OVERVIEW

Introduction
Artificial Intelligence introduces the basic principles of knowledge representation and search which underlie symbolic Artificial Intelligence and illustrates these principles by enabling students to represent and manipulate knowledge in small AI systems, using the Prolog computer language. The unit also describes the application of these principles in the main AI sub-fields, including expert systems, natural language understanding, machine learning, computer vision, robotics and intelligent agents. Students will examine the assumptions underlying the symbolic approach to AI and compare them with those of alternative approaches used in the neural network and evolutionary computing sub-fields.

Objectives
On successful completion of this unit, you will be able to:

1. demonstrate an understanding of the basic principles of symbolic AI as a process of knowledge representation and search.
2. use the Prolog logic programming language to represent and manipulate knowledge in small AI systems.
3. describe the use of AI principles and techniques in AI subfields including Expert Systems, Natural Language Understanding, Machine Learning, Computer Vision and Robotics.
4. compare the assumptions and techniques underlying the symbolic approach to AI with those of alternative approaches.

Unit Content
Introduction to AI:
- The Definition of Artificial Intelligence
- The Symbol System Hypothesis
- The History of Artificial Intelligence
- Applied AI Sub-Fields

Propositional and Predicate Logic:
- Basics of Propositional Logic
- Inference Rules
- Basics of Predicate Logic
- Variables and Quantifiers
- Exotic Logics
Introduction to Prolog:
- Predicates, Facts, Rules and Queries
- Recursion
- Problem Solving using Recursive Search
- Prolog Operators
- The Cut Facility
- List Processing in Prolog

Problem Solving Techniques:
- Problem Spaces and Search Trees
- Blind Search Techniques
- Heuristic Search using Evaluation Functions
- The A* Algorithm
- Randomized Searches
- Adversarial Search
- Search Complexity

Knowledge Representation Schemes:
- Production Rules
- Inference Control and Conflict Resolution
- Semantic Networks and Conceptual Graphs
- Frames and Scripts

Expert Systems:
- Characteristics of Expert Systems
- Components of an Expert System
- Classical and Current Expert Systems
- Knowledge Engineering
- Development Tools
- Knowledge Acquisition

Natural Language Understanding:
- The Language Analysis Process
- Grammars and Parsing
- Semantic Representations
- Current Research and Applications

Machine Learning:
- The Knowledge Engineering Bottleneck
- Decision Tree Induction
- Data Mining
- Artificial Neural Networks
- Multilayer Networks and Backpropagation

Computer Vision:
- Image Capture and Processing
- Segmentation and Object Recognition
- Deriving 3-D Information
- Scene Description
- Vision Applications

Artificial Life and Robotics:
- Evolutionary Computing
- The Physical Grounding Hypothesis
- Early Work on Artificial Life
- Behavioural Robotics
- Digital Ecosystems
- Swarm Intelligence

Intelligent Agents:
- Characteristics of Intelligent Agents
- Agents in Cyberspace
- The Unifying Role of Agents in the AI Field

For more information see the section titled 'Content' on the unit website.

Generic Skills
The university has defined a set of generic graduate attributes expected in its graduates. [http://www.utas.edu.au/policy/subject.html#graduates](http://www.utas.edu.au/policy/subject.html#graduates) Your course is designed to enable you to develop generic skills that are valued in, and expected of, graduates. These are skills that you will need to develop over time. Hence you are encouraged to look for opportunities, as you study each unit, to reflect on and improve these skills.

LEARNING AND TEACHING

Approach to Learning
You are expected to spend about 130 hrs studying in this unit - this includes attendance at scheduled teaching sessions. (For a 13 week semester this is, on average, 10 hr/wk.) This is the
Learning
amount of study time that the 'typical' student will need to reach the level of competence and understanding required to fulfil the unit objectives.

You are expected to:

- attend all scheduled lectures and tutorials, unless otherwise notified by the unit coordinator
- prepare for, and actively participate in lectures and tutorials
- complete the assigned learning tasks
- review what has been learnt
- complete assessment items and submit them on time
- access and be familiar with the information and resources available on the unit website
- seek help from teaching staff if you have any questions or difficulties in studying this unit

You are encouraged to read the university's Code of Conduct for Teaching and Learning. Part A describes the 'Responsibility of the University to Students' and part B describes the 'Responsibilities of Students to the University'. [http://www.utas.edu.au/tl/policies/codes.html](http://www.utas.edu.au/tl/policies/codes.html)

Schedule
See the 'Schedule' section on the unit website.

Teaching and Support Staff

Teaching Staff

Unit Coordinator:

Dr. Ian Lewis
E-Mail: ij_lewis@utas.edu.au

Lecturing Staff

Dr. Xuhua Yang
Email: xhyang@zjut.edu.cn

School Help Desk

Contact technical staff at ZUT for information about accessing and using the Computer labs.

