necessary.

References:

Candidate characteristics

Education:

A first-class honours degree, or a distinction at master level, or equivalent achievements in Computer Science, AI, Data Science, Mathematics

Subject knowledge:

- Computer programming/coding
- Mathematics/logic

Essential attributes:

- High levels of self-motivation
- Desire to learn