GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Artificial Intelligence in Automatic Control, PG_00047568		
Field of study	Automatic Control, Cybernetics and Robotics		
Date of commencement of studies	October 2024	Academic year of realisation of subject	2025/2026
Education level	first-cycle studies	Subject group	Obligatory subject group in the field of study Subject group related to scientific research in the field of study
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	2	Language of instruction	Polish
Semester of study	4	ECTS credits	3.0
Learning profile	general academic profile	Assessment form	exam
Conducting unit	Department of Decision Systems and Robotics -> Faculty of Electronics, Telecommunications and Informatics		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Tomasz Białaszewski	
	Teachers	dr inż. Tomasz Białaszewski	

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	30.0	0.0	0.0	0.0	0.0	30

E-learning hours included: 0.0

Learning activity and number of study hours

Learning activity	Participation in didactic classes included in study plan	Participation in consultation hours	Self-study	SUM
Number of study hours	30	3.0	42.0	75

Subject objectives

The lecture provides tha basic knowledge of artificial intelligence methods

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_W01] knows and understands, to an advanced extent, mathematics necessary to formulate and solve simple issues related to the field of study	Student knows and can apply basic methods of artificial intelligence	[SW3] Assessment of knowledge contained in written work and projects
[K6_W05] Knows and understands, to an advanced extent, methods of supporting processes and functions, specific to the field of study	Student knows and can apply basic methods of artificial intelligence	[SW3] Assessment of knowledge contained in written work and projects

Subject contents

1. Organization of the course and assessment criteria 2. Definitions of AI, overview of methods and applications 3. Philosophy of AI 4. Graph searching methods: breadth first, depth-first, Dijkstra, A* 5. Graph searching methods: ant colony optimization 6. AND/OR graph searching methods: introduction 7. AND/OR graph searching methods: minimax and alpha-beta pruning methods 8. AND/OR graph searching methods: computer chess 9. Knowledge representation and reasoning: introduction to first order logic 10. Knowledge representation and reasoning: resolution 11. Knowledge representation and reasoning: examples and refinements 12. Knowledge representation and reasoning: frames and description logic 13. Fuzzy inference systems: Mamdani and Sugeno inferences 14. Bayesian networks: overview and types of applications 15. Bayesian networks: methods of computing of probabilities 16. Machine learning: overview of types of learning, algorithms of learning and learned structures 17. Machine learning: gradient and Levenberg Marquardt algorithms 18. Machine learning: random search and simulated annealing algorithms 19. Machine learning: evolutionary algorithms 20. Machine learning: genetic programming 21. Machine learning: particle swarm optimization 22. Machine learning: artificial immune system algorithms 23. Machine learning: artificial neural networks, structures and basic properties 24. Machine learning: artificial neural networks - supervised learning 25. Artificial neural networks - recurrent networks 26. Machine learning: learning of fuzzy systems (ANFIS) 27. Machine learning: decision trees construction 28. Machine learning: generalization problems, VC dimension and Vapnik inequality 29. Reinforcement learning: overview and types of multistage decision processess 30. Reinforcement learning: reinforcement learning algoithms 31. Unsupervised learning: clustering algorithms and self-organizing features maps. 32 Elements of deep learning: autoencoding, convolutional networks.

Prerequisites and co-requisites

Elementary knowledge of Boolean algebra, probabilty theory, calculus, and basics in computer programming

<table>
<tr><td>Assessment methods and criteria</td><td colspan="3"><table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>Written exam (midterm and final exams)</td><td>50.0%</td><td>100.0%</td></tr>
</table></td></tr>
<tr><td rowspan="3">Recommended reading</td><td>Basic literature</td><td colspan="2">Russel S., Norvig P.: Artificial Intelligence, Prentice-Hall, London. 2009</td></tr>
<tr><td>Supplementary literature</td><td colspan="2">Nielsen M.:Neural networks and deep learning, 2019

neuralnetworksanddeeplearning.com</td></tr>
<tr><td>eResources addresses</td><td colspan="2">Adresy na platformie eNauczanie:</td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td colspan="3">What is relation between Turing test and the Searle's 'chinese room' model? Show the leaves in a given tree which value has no influence on the final result of alpha-beta method. Using resolution refutation algorithm proof some example taska. Compute output value of some simple fuzzy system. Compute the some conditional probability in a given Bayesian network. Compute and plot one step of the steepest descent method in a shown contour of a given function. Plot a one step trajectories of a few points moving according to the PSO method. Compute the weights of an ANN classifying few given training poits. Explain the two stages during training of ANFIS systems. Construct a simple decision tree using ID3 algotithm. Explain the Vapnik inequality. