Module Code:	CHA 2555
Module Title:	ARTIFICIAL INTELLIGENCE
Schools:	Computing and Engineering
Courses:	Any final year
Module leader:	Lee McCluskey
Location:	Queensgate
Module type:	Core (BSc CSci, BSc CGP) Optional (MEng SEng, BSc Comp., BSc SDev, BSc S&F Comp.)
Credit rating:	20 credits
Level:	H
Learning Method:	Lectures: 24 hrs Tutorials: 24 hrs Directed Unsupervised Activity: 152 hrs
Prerequisites:	N/A
Recommended prior learning:	First two stages of Computer Science degree or equivalent
Professional body requirements:	N/A
Graded:	Graded
Barred combinations:	None

Synopsis

The module combines the theory and practical applications of artificial neural networks with a symbolic approach to intelligent agents as systems that can sense, plan and act in pursuit of goals.

In semester one, the focus is on the symbolic approach to implementing intelligent systems. Theory underlying a selection of application areas will be studied; possible topics include turn-based games, machine perception, knowledge engineering, automated inference, language processing, planning and scheduling, and machine learning. Research tools will be introduced (e.g. planners, intelligent games, NLP tools) to support the theory, allowing the students to explore current developments and the potential applications of intelligent technology.

In semester two, students are introduced to the ideas involved in using the structure and operation of the brain as a model for computing systems. They will: develop an awareness of the role which artificial neural networks can play in the solution of various types of problem, develop the techniques and strategies needed to build a variety of artificial neural networks

Outline syllabus

Overview of the characteristic capabilities of intelligent agents: pattern recognition, reasoning, planning, learning. Underlying principles/techniques of symbolic analysis: knowledge representation, inference and search. A range of aspects of intelligent behaviour (language processing, planning and scheduling, machine

learning) and applications areas (decision support, language translation, turn-based games, machine perception) will be covered.

Ideas of neuroscience. Neurons and neural networks. Artificial neural networks and artificial intelligence. The McCulloch and Pitts model. Perceptron/multilayer perceptron. Applications of artificial neural networks in commerce/industry. Comparisons between networks. Applications and choice of network architecture

Learning Outcomes

1. Knowledge and Understanding

Upon completion of this module the student will be able to:

1.1 Describe the biological ideas behind artificial neural networks.
1.2 Discuss a significant number of types of artificial neural networks and their applications.
1.3 Identify when artificial neural networks are a useful tool to use in problem solving.
1.4 Explain concepts fundamental to symbolic AI such as knowledge representation, inference and reasoning,
1.5 Explain processing techniques fundamental to symbolic AI such as search methods and heuristics
1.6 Describe some of the major application areas of Intelligent Systems.

2. Abilities

Upon completion of this module the student will be able to:

2.1 Judge the appropriateness of an artificial neural network approach to solving a given problem.
2.2 Design, construct and train an artificial neural network to solve a given problem.
2.3 Choose and apply AI processing techniques, and appropriate technology, for implementing intelligent systems in a range of application areas such as planning, language understanding, learning
2.4 Construct and reason with knowledge representations within formalisms such as rules, action schema, description logics, classical logics, Petri Nets

Assessment Strategy

Formative Assessment

Feedback to students will be given in tutorials, in-class tasks and practical sessions. Graded exercises will be set and model answers and solutions to problems will be provided.

In the spring term various research tools will be given to the students in order for them to test out the theory. Feedback and help in using the tools will help students to assess their progress and understanding.

Coursework will be set in term 1 and indicative marks supplied to students early in term 2.

Summative Assessment

Task 1: One in-course assessment designed to investigate and evaluate key concepts of symbolic AI such as search and knowledge representation.

Task 2: One three-hour examination.

The relative weightings will be:

Task 1: Coursework 40%
Assessment Criteria: The work will involve application of basic symbolic AI principles such as search and knowledge representation, and will be aimed at a particular aspect of intelligence such as Planning and Problem Solving. Coursework exercises will assess learning outcomes 1.5, 2.3 and 2.4.

Task 2: Examination 60%
Assessment Criteria: One end-of-year, three-hour examination assessing learning outcomes 1.1, 1.2, 1.3, 1.4, 1.5, 1.6 and ability outcomes 2.1 and 2.2 will be assessed. Typically, students will be asked to answer four out of six questions.

Task 2 is the final assessment for this module.

Note: *The coursework (Task 1) will be eligible for tutor reassessment.*

The assignment will be submitted for marking with an approved cover sheet containing the student's name, identity number and date of submission.

Assessment Criteria:
Assignment One – investigate and evaluate key concepts of symbolic AI such as search and knowledge representation

At Pass level, students will demonstrate a solution that shows a basic understanding of search methods (breadth first, depth first, best first, or A*), a basic knowledge of the form and role of heuristics, and some understanding of the form and use of knowledge representation languages such as (in planning) PDDL.

At Modal level, students will demonstrate a solution that shows a penetrating understanding of search methods and knowledge representation languages, the ability to use and predict the performance of individual heuristics, and an excellent ability to understand and manipulate sentences in a knowledge representation language such as (in planning) PDDL.

Learning strategy:

Learning is to be achieved by attendance at lectures, seminars, and by study of directed reading. Attendance at seminars/tutorials will reinforce the taught material and give the students practical experience of Intelligent Systems construction and in the design, construction and training of an artificial neural network.