

Artificial Intelligence

COMP3702/COMP7702

Lecturer: Ruth Schulz

ruth@itee.uq.edu.au

Axon 308

Office Hours: Tuesday 2-3pm Axon 211

Artificial Intelligence

COMP3702/COMP7702

- View
 - Methods and techniques within the field of artificial intelligence solve problems - theoretical and practical
- Scope
 - The course provides an understanding of the field and describes many of the most important algorithms and techniques that have found theoretical and practical applicability
- Purpose
 - The course helps the student
 - gain an appreciation for the scientific context of artificial intelligence
 - understand and develop computing algorithms, and to analyse their properties
 - find the right tools for solving specific problems, and to implement such tools in software

Course goals (1)

- In general terms, it is expected that the student gains an understanding of the theories, methods and practices which form the basis of Artificial Intelligence
- The course aims to introduce the basic concepts and methods used in the field of artificial intelligence and provide students with skills in the use of applying these techniques
- Specifically the course aims to give students an overview of the following topics in artificial intelligence:
 - Problem solving and optimisation (search algorithms)
 - Reasoning with uncertain knowledge (probability theory)
 - Machine Learning (decision trees, neural networks, etc)
 - Applications of AI

Course goals (2)

- After the course, you should
 - be familiar with the historical context of artificial intelligence
 - know several definitions of artificial intelligence
 - be familiar with an agent-based intelligent system design
 - understand several problem solving and optimisation techniques based on search (both uninformed and informed)
 - be able to implement and apply search techniques

Course goals (3)

- In addition, you should
 - understand general principles of machine learning (both supervised and unsupervised)
 - know several machine learning techniques (including decision tree learning and neural networks)
 - be able to implement, apply and systematically evaluate machine learning techniques
 - understand probability theory and how it can be used for representing and reasoning with uncertain knowledge
 - be able to apply basic probability theory to machine learning problems
 - know about some of the current advances in robotics and AI

Resources (1)

- Russell S. and Norvig P., Artificial Intelligence: A modern approach, 2nd edition, 2003
 - Highly recommended reading
 - Used extensively (see reading list on Semester overview)
 - Available for purchase from the University Bookshop
 - Several copies are also available at the library

Resources (2)

- Handouts
 - At www.itee.uq.edu.au/~comp3702 you will find
 - Slides used in lectures
 - Tutorials
 - Assignments
 - Readings and handouts
 - Links and resources

Resources (3)

- Announcements
 - www.itee.uq.edu.au/~comp3702
 - Newsgroup: uq.itee.comp3702

Times and Venues

- Lecture
 - Tuesday 10am – 11.50am [78-343]
- Tutorials
 - Tuesday 12pm – 1.50pm [68-214]
 - Wednesday 10am – 11.50am [14-115]
 - Friday 10am – 11.50am [78-420]
- Sign-up for Tutorials via SI-net
- Tutor: Arren Glover arren@itee.uq.edu.au
- Office Hours Tuesday 2-3pm Axon 211

Semester overview (1)

	<i>Lecture</i>	<i>Reading</i>	<i>Tutorial</i>	<i>Assessment</i>
1	Introduction to artificial intelligence, an agent-based perspective.	Chapter 1,2, 26: pp. 947-949, 958-960.	No tutorial	
2	Solving problems by searching	Chapter 3	The definition of artificial intelligence	
3	Informed search and exploration	Chapter 4	Problem representation	
4	Adversarial search, game playing	Chapter 6	Informed search	Assignment 1 available
5	Applying search algorithms, discussion		Adversarial search	

Semester overview (1)

	<i>Lecture</i>	<i>Reading</i>	<i>Tutorial</i>	<i>Assessment</i>
6	Mid-semester exam		Assignment 1 preparation	Mid-semester exam
7	Probabilistic reasoning	Chapter 13	Exam discussion, Feedback and revision of tutorials 1-4	Assignment 1 deadline
8	Principles of machine learning, decision trees	Chapter 18 and 19	Probabilistic reasoning	Assignment 2 available
9	Symbolic machine learning	Chapter 18 and 19	Machine learning basics	

Semester overview (2)

	<i>Lecture</i>	<i>Reading</i>	<i>Tutorial</i>	<i>Assessment</i>
	Mid-semester break			
10	Statistical machine learning Neural networks	Chapter 20	Current best learning and decision trees	
11	Neural networks	Chapter 20	Decision trees and Naive Bayes Classification	
12	Applying machine learning: Robotics, Developmental Robotics	Chapter 25	Neural networks	

Semester overview (2)

