MODULE SPECIFICATION

1 The title of the module:

CO528 Introduction to Intelligent Systems

2 The Department which will be responsible for management of the module:

Computer Science

3 The Start Date of the Module:

January 2006 (*revised version start date September 2013)*

4 The number of students expected to take the module:

150

5 Modules to be withdrawn on the introduction of this proposed module and consultation with other relevant Departments and Faculties regarding the withdrawal:

None

6 The level of the module:

Level I

7 The number of credits which the module represents:

15 (7.5 ECTS credits)

8 Which term(s) the module is to be taught in:

Spring

9 Prerequisite module:

CO520 or CO523.

10 The programmes of study to which the module contributes:

CS BSc, CS and Management Science, CS with Artificial Intelligence, Business Computing, Mathematics and CS, Computing and Business Administration, Applied Computing Joint Honours, and Year in Industry variants.

11 The intended subject specific learning outcomes and, as appropriate, their relationship to programme learning outcomes

Students who successfully complete this module will be able to:

11.1 Explain the motivation for designing intelligent machines, their implications and associated philosophical issues, such as the nature of intelligence and learning.

11.2 Describe the main kinds of state-space search algorithms, discussing their strengths and limitations.

11.3 Explain the main concepts and principles associated with different kinds of knowledge representation, such as logic, case-based representations, and sub-symbolic/connectionist representations.

11.4 Explain the differences between the major kinds of machine learning problems – namely supervised learning, unsupervised learning and reinforcement learning – and describe the basic ideas of algorithms for solving those problems.

11.5 Describe the main concepts and principles of major kinds of biologically-inspired algorithms, and understand what is required in order to implement one such technique.

11.6 Describe how various intelligent-system techniques have been used in the context of several case studies, and compare different techniques in the context of those case studies.

Outcomes 11.1-11.5 are related to the following Computer Science programme outcomes:

- Knowledge and Understanding of: A.2 (Software), A.4 (Practice) and A.5 (Theory).
- Intellectual Skills: B.1 (Modelling) B.4 (Criteria Evaluation and Testing).

Outcome 11.6 is related to the following Computer Science programme outcomes:

- Subject-Specific Skills: B.7 (Computational thinking), C.1 (Design and Implementation), C.14 (Identify and develop solutions for computational problems requiring machine intelligence) and D.2 (Evaluation).

12 The intended generic learning outcomes and, as appropriate, their relationship to programme learning outcomes

Students who successfully complete this module will be able to:

12.1 Discuss and give examples of the role of analogy and metaphor in science and engineering;

12.2 apply mathematical and computational skills in solving problems;

12.3 compare different strategies for problem solving, choose a strategy and justify that choice;

12.4 assess the strengths and weaknesses of hypotheses and techniques;

12.5 use the library and appropriate internet resources in support of learning.

Outcomes 12.1-12.2 are related to the following Computer Science programme outcomes:

- Intellectual Skills: B.1 (Modelling) B.4 (Criteria Evaluation and Testing).

Outcomes 12.3 and 12.4 are related to the following Computer Science programme outcomes:

- Knowledge and Understanding of: A.2 (Software), A.4 (Practice) and A.5 (Theory).
- Intellectual Skills: B.4 (Criteria Evaluation and Testing).

Outcome 12.5 is related to the following Computer Science programme outcomes:

- Transferable Skills: D.3 (Information Technology) and D.5 (self-management).

13 A synopsis of the curriculum

Introduction

The motivation to create intelligent machines and an initial discussion about the nature of intelligence.

Philosophy of AI

Main philosophical components of AI, investigating topics such as the nature of intelligence, learning and consciousness. Social implications of intelligent machines. A Brief history of AI. Similarities and differences between AI and Computational Intelligence. The evolution of the mind.

State-space search algorithms

The concepts of state space and heuristic evaluation function. Depth-first, breadth-first and best-first search. A* Algorithm.

Knowledge representation

Main concepts of different kinds of knowledge representation, such as logic (both classic and fuzzy logic), case-based representations, and sub-symbolic/connectionist representations. Principles of AI algorithms using each of these kinds of representations.

