

Overview

The module consists of the following sections.

I. Intelligent Systems

In this section we give an overview of different approaches towards artificial intelligence and discuss some attempts to define intelligence. Furthermore, we present a general agent framework for studying artificial intelligence.

II. Problem Solving by Searching

Relatively simple search algorithms can be utilised to solve many problems for which some entities assert that they require intelligence for solving. We review standard, uninformed graph search algorithms and discuss in detail informed search algorithms, algorithms for playing two player board games, and constraint satisfaction problem solvers.

III. Knowledge and Reasoning

The search algorithms from II represent the problem they aim to solve in code and are essentially designed to solve a single problem. In this section we will investigate options for representing problems in a general, mathematical language and devise algorithms which can find solutions to problems presented in this language. In other words, this section is all about logic and proofs.

IV. Uncertain Knowledge and Reasoning

Logic is about facts being true or false, nothing in between. But in the real world we are hardly ever 100% certain about a fact. In this section we will introduce methods to handle uncertainty in our knowledge and discuss how to use this for reasoning and making decisions. So we'll discuss probability theory and Bayesian theory for representing uncertainty and utility theory for making decisions.

V. Machine Learning

II to III is all about algorithms and operations on representations of the real world to make a decision. These operations are predominantly based on symbol manipulation and the environment is represented with a fairly static model. In this section we consider approaches to learning how the environment works and also study non-symbolic approaches towards creating intelligent behaviour and the way the environment works can be detected; depending on how much time we have left.

Recommended Literature

The core reference book for this module is

- S. Russell, P. Norvig. Artificial Intelligence: a Modern Approach, 2nd ed. Pearson Higher Education, 2003. [sometimes called AIMA]
An extensive, detailed overview of artificial intelligence covering every aspect of the module and much more in the context of intelligent agents. Most of the course is based on material in this book.

The following books cover similar content as far as this module is concerned and can be used as alternatives:

- D. Poole, A. Mackworth, R. Goebel. Computational Intelligence: a Logical Approach. Oxford University Press, 1998. [referenced as CILA]
A detailed discussion of the material in the module in the context of logical programming.
- R. Callan. Artificial Intelligence. Palgrave Macmillan, 2003.
Another general introduction to Artificial Intelligence covering the complete material of the course.

- G. Luger. Artificial Intelligence: Structures and Strategies for Complex Problem Solving, 5th edition. Addison Wesley, 2005
A detailed, general introduction to Artificial Intelligence covering the complete material of the course.

Background Reading

Other books you may find of interest:

- S. Franklin. Artificial Minds. MIT Press, 1997.
A very good discussion of philosophical and practical issues relating to intelligent systems for non-experts as well as professional researchers.
- J. Hawkins, S. Blakeslee. On Intelligence. Times Books, 2004.
An interesting book on a comprehensive theory of intelligence based on the human brain and neuro-science.
- J. Self. Whoever Said Computers Would Be Intelligent?
A general overview and review of the subject of Artificial Intelligence.
- M. Negnevitsky. Artificial Intelligence: A Guide to Intelligent Systems, 2nd edition. Addison Wesley, 2005.
A practical guide to the core concepts of intelligent systems.
- Rich, Knight. Artificial Intelligence, 2nd ed. McGrawHill, 1993.
An older book about artificial intelligence covering all the core concepts of the module.
- P. H. Winston. Artificial Intelligence, 3rd ed. Addison Wesley, 1992.
A classic artificial intelligence text covering all the core concepts of the module.
- F. O. Karray, C. de Silva. Soft Computing and Intelligent Systems Design. Addison Wesley, 2004.
A book on more advanced concepts of artificial intelligence.

WWW Sites

- Module site: <http://www.langbein.org/teaching/ai/>
- AIMA site: <http://aima.cs.berkeley.edu/>
- CILA site: <http://www.cs.ubc.ca/spider/poole/ci.html>

Tutorials

For each section of the module there will be some exercise sheets which will be discussed in the tutorials. You are expected to work on these exercises *before* the tutorials, such that you can answer questions about the exercises, discuss the topics and ask question about what you did not understand, etc. You will also have the opportunity to present your solution to some of the exercises (highly recommended for exam preparation). Some of the exercises may also be solved in small groups during the tutorials.

Programming Environment

In principle you can use any language on any platform to implement algorithms, etc. (in particular for the coursework). The emphasis of the module is on the concepts of the algorithms rather than the detailed implementation or a particular programming language. Programs discussed in the module, etc. are written for Linux (but may work on other platforms).