

T-79.5102

Special Course in Computational Logic (4 cr)

Autumn 2008

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Practical Arrangements

Lectures: Tuesdays, 14–16, room TB353

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Tutorials: Wednesdays, 15–16, room TB353

Course assistant: M.Sc.(Tech.) Antti Hyvärinen, office TB358, tel. 09 451 4774, email @tkk.fi

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Agenda for Autumn 2008

- Contents according to the TKK Study Programme 2008–2009:
Knowledge representation, reasoning, and decision-making.
Automated reasoning.
- In Autumn 2008, the course concentrates on *agent-based computing* in which *software agents* are used as natural building blocks of complex software systems.
- From the methodological point of view, the course provides an introduction to using *Bayesian networks* for the representation of probability distributions and as the basis of uncertain reasoning.

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Course Contents

➤ Lectures

1. Design of intelligent agents:
structure, functionality, properties of environments
2. Conditional probabilities and the Bayes' rule
3. Decision-making on the basis of uncertain information
4. Decision and utility theory
5. Optimization of behavior
6. Learning agents and inductive learning

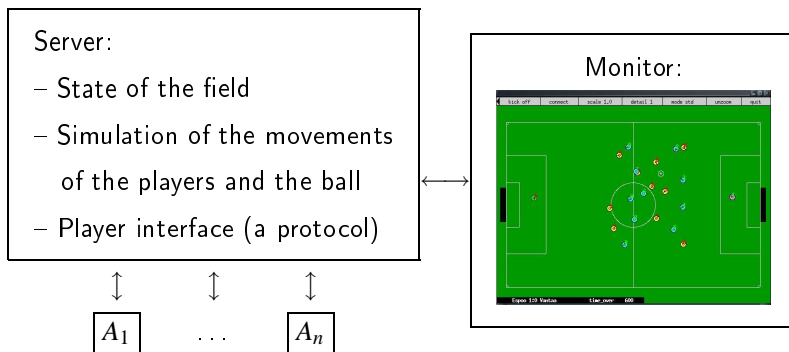
➤ Project Work

The simulation league of RoboCup (<http://www.robocup.org/>)

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Project Work

- The goal is to implement a soccer playing agent, or a team of agents, for the simulation league of RoboCup.
- Compatibility with the RoboCup-server/monitor is required.



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Course Material

- The course book
Stuart Russell and Peter Norvig:
Artificial Intelligence: A Modern Approach
Second edition, Prentice Hall, 2003.
Chapters 2, 13–19, to the extent presented at lectures.
- Lecture notes
- Problems from tutorials and their solutions
- RoboCup documentation

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Project Work (Cont'd)

- The protocol between the server and players defines:
 1. Actions available to players and action parameters
 2. Pieces of information that can be obtained from percepts
- Given a sequence of percepts, a player is supposed to build/update its own view of the world and decide about the next action to take.
- You are not supposed to implement the protocol, i.e., use one of existing libraries in your preferred programming language.
- An existing implementation can also be used as a starting point.
- The project is done in groups of 1–3 students and the *project plan* must be first approved by the course assistant.

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Tentative Schedule

Period I (Lectures 1–7)

- **Sep 9:** Intelligent agents
- **Sep 10:** (Continued)
- **Sep 23:** Uncertainty
- **Sep 30:** Probabilistic reasoning
- **Oct 7:** (Continued)
- **Oct 14:** Probabilistic reasoning over time
- **Oct 21:** Making simple decisions

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Tentative Schedule

Period II (Lectures 8–12)

- **Nov 4:** Making simple decisions (continued)
- **Nov 11:** Making complex decisions
- **Nov 18:** (Continued)
- **Nov 25:** Learning from observations
- **Dec 2:** Logical and Bayesian learning
- **Dec 9:** (In reserve)

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General Objectives

- In-depth understanding of the agent model
- Basics of probability theory and Bayesian networks
- Practical modelling skills
- Familiarity with some applications of agent technology
- Hands-on experience on implementing software agents

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Formal Course Requirements

Course credits (4 cr) are granted on the following basis:

1. An **examination** is passed with a grade 1–5.
 - The first exam is arranged on
the 18th of December, 2008, 13–16, in hall T1.
 - Additionally, two other exams are arranged **on demand** in 2009.
2. The **project work** is passed (with distinction).
 - Implementing a soccer playing agent in a simulated environment.
 - Participation in a cup among the teams implemented by groups.
 - Grading on the scale *failed*, *passed*, and *passed with distinction*.

The grade for the exam determines the **course grade** except that grades 1–4 are raised by one if the project is passed with distinction.

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Roots of Agent-Based Systems

- Object-oriented programming
- Artificial intelligence
- Distributed computing
- Game theory
- Economics

S. Russell & P. Norvig:

An agent is anything that can be viewed as perceiving its environment through sensors and acting upon that environment through actuators.

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Themes Related to Agents

- Communication and interaction between agents
- Coordination and negotiation
- Intelligence and rational behaviour
- Knowledge representation and reasoning
- Distributed heterogeneous databases, ontologies
- Cooperation, delegation, distributed services
- Trading mechanisms
- Mutual trust and information security

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Applications

- Desktop
Operating systems, application programs
- Internet
Information retrieval, filtering, digital services, mobile applications, digital libraries, electronic trade, auctions
- Intranet
Workflow management, automation, resource management, network management, distributed databases, personal digital assistants

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