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Section 1: Overview of Assessment

This assignment assesses the following module learning outcomes:

1. Demonstrate the ability to select appropriate paradigms and solve one or more problems with Artificial Intelligence techniques
2. Identify the issues associated with the application of modern Artificial Intelligence techniques, including any ethical issues, and evaluate challenges presented

The assignment is worth **75%** of the overall mark for the module.

Broadly speaking, the assignment requires you to write a report on your attempts to solve a set of simple problems as effectively as possible using any form of evolutionary intelligence covered on the course. This requires you to write your own code, in a language of your choice, building upon your own code written and developed in the first lab sessions.

The assignment is described in more detail in section 2. This is an individual assignment.

Working on this assignment will help you to develop your understanding of how learning can be seen as a search process and how the parameters controlling search techniques affect their ability to solve tasks. If you have questions about this assignment, please email the module leader.

Section 2: Task Specification

There are three worksheets on Blackboard which take you through the implementation of a simple evolutionary algorithm. This assignment requires you to complete all three worksheets and then extend the algorithm to show competitive performance on a number of optimisation problems. Thereafter you are free to find other well-known problems and algorithms.

To pass the assignment, you must implement a system that successfully evolves solutions to the two minimisation fitness functions below and demonstrate the effects of parameter changes, through graphs, including your understanding of what is happening.

Approaches you might like to consider are different forms of mutation and crossover, as well as selection. It is also acceptable to use implementations of other related algorithms for comparison with your own code on benchmark functions.

All reports should include a research section which, drawing on two specific examples from the media, considers the ethical issues which can arise from the use of AI, eg, for face recognition, and how they might be avoided or reduced in future. In an experimentation section on the use of evolutionary search describe the encoding(s) used, show example runs and solutions found. *More marks will be given to the effective use of more sophisticated approaches.* Written feedback will be given in Blackboard with marks.

$f(\mathbf{x}) = \frac{1}{2} \sum_{i=1}^d (x_i^4 - 16x_i^2 + 5x_i)$ <p>where $-5 \leq x \leq 5$, start with $d=20$</p>	$f(\mathbf{x}) = (x_1 - 1)^2 + \sum_{i=2}^d i (2x_i^2 - x_{i-1})^2$ <p>where $-10 \leq x \leq 10$, start with $d=20$</p>
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Section 3: Deliverables

Depending on font size, and line spacing, around 2,500 words is a reasonable target length. The intention is your hand-in approximates to a research paper – please use the template provided, submitted as Word or PDF. Include commented source code as a printed Appendix. DO NOT make your report or code publicly available. A demonstration might be required during the lab sessions before the end of term if any aspects are unclear to the marker(s).

Section 4: Marking Criteria

	0-40%	40-60%	60-100%
General approach – technical writing style and visual impression (10%)	Use of template and basic word processing skills.	Coherent structure in presentation, including some graphs.	Well structured, results presented in multiple/suitable ways.
Research – relevance and level of understanding shown (20%)	Brief mention of some ethical issues in two very commonly cited examples.	Summaries of the ethical consequences of two interesting applications.	Clear identification and discussion of pertinent ethical issues and possible future ways to mitigate them in two interesting areas.
Experimental Method – no. of experiments, systematic parameter changes, etc.(30%)	Presentation of attempts on the third worksheet functions.	Presentation of increasingly successful attempts on third worksheet functions, moving to others.	Presentation of successful attempts on all provided tasks, moving to others and relative comparisons.
Analysis and Discussion – presentation and discussion of learning behaviour (30%)	Brief discussion of apparent effects of varying one or more parameters.	Discussion of apparent effects of varying parameters clearly supported by results.	Demonstration of clear insight of effects from parameter sweeps and/or operators or network type.
Conclusions (5%)	Concise summary.	Summary showing wider understanding.	Demonstration of clear understanding and implications of results.
Citation and Reference Scheme (5%)	A small number of relevant refs.	Some good ethical refs.	Sets of refs for ethics, solutions, etc.