MONASH University
Information Technology

FIT4009
Advanced topics in intelligent systems

Unit Guide

Semester 2, 2010

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FIT4009 Advanced topics in intelligent systems - Semester 2, 2010

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Introduction

Welcome to FIT4009 Advanced Topics in Intelligent Systems.

Intelligent Systems is one of the most active research groups in the Faculty of IT. In 2009, this unit will be divided into two topics,

Topic 1: Natural Language Processing and User Modeling in Assistive TechnologiesThe proliferation of the WWW and pervasive technologies have created new needs which involve sophisticated interactions with devices (including robotic agents). This unit will consider different technologies developed to assist people to interact with machines.The unit is roughly divided into traditional knowledge-intensive approaches to Natural Language (NL) and User Modeling (UM) tasks, and recent statistical approaches. We begin with a brief introduction to Natural Language Processing and User Modeling. We then discuss planning,and its applications to NL and UM, followed by introduction to probability and Markov models. Thereafter we will consider the application of Bayesian networks and Markov models to NL and UM tasks. We will then study document retrieval and recommender systems.

Topic 2: Introduction to Bayesian Networks.Bayesian networks (BNs) have rapidly become one of the leading technologies for reasoning and decision making with uncertainty and applying AI to real world problems. This follows the work of Pearl, Lauritzen, and others in the late 1980s showing that Bayesian reasoning in practice could be tractable (although in principle it is NP-hard). We begin this topic with a brief examination of the philosophy of Bayesianism, including a quick review of probability theory, and an introduction to utility theory and decision analysis. We then introduce Bayesian networks, covering the syntax and semantics of BN and how to reason with them. We'll look at some extensions to BNs: dynamic Bayesian networks, for explicitly reasoning over time; decision networks, for decision making that maximises expected utility; object oriented BNs, for building complex hierarchical and modular networks. We will briefly look at methods for learning BNs. We'll conclude by looking at methodologies for knowledge engineering BNs, including some case studies in intelligent tutoring, environmental and medical risk assessment.

Unit synopsis

Methods from Artificial Intelligence (AI) form the basis for many advanced information systems. These techniques address problems that are difficult to solve or not efficiently solvable with conventional techniques. Building on the undergraduate curriculum this unit introduces the student to advanced AI methods and their applications in information systems.

Learning outcomes

At the completion of this unit students will have:

- achieved an overview of different technologies that form the basis of intelligent information systems;
- understood the capabilities of these methods;
- learned to recognise tasks that can be solved with these methods;
- the ability to judge the limitations of these methods.With successful completion of the unit the students;
- the ability to apply the standard techniques in the chosen sub-fields of intelligent information systems to the construction and design of such systems;
- the ability to critically evaluate the performance of these approaches;
- the ability to compare these techniques to alternative approaches;
- gained an appreciation of the practical relevance of intelligent information systems.

Contact hours

2 hrs lectures/wk, 1 hr laboratory or tutorial/wk

Workload

For on campus students, workload commitments are: (12 hrs/week total)

- Lectures: 2 hours per week
- Tutorials (for Topic 2); 1 hr per week
- Reading, preparation, assignment work, revision: 9-10 hours per week

Unit relationships

Prerequisites

Completion of the Bachelor of Computer Science or equivalent to the entry requirements for the Honours program. Students must also have enrolment approval from the Honours Coordinator.

Teaching and learning method

Teaching approach

The main teaching forum will be the lectures. Students are also expected to make use of the on-line discussion forums for any questions regarding the unit material or organisation.

Timetable information

For information on timetabling for on-campus classes please refer to MUTTS, http://mutts.monash.edu.au/MUTTS/

Tutorial allocation

On-campus students should register for tutorials/laboratories using the Allocate+ system: http://allocate.its.monash.edu.au/

Unit Schedule

Week	Date*	Topic	References/Readings	Key dates
1	19/07/10	Introduction		
2	26/07/10	Planning and applications to NL and UM		
3	02/08/10	Introduction to probability and Markov models		
4	09/08/10	Foundations (AN)	Korb & Nicholson, 2004, Chapter 1	
5	16/08/10	BN Basics (AN)	Korb & Nicholson, 2004, Chapter 2, Ch 3	
6	23/08/10	Extensions to BNs (AN)	Korb & Nicholson, 2004, Chapter 4	
7	30/08/10	Application of BNs and Markov models to NL and UM		BN Modelling Assignment due (TBC)
8	06/09/10	Document retrieval		
9	13/09/10	Recommender systems		
10	20/09/10	Learning BNs (AN)	Korb & Nicholson, 2004, Chapters 6-8	
Mid semester break				
11	04/10/10	Knowledge engineering BNs (AN)	Korb & Nicholson, 2010, Chapter 10	
12	11/10/10	Applications of BNs (AN)	Korb & Nicholson, 2010, Chapters 5,11	BN Programming assignment due (TBC)

*Please note that these dates may only apply to Australian campuses of Monash University. Off-shore students need to check the dates with their unit leader.

Unit Resources

Prescribed text(s) and readings

There are no prescribed books.