	<i>Lecture</i>	<i>Reading</i>	<i>Tutorial</i>	<i>Assessment</i>
13	Assignment 2 Competition, Review		Robotics	Assignment 2 deadline
Revision Period				
1				Final Exam
2				

Assessment (1)

- Assignments (30%)
 - 2 assignments
 - Assignment 1 (10%): Search – game playing
 - Assignment 2 (20%): Machine learning – pattern recognition
- Tutorials (10%)
 - Active participation mark (1% per tutorial)
 - Can submit online at submit.itee.uq.edu.au
 - Due by 5pm on the Monday BEFORE the tutorial session
 - Must be submitted on time and be substantially correct to obtain marks for active participation
- Mid-semester Examination (10%)
 - During Lecture in Week 6
 - Covers lectures from Weeks 1-4
 - 45 minutes
 - Closed-book
 - Multiple Choice
- Final Examination (50%)
 - During final examination period
 - Covers lecture material
 - 2 hours
 - Closed-book
 - Primarily short answer / short essay

Assessment (2)

- COMP3702
 - Mid-semester exam is optional
 - Total exam mark is 60%, best result of:
 - Mid-semester 10% + Final 50%
 - Mid-semester 0% + Final 60%
- COMP7702
 - Mid-semester exam is compulsory
 - Total exam mark is 60 %
 - Mid-semester 10% + Final 50%

Important Assessment Information

- All assessment is due at 5pm of the due date
- Assignments need to be submitted on-line at <http://submit.itee.uq.edu.au>
- Late submission not accepted except for medical or strong personal reasons (documentation required)
- The programming language will be Java
- Tutorials for C/C++ programmers are available at the course website

Assignments

- Two assignments – Two problems/applications which require intelligence (artificial or natural)
 - Problem-solving/optimisation (solving a puzzle)
 - Approach: clever search algorithms, optimising outcomes on basis of a well-defined ‘current state’, exposes computational complexity issues
 - Pattern recognition (classifying handwritten characters)
 - Approach: learning-by-example/machine learning, exposes difficulties of ‘representation by rules’, illustrates the use of probabilistic methods and neural networks

Assignment 1

- Solving a puzzle
 - Use standard search algorithms to find an optimal solution
 - Write your own heuristic function that can provide informed guidance to the search algorithm, making combinatorial optimisation computationally feasible
 - Provides insights into game-playing algorithms

Assignment 2

- Recognizing handwritten characters
 - Access a large data set of letters
 - Use example Java programs to train a letter-recognition model
 - Write your own machine learning program using existing example code and theory described in lectures, and evaluate how well the model works
 - A live competition will be held amongst submitted models on new data - estimates true, real-world accuracy

Tutorials

- Aims
 - to provide examples of potential examination questions
 - to enable and encourage peer-tutoring
 - to provide an opportunity for questions
 - to explore the theoretical concepts
 - to apply the theoretical concepts

Tutorials

- You receive 1% for participating in a tutorial (or submitting a substantially correct solution online by the Monday before the tutorial)
- Students will work individually or in pairs during tutorials (online submissions must be individual)
- Participation marks will be allocated for active participation
 - Working through problems
 - Participating in discussions
 - Answering questions
 - Submitting tutorial solutions
- Feedback
 - Tutors will provide some feedback on submitted work
 - Work will be returned the week after submission

Mid-Semester Examination

- Multiple choice
- 50 minutes
- During the lecture in week 6
- Covers the first 5 weeks of lectures
- Closed book
- Optional for COMP3702, Compulsory for COMP7702

Examination

- Closed book, non-programmable calculator allowed
- Knowledge questions - theory
 - may have been in tutorials
 - explicit in the recommended text book
 - assessed on correctness of answer
- Knowledge questions - practical
 - similar to those in tutorials
 - method described in the recommended text and lectures
 - assessed on correctness of method application
- Discussion questions
 - may have been addressed in lectures
 - not necessarily explicit in the readings
 - assessed on insight / justifications
- Different exam for COMP3702 and COMP7702
 - COMP7702 will have more discussion questions, including a short essay question

Lectures

- Aims
 - to outline theories, methods and applications of the field of AI
 - to explain difficult concepts from the recommended text and other sources
 - to illustrate concepts in AI with diagrams and examples
 - to provide a forum for general discussion and questions about the subject matter

Some tips...

- Don't be shy, participate in lectures, ask questions
- Buy the book, read chapters as noted – it is well-written, up-to-date, and an excellent reference for later
- AI is actually quite fun and useful, but you need to work hard
- Assignments and tutorials are there to make you work and to help you to learn

Questions ...