GHENT UNIVERSITY

Course Specifications

Valid in the academic year 2023-2024

Artificial Intelligence (E016330)

Course size *(nominal values; actual values may depend on programme)*

Credits 6.0 **Study time 180 h**

Course offerings and teaching methods in academic year 2023-2024

A (semester 1)	English	Gent	seminar lecture
B (semester 1)	Dutch	Gent	

Lecturers in academic year 2023-2024

Pizurica, Aleksandra	TW07	lecturer-in-charge

Offered in the following programmes in 2023-2024	crdts	offering
Master of Science in Electrical Engineering (main subject Communication and Information Technology)	6	A
Master of Science in Business Engineering(main subject Data Analytics)	6	A
Master of Science in Business Engineering (Double Degree)(main subject Operations Management)	6	A
Master of Science in Business Engineering(main subject Operations Management)	6	A
Master of Science in Biomedical Engineering	6	B
Master of Science in Biomedical Engineering	6	A
Master of Science in Computer Science Engineering	6	A
Exchange Programme in Computer Science (master's level)	6	A

Teaching languages

English, Dutch

Keywords

knowledge representation, reasoning under uncertainty, Bayesian networks, Hidden Markov Models, belief propagation, deep learning, rational agents and rational decisions, Markov decision processes, reinforcement learning, computer vision

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

- Intelligent agents, task environment, agent design (reflex, goal-based, utility-based)
- Solving problems by searching: Tree- and graph-search strategies, informed and local search
- Game playing: Game trees, minimax and expectimax strategies
- Constraint satisfaction problems
- Knowledge representation and reasoning: Logical agents, Resolution, Planning and Acting
- Reasoning under uncertainty: Bayesian networks, Markov Random Fields, Inference in graphical models, Belief propagation, Viterbi algorithm, MCMC samplers
- Probabilistic reasoning over time: Hidden Markov Models, Kalman filtering, Dynamic Bayesian Networks, Particle filtering
- Machine Learning: Inductive learning, Naive Bayesian Classifier, Decision Tree Learning, Artificial Neural Networks
- Deep learning: Convolutional neural networks (CNN), autoencoders, deep belief networks
- Rational decisions: Utility and preferences, Maximizing expected utility, Value of information, Decision networks
- Making complex decisions: Markov Decision Processes (MDP)

- Reinforcement learning: Temporal difference learning, Q-learning, policy search
- Advanced topics: applications in machine vision and robotics

Initial competences

Principles of probability theory and basics of predicate logic

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.
3 Structure and represent knowledge with predicates, rules, description logic.
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 and apply basic principles of reinforcement learning and understand how these lead to the design of rational autonomous agents.

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

Seminar, Lecture

Extra information on the teaching methods

Classroom lectures; Classroom problem solving sessions; Computer-assisted problem solving

Learning materials and price

Slides with notes available (free of charge) on the electronic learning environment.
Recommended book: S. Russel and P. Norvig, "Artificial Intelligence A Modern Approach" (2020)

References

- S. Russel and P. Norvig: Artificial Intelligence, A Modern Approach. Fourth Edition, Prentice Hall, 2020.
- I. Goodfellow, Y. Bengio and A. Courville: Deep Learning. MIT Press, 2017.

Course content-related study coaching

Assessment moments

end-of-term and continuous assessment

Examination methods in case of periodic assessment during the first examination period

Written assessment, Assignment

Examination methods in case of periodic assessment during the second examination period

Written assessment, Assignment

Examination methods in case of permanent assessment

Assignment

Possibilities of retake in case of permanent assessment

examination during the second examination period is possible in modified form

Extra information on the examination methods

During examination period (PE): written exam, closed book, closed notes except crib sheet on one A4-size paper.
During semester (NPE): graded practicum reports and homework assignments.
Practicums are organized as group work and involve programming in Python. Homework assignments are individual computer exercises. It will not be assumed that you have previous experience with Python, but you will need to learn the basics rapidly and the necessary support will be provided for this including an introductory lab session.

Calculation of the examination mark

Weighting:
- Exam: 60%

- Practicum reports: 30%
- Homework: 10%

In order to be able to pass this course, the minimum score of 9/20 is required both for PE (exam) and NPE (weighted average of the scores for practicum reports and homework assignments). If these conditions are not met and the total score is still 10/20 or above, the final grade will be brought to 9/20. If the exam score is below 10/20, the maximum obtainable final grade is 10/20 regardless of the total score.

Failing to participate in one or more parts of the evaluation results in the non-passing final grade.