Course Specifications
Valid as from the academic year 2016-2017

Course size

<table>
<thead>
<tr>
<th>Credits</th>
<th>Study time</th>
<th>Contact hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.0</td>
<td>180 h</td>
<td>52.5 h</td>
</tr>
</tbody>
</table>

Course offerings and teaching methods in academic year 2016-2017

A (semester 1)
- lecture: 37.5 h
- seminar: 15.0 h
- seminar: practical PC room classes: 7.5 h

Offered in the following programmes in 2016-2017

- Bridging Programme Master of Science in Industrial Engineering and Operations Research: 6 crds, offering A
- Master of Science in Electrical Engineering (main subject Communication and Information Technology): 6 crds, offering A
- Master of Science in Business Engineering (main subject Data Analytics): 6 crds, offering A
- Master of Science in Business Engineering (main subject Finance): 6 crds, offering A
- Master of Science in Business Engineering (main subject Operations Management): 6 crds, offering A
- Master of Science in Biomedical Engineering: 6 crds, offering A
- International Master of Science in Biomedical Engineering: 6 crds, offering A
- Master of Science in Biomedical Engineering: 6 crds, offering A
- Master of Science in Industrial Engineering and Operations Research: 6 crds, offering A
- Master of Science in Computer Science Engineering: 6 crds, offering A
- Master of Science in Computer Science Engineering: 6 crds, offering A
- Master of Science in Industrial Engineering and Operations Research: 6 crds, offering A

Teaching languages
- English

Keywords
- knowledge representation, reasoning under uncertainty, Bayesian networks, Hidden Markov Models, belief propagation, deep learning, rational agents and rational decisions, visual intelligence.

Position of the course
- The course gives an overview of the principles and modern approaches in artificial intelligence. The focus is on intelligent agents, reasoning under uncertainty, and making rational decisions.

Contents
- Solving problems: Search (graph-based, local, informed), Game playing, Constraint satisfaction.
- Knowledge representation and reasoning: Logical agents, First-order logic, Resolution, Semantic networks, Planning and Acting.
Inference, Belief propagation, Viterbi algorithm, MCMC samplers, Probabilistic reasoning over time.

- Learning: Decision Tree Learning, Inductive learning (classification), Artificial Neural Networks, Deep learning (autoencoders, deep belief networks).
- Perception: Sensory processing in the brain, Computational models of visual perception, Visual intelligence.

**Initial competences**
Principles of predicate logic and probability theory

**Final competences**
1. Know and apply search strategies for complex problem solving.
2. Know and apply principles of logic deduction and reasoning, and techniques for action planning.
4. Know and apply principles of reasoning under uncertainty, using Bayesian networks and other graphical models, including Hidden Markov Models and dynamic networks.
5. Know and apply basic principles of inductive learning and reasoning.
6. Make rational decisions by combining probability and utility theories.
7. Understand basic elements of computational models of sensor processing and intelligent visual perception.

**Conditions for credit contract**
Access to this course unit via a credit contract is determined after successful competences assessment.

**Conditions for exam contract**
This course unit cannot be taken via an exam contract.

**Teaching methods**
Lecture, seminar, seminar: practical PC room classes

**Extra information on the teaching methods**
Classroom lectures; Classroom problem solving sessions; Computer-assisted problem solving

**Learning materials and price**

**References**

**Course content-related study coaching**

**Evaluation methods**
end-of-term evaluation and continuous assessment

**Examination methods in case of periodic evaluation during the first examination period**
Written examination, report

**Examination methods in case of periodic evaluation during the second examination period**
Written examination, report

**Examination methods in case of permanent evaluation**
Report

**Possibilities of retake in case of permanent evaluation**
Examination during the second examination period is possible in modified form

**Extra information on the examination methods**
During examination period: written exam partly closed-book (theory), partly open-book (problem solving)
During semester: graded lab session reports (3)

**Calculation of the examination mark**

(Approved)
Written exam counts for 2/3 and lab session work for 1/3 of the final grade, provided that both parts are above given minimum requirements as follows:
• written exam is at least 9/20 and its both parts (theory and problem solving) are above 8/20;
• the average of lab session reports is at least 9/20.
If these conditions are not met and the total score is still 10/20 or above, the final grade will be brought to the highest non-passing grade (9/20).
Failing to participate in one or more parts of the evaluation results in the non-passing final grade.