Elements of artificial intelligence - course description

General information

Course name	Elements of artificial intelligence
Course ID	11.4-WE-INFP-EoAI-Er
Faculty	Faculty of Computer Science, Electrical Engineering and Automatics
Field of study	Computer Science
Education profile	academic
Level of studies	First-cycle Erasmus programme
Beginning semester	winter term 2021/2022

Course information

Semester	4
ECTS credits to win	6
Course type	obligatory
Teaching language	english
Author of syllabus	• dr hab. inż. Marek Kowal, prof. UZ • prof. dr hab. inż. Józef Korbicz

Classes forms

The class form	Hours per semester (full-time)	Hours per week (full-time)	Hours per semester (part-time)	Hours per week (part-time)	Form of assignment
Lecture	30	2	-	-	Exam
Laboratory	30	2	-	-	Credit with grade

Aim of the course

- Familiarize students with the concept of artificial neural networks and their learning algorithms,
- Familiarize students with the concept of fuzzy sets and fuzzy inference mechanism,
- Familiarize students with different graph search strategies.
- Teach students to solve practical engineering problems using artificial intelligence methods.

Prerequisites

Principles of programming, Algorithms and data structures

Scope

Artificial neural networks.Biological neuron. Mathematical model of a neuron. Simple perceptron. Perceptron learning rule. Perceptron limitations. Models of neurons and their properties. Adaline and Madaline architectures. Multilayer neural networks. Learning of single-layer neural network. Learning of multi-layer neural network. Backpropagation algorithm. Models of dynamic neurons. Dynamic neural networks. Sample applications of artificial neural networks.

Fuzzy sets and neuro-fuzzy systems. Fuzzy sets and fuzzy logic. Operations on fuzzy sets. Fuzzy inference. Fuzzy rules. Neuro-fuzzy structures and learning algorithms. Sample applications of fuzzy systems.

Graph search strategies. The breadth-first search algorithm. The depth-first search algorithm. The A* search algorithm. Heuristic functions. Memory and time complexity. The minimax algorithm. The alpha-beta pruning algorithm.

Teaching methods

Lecture, teaching laboratory classes.

Learning outcomes and methods of theirs verification

Outcome description	Outcome symbols	Methods of verification	The class form
Student is aware of the computational complexity of learned AI methods.		• an exam - oral, descriptive, test and other	• Lecture
Student can name artificial neuron types and characterize their properties.		• an exam - oral, descriptive, test and other	• Lecture
Student can name and characterize fuzzy and neuro-fuzzy systems.		• an exam - oral, descriptive, test and other	• Lecture
Student is able to implement and use fuzzy and neuro-fuzzy systems to solve engineering problems.		• a test with score scale • an evaluation test • an observation and evaluation of activities during the classes	• Laboratory

Outcome description	Outcome symbols	Methods of verification	The class form
Student can creatively use learned methods of AI in order to solve new problems.		• activity during the classes • carrying out laboratory reports	• Laboratory
Student can name and define uninformed and heuristic graph search algorithms.		• an exam - oral, descriptive, test and other	• Lecture
Student is able to design and implement a program for heuristic search.		• a test with score scale • an evaluation test • an observation and evaluation of activities during the classes	• Laboratory
Student is able to implement and use artificial neural networks to solve engineering problems.		• a test with score scale • an evaluation test • an observation and evaluation of activities during the classes	• Laboratory

Assignment conditions

Lecture - the passing criterion is a sufficient mark from the final test.
Laboratory - the passing criterion are positive marks for laboratory exercises and tests.
Final mark components = lecture: 50% + teaching laboratory: 50%

Recommended reading

1. Russell S., Norvig P.: Artificial Intelligence: A Modern Approach, Prentice Hall, 2009.
2. Bishop C.M., Hinton G. : Neural Networks for Pattern Recognition, Clarendon Press, Oxford, 1995.
3. Edelkamp S., Schroedl S.: Heuristic Search: Theory and Applications, Morgan Kaufmann, 2012.
4. Zimmermann H-J.: Fuzzy Set Theory and Its Applications, Springer, 2006.

Further reading

1. Bishop C.: Pattern Recognition and Machine Learning, Springer Verlag, 2006.
2. Goodfellow I., Bengio Y., Courville A.: Deep Learning, MIT Press, 2016.
3. Ross. T.: Fuzzy Logic with Engineering Applications, Wiley, 2004.

Notes

Modified by prof. dr hab. inż. Józef Korbicz (last modification: 30-08-2021 14:32)