University Services and Support

The University has staff available to assist you, such as the:

- Learning Development Advisor
- Student Counselor
- Careers Advisor
- Disability Officer

For more information and contact details see the Services and Support section on the University 'Current Students' web page. [http://www.utas.edu.au/students/](http://www.utas.edu.au/students/)

Resources

Unit Website

The unit website contains unit information and resources.

Prescribed Text

None

Readings

Students are advised to have access to the following book (but not necessarily a personal copy). The book is a useful reference for students who wish to pursue topics from lectures in more detail.


Software

The software that you will need to access the unit website and to study this unit, including general purpose software such as word processors, is provided on the computers in the computing labs. If you intend to use software on other computers please check that the versions are compatible.

In this unit you will use:

- Amzi! Prolog.

ASSESSMENT
Assignment Items

Item 1
Title: Assignment 1
Type: In-Semester - individual assignment
Weighting: 15%
Due: Monday, the 5th of November at 12 noon (week 8)

Item 2
Title: Assignment 2
Type: In-Semester - individual assignment
Weighting: 15%
Due: Monday, the 17th of December at 12 noon (week 14)

Item 3
Title: 3 hr Examination
Type: Formal Examination
Weighting: 70%
Due: University Examination Period

This is a closed book exam. No materials are permitted into the examination room.

In-Semester Assessment

Unless specifically stated in the specification of the assessment item provided on the unit website, it is required that:

♦ work submitted by a student is the work of that student alone OR
♦ where the assessment item is to be completed by a group of students, the work submitted by the group of students is the work of that group of students alone.

Plagiarism

Plagiarism is a form of cheating. It is taking and using someone else's thoughts, writings or inventions and representing them as your own, for example:

♦ using an author's words without putting them in quotation marks and citing the source;
♦ using an author's ideas without proper acknowledgment and citation; or
♦ copying another student's work.

If you have any doubts about how to refer to the work of others in your assignments, please consult your lecturer or tutor for relevant referencing guidelines, and the academic integrity resources on the web at http://www.utas.edu.au/tl/supporting/academicintegrity/index.html.

The intentional copying of someone else's work as one's own is a serious offence punishable by penalties that may range from a fine or deduction/cancellation of marks and, in the most serious of cases, to exclusion from a unit, a course or the University. Details of penalties that can be imposed are available in the Ordinance of Student Discipline – Part 3 Academic Misconduct, see http://www.utas.edu.au/policy/subject.html#students.

The University reserves the right to submit assignments to plagiarism detection software, and might then retain a copy of the assignment on its database for the purpose of future plagiarism checking.

Referencing

The university document on plagiarism contains information about referencing the work or ideas of others. (See http://www.utas.edu.au/plagiarism/.) The preferred text referencing systems for the School is the Harvard system (also referred to as the author-date system).

Submissions

The details of the submission method (paper, electronic or other) for each assignment will be supplied in a separate assignment specification sheet. All in-semester assignment submissions (including electronic submissions) are to include an Assignment Cover Sheet which includes a statement confirming that the submission is your own work. If this undertaking is not signed, the assignment will not be marked. The Assignment Cover Sheet is available on the School's web site http://www.comp.utas.edu.au/app/studyresources.jsp.

Extensions

Assessment items will not be accepted after the due date except under the conditions stated in the school policy on late assessment. http://www.comp.utas.edu.au/app/late_assess.jsp

Formal Examination

The formal examination will be held at ZUT, Hangzhou, and is conducted by the University Registrar.

Final Grade

Overall assessment will be based on the student's performance throughout the semester as well as in a formal examination. In order to achieve a pass (or better) result, a student must obtain:
1. at least 45% of the total mark for in-semester assessment items
2. at least 45% of the mark for the formal examination
3. at least 50% of the overall mark

In order to comply with the benchmarks set by the Faculty of Science, Engineering & Technology for distribution of grades in units, both the in-semester and examination marks that students obtain may be adjusted either upwards or downwards. See http://fcms.its.utas.edu.au/scieng/scieng/policies.asp for details of the Faculty Assessment Guidelines.

Passing grades will be awarded based on the AVCC guidelines:

- PP at least 50% of the overall mark but less than 60%
- CR at least 60% of the overall mark but less than 70%
- DN at least 70% of the overall mark but less than 80%
- HD at least 80% of the overall mark

The maximum mark awarded to a student who fails the unit will be 44.

For more information, including other grades such as Supplementary and Terminating grades, see the School of Computing’s guidelines for assessment - available at: http://www.comp.utas.edu.au/app/assess.jsp