COURSE DESCRIPTION CARD - SYLLABUS

Course name
Methods of Artificial and Computational Intelligence

Course

Field of study
Computing
Area of study (specialization)
Intelligent Information Technologies
Level of study
Second-cycle studies
Form of study
full-time

Year/Semester
1/1
Profile of study
general academic
Course offered in
Polish
Requirements
compulsory

Number of hours

Lecture
30
Laboratory classes
30
Other (e.g. online)
Tutorials
Projects/seminars

Number of credit points

5

Lecturers

Responsible for the course/lecturer:
Bartosz Wieloch, PhD

Responsible for the course/lecturer:

Prerequisites

Student starting this course should have basic knowledge in artificial intelligence, mathematics, in particular in the theory of probability, and programming skills. They should also be capable of continuous learning and knowledge acquisition from selected sources.

Course objective

The objective for this course it to give the students a knowledge about selected methods of artificial intelligence and computational intelligence in the field of agent systems, games, state estimation

algorithms, uncertainty modeling using Bayesian networks, probabilistic reasoning, Markov decision problems, and reinforcement learning.

Developing students' ability to solve problems that require intelligent solutions.

Course-related learning outcomes

Knowledge

1. Has organized and well-formed theoretical general knowledge regarding artificial and computational intelligence algorithms.

2. Has advanced detailed knowledge regarding selected IT issues like Markov decision problems, reinforcement learning or state estimation algorithms.

3. Has knowledge about development trends and the most important achievements in artificial intelligence intelligence.

4. Knows advanced methods, techniques and tools used to solve computational intelligence problems

Skills

1. Can apply artificial and computational intelligence methods to solve hard problems.

2. Can formulate and test hypotheses related to simple research problems of computational intelligence.

3. Is able to solve complex computational intelligence tasks containing a research component

Social competences

1. Understands that in the field of artificial and computational intelligence new methods and algorithms are constantly being developed.

2. Understands the importance of using the latest knowledge in the field of artificial and computational intelligence in solving research and practical problems.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Formative assessment:

a) lectures: on the basis of answers to questions about the material discussed in lectures,

b) laboratories: based on an assessment of the current progress in the implementation of tasks.

Summative assessment:

a) lectures: assessment of the knowledge and skills demonstrated during the test consisting of several test questions or short tasks. Exceeding 50% of the points allows to obtain a satisfactory grade.

b) in the field of laboratories: assessment of the implementation of laboratory exercises, oral answers and reports prepared partly during the classes and partly after their completion.

Programme content

Agent systems: agent-environment interaction, environment features, agent types.

State estimation algorithms: localization problem, histogram filter, Kalman filter, particle filter.

Markov decision problems: sequential decision problems, optimal policy, utility of state sequence, Bellman system of equations, value iteration algorithm, policy iteration algorithm.

Reinforcement learning: passive and active learning, direct value estimation, adaptive dynamic programming, temporal difference learning, exploration-exploitation tradeoff, Q-learning.

Computational intelligence in games: monte carlo tree search, UTC.

Bayesian networks: practical applications, mathematical foundations, Bayesian rule, inference algorithms.

Teaching methods

Lectures: multimedia presentation, illustrated with examples given on the board.

Laboratory: presentation illustrated with examples given on the blackboard and carrying out the tasks given by the teacher - practical exercises.

Bibliography

Basic

1. "Artificial Intelligence: A Modern Approach", Stuart J. Russell and Peter Norvig, 2009

2. "Reinforcement Learning: An Introduction", Richard S. Sutton and Andrew G. Barto, 2018 (online: http://incompleteideas.net/book/the-book.html)

Additional

1. "Knowledge-Free and Learning-Based Methods in Intelligent Game Playing", J. Mandziuk, Springer, 2000

2. "Computational Intelligence: An Introduction", Andries Engelbrecht. Wiley & Sons, Second Edition, 2007

3. "Systemy uczące się", P. Cichosz, WNT, 2000

Breakdown of average student's workload

	Hours	ECTS
Total workload	125	5
Classes requiring direct contact with the teacher	60	2.5
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) [1]	65	2.5

[1] delete or add other activities as appropriate