Recommended text(s) and readings

- Korb & Nicholson (2004), *Bayesian Artificial Intelligence* , Chpapman Hall / CRC Press.(Also, chapters 10 and 11 from 2nd edition 2010 will be made available)
- Russell & Norvig (2003), *Artificial Intelligence: A Modern Approach*, Prentice Hall.
- Jackson & Moulinier (2002), *Natural Language Processing for Online Applications: Text Retrieval, Extraction and Categorization* (Paperback), John Benjamins publisher, 2nd edition.
- Chakrabarti (2003), *Mining the Web: Discovering Knowledge from Hypertext Data,* Morgan Kaufmann.
- Jurafsky & Martin (2000), *Speech and Language Processing*, Prentice Hall.
- Manning & Schutze (1999), *Foundations of Statistical Natural Language Processing*, MIT Press, 1999.
- Baeza-Yates & Ribeiro-Neto (1999), *Modern Information Retrieval*, Addison Wesley.
- Selected articles in User Modeling.
- Selected articles in Bayesian networks

Required software and/or hardware

For Topic 2 students will need to use a Bayesian networks software package (Netica, GeNIe, etc), and also complete a programming assignment (in any language they choose).

Study resources

Study resources we will provide for your study are:

Study resources we will provide for your study are:

- Lecture notes including required readings;
- Exercises after each topic;
- Supplementary material;
- This Unit Guide outlining the administrative information for the unit;
- The FIT4009 unit web site on MUSO, where resources outlined above will be made available.

Assessment

Overview

Assignment and Examination, relative weight depending on topic composition. When no exam is given students will be expected to demonstrate their knowledge by solving practical problems and maybe required to give an oral report. This variability is designed to give flexibility to the lecturer to decided the most appropriate form of examination for a given choice of topics.

Faculty assessment policy

To pass a unit which includes an examination as part of the assessment a student must obtain:

- 40% or more in the unit's examination, and
- 40% or more in the unit's total non-examination assessment, and
- an overall unit mark of 50% or more.

If a student does not achieve 40% or more in the unit examination or the unit non-examination total assessment, and the total mark for the unit is greater than 50% then a mark of no greater than 49-N will be recorded for the unit.

Homework Exercises (60%)

Each topic will have two associated homework exercises/assignments. The nature of these vary according to the topic. Each will be worth 15% of the final mark, giving a total of 15x4=60%.

- Topic 1: NL and UM in Assistive Technologies Homework
- Topic 2: Bayesian Networks Homework

Assignment tasks

Assignment coversheets

Assignment coversheets are available via "Student Forms" on the Faculty website:
http://www.infotech.monash.edu.au/resources/student/forms/
You MUST submit a completed coversheet with all assignments, ensuring that the plagiarism declaration section is signed.

Assignment submission and return procedures, and assessment criteria will be specified with each assignment.

Assignment submission and preparation requirements will be detailed in each assignment specification. Submission must be made by the due date otherwise penalties will be enforced. You must negotiate any extensions formally with your campus unit leader via the in-semester special consideration process: http://www.infotech.monash.edu.au/resources/student/equity/special-consideration.html.

- **Assignment task 1**

  Title:
  NL&UM: Dialogue system for a robotic agent
  Description:
  Weighting:

15%
Criteria for assessment:
Will be included in handout.
Due date:

- **Assignment task 2**

Title:
NL&UM: Document retrieval system
Description:
Weighting:
15%
Criteria for assessment:
Due date:

- **Assignment task 3**

Title:
BN Modelling
Description:
Weighting:
15%
Criteria for assessment:
See assignment handout
Due date:

- **Assignment task 4**

Title:
BN Programming assignment
Description:
Weighting:
15%
Criteria for assessment:
Due date:

Examination

-
Weighting:
40%
Length:
3 hours
Type (open/closed book):
Open book
Electronic devices allowed in the exam:
calculators

See Appendix for End of semester special consideration / deferred exams process.

Due dates and extensions

Please make every effort to submit work by the due dates. It is your responsibility to structure your study program around assignment deadlines, family, work and other commitments. Factors such as normal work pressures, vacations, etc. are not regarded as appropriate reasons for granting extensions. Students are advised to NOT assume that granting of an extension is a matter of course.

Students requesting an extension for any assessment during semester (eg. Assignments, tests or presentations) are required to submit a Special Consideration application form (in-semester exam/assessment task), along with original copies of supporting documentation, directly to their lecturer within two working days before the assessment submission deadline. Lecturers will provide specific outcomes directly to students via email within 2 working days. The lecturer reserves the right to refuse late applications.

A copy of the email or other written communication of an extension must be attached to the assignment submission.

Refer to the Faculty Special consideration webpage or further details and to access application forms: http://www.infotech.monash.edu.au/resources/student/equity/special-consideration.html

Late assignment

Assignments received after the due date will be subject to a penalty of 5% per day, including weekends. Assignments received later than one week (seven days) after the due date will not normally be accepted.

Return dates

Students can expect assignments to be returned within two weeks of the submission date or after receipt, whichever is later.

Appendix

Please visit the following URL: http://www.infotech.monash.edu.au/units/appendix.html for further information about:

- Continuous improvement
- Unit evaluations
- Communication, participation and feedback
- Library access
- Monash University Studies Online (MUSO)
- Plagiarism, cheating and collusion
- Register of counselling about plagiarism
- Non-discriminatory language
- Students with disability
- End of semester special consideration / deferred exams