Introduction to Machine Learning

Main concepts of supervised learning, unsupervised learning and reinforcement learning. Basic ideas of algorithms for each of these kinds of machine learning problems.

Introduction to Biologically-Inspired Computation

The motivation for biologically-inspired computation. Overview of biological systems that serve as inspiration for AI, such as the brain, evolutionary theory, swarming insects and immune systems. Introduction to those systems' artificial counterparts in the context of AI, i.e. artificial neural networks, evolutionary algorithms, swarm intelligence algorithms and artificial immune systems.

Applications and case studies

A number of case studies which will illustrate the application of ideas, techniques and technologies from the remainder of the course.

14 Indicative Reading List

- S.J. Russell & P. Norvig, “Artificial Intelligence: a modern approach”, 2nd Edition. Prentice-Hall, 2002. (main textbook)
- S. Pinker. “How the Mind Works”, W.W. Norton & Company, 1999.
- A. Cawsey, “The Essence of Artificial Intelligence”, Prentice-Hall, 1998.
- P. Bentley. “Digital Biology”, Simon & Schuster, 2002.

15 Learning and Teaching Methods, including the nature and number of contact hours and the total study hours which will be expected of students, and how these relate to achievement of the intended learning outcomes

The material will be taught as a series of 22 lectures, in a single term. The lectures will be supported by notes available electronically and/or on paper. The students will undertake coursework in topics covered by the lectures. The lectures and the coursework will allow the achievement of specific learning outcomes (11.1-11.6) and generic learning outcomes (12.1-12.5).

Hours of study: 150

Contact hours: 22 lectures

16 Assessment methods and how these relate to testing achievement of the intended learning outcomes

Coursework Assessment: 50%; Written Examination: 50%.

The coursework will assess specific learning outcomes (11.2-11.6) and generic learning outcomes (12.1-12.5). The exam will assess specific learning outcomes (11.1-11.6) and generic learning outcomes (12.1-12.4).

17 Implications for learning resources, including staff, library, IT and space

This module will be managed by Computer Science. The major requirement will be teaching time. There are no library resource requirements over and above purchasing a small number of core books.

18 The School recognises and has embedded the expectations of current disability equality legislation, and supports students with a declared disability or special educational need in its teaching. Within this module we will make reasonable adjustments wherever necessary, including additional or substitute materials, teaching modes or assessment methods for students who have declared and discussed their learning support needs. Arrangements for students with declared disabilities will be made on an individual basis, in consultation with the University’s/Collaborative Partner’s (delete as applicable) disability/dyslexia support service, and specialist support will be provided where needed.

19 Campus(es) where module will be delivered[1]

Canterbury

If the module is part of a programme in a Partner College or Validated Institution, please complete the following:

20 Partner College/Validated Institution

21 University School (for cognate programmes) or Faculty (for non-cognate programmes) responsible for the programme

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SECTION 2: MODULE IS PART OF A PROGRAMME OF STUDY IN A UNIVERSITY SCHOOL

Statement by the School Director of Learning and Teaching/School Director of Graduate Studies (as appropriate): "I confirm I have been consulted on the above module proposal and have given advice on the correct procedures and required content of module proposals"

[1] Required for information purposes only. Changes of campus will not require re-approval of the module specification.

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Director of Learning and Teaching/Director of Graduate Studies (delete as applicable) Date

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Print Name

Statement by the Head of School: "I confirm that the School has approved the introduction of the module and, where the module is proposed by School staff, will be responsible for its resourcing"

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Head of School Date

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Print Name

SECTION 3: MODULE IS PART OF A PROGRAMME IN A PARTNER COLLEGE OR VALIDATED INSTITUTION

(Where the module is proposed by a Partner College/Validated Institution)

Statement by the Nominated Officer of the College/Validated Institution *(delete as applicable)***:** "I confirm that the College/Validated Institution *(delete as applicable)* has approved the introduction of the module and will be responsible for its resourcing"

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Nominated Responsible Officer of Partner College/Validated Institution Date

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Print Name

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Post

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Partner College/Validated Institution