Coursework: Research Essay (10%)

Due date: Friday 13 January 12:00pm noon.

This assignment aims to assess how you describe, use, analyse and discuss recent research literature in a sub-field of natural computation and demonstrate a critical understanding of these methods.

Task

We covered several different kinds of nature-inspired optimization algorithms in the lectures. Although these approaches have excellent search abilities in some small or medium size problems, many of them will encounter severe difficulties when applying to large scale problems, e.g., problems with up to 1000 variables. The search space increases exponentially with the number of decision variables, and a more efficient search strategy is required to explore all the promising regions with limited computational resources.

Scaling up EAs to large scale problems has attracted much interest, including regularly held competitions at conferences, see for instance:

CEC2012 Special Session and Competition on Large Scale Global Optimisation
http://staff.ustc.edu.cn/~ketang/cec2012/cec2012lsgo.htm

These provide benchmark problems as well as an overview of recent advances on this topic.

This assignment requires you to write an essay on the topic of “Large Scale Optimisation by Nature-Inspired Techniques”.

Your discussion needs to include the following aspects:

1. Introduction:
   A brief introduction to large scale optimisation including motivations, any necessary definitions, properties of large scale problems and other aspects you consider important in the context of your essay.

2. Optimisation Goals and Techniques:
   An overview and critical discussion of the goals and techniques as well as the performance measures used in large scale optimisation.

3. Example Application:
   Discuss a real-world application of your choice. You should include the following aspects:
   – A clear motivation for and definition of the problem you consider.
   – A brief discussion of the rational for using nature-inspired search and optimisation methods and discussion of alternative classical approaches where appropriate.
   – A description of nature-inspired methods used to solve the problem including a brief motivation why these methods were selected.
   – An overview of results and other insights gained (e.g., advantages, disadvantages, general
observations) and your critical reflection of these contributions.

4. Concluding remarks and references

The following two papers give you a good starting points for your research, and you will find further information in the literature:


Note that you should not simply copy definitions, data, diagrams or similar content from the literature but rather discuss the most important aspects in your own words. You can add figures or diagrams to support your descriptions.

**Popular Publication Venues in Natural Computation**

Natural Computation is a rapidly growing research area with plenty of different publication venues. The following list provides you with some journals and conferences to get you started. They are available through the library.

- Swarm and Evolutionary Computation: http://www.journals.elsevier.com/swarm-and-evolutionary-computation/
- Evolutionary Computation: http://www.mitpressjournals.org/loi/evco or http://dl.acm.org/citation.cfm?id=J277
- Natural Computing: http://link.springer.com/journal/11047
- Genetic and Evolutionary Computation Conference http://dl.acm.org/event.cfm?id=RE290

**Requirements and Submission**

Submit your solutions through Canvas. In case you encounter any problems with Canvas, please email support.
Your submission should contain a single pdf file with your solutions.
No late submissions are allowed, except in cases where we have explicit permission to grant an extension from the welfare team. If this is the case, please also let me know via email. 2000-3000 words is appropriate for this essay (excluding any figures and the list of references).

You should add a declaration that the essay is entirely written by yourself, unless it is noted otherwise.

The essay should be completed independently and any reference used in the essay needs to be clearly cited. You can use a reference system of your choice, but you must be consistent. Please refer to the University’s guide to referencing:
https://intranet.birmingham.ac.uk/as/libraryservices/library/referencing/icite/referencing/index.aspx

Please also refer to the School’s guidance notes on plagiarism:
http://www.cs.bham.ac.uk/internal/taught-students/plagiarism

This assessment is worth 10% of your overall mark for this module. Marking will be based on the quality of the essay in its content, structure and language. Marks will take account the quality of the presentation regarding
• the general introduction, conclusions and references (20%)
• the discussion of goals, techniques and performance measures (40%)
• the discussion of a real-world application of your choice (40%)
Mark descriptors will roughly follow those used in project marking:
http://www.cs.bham.ac.uk/internal/staff/handbook/ProjectGradeDescriptors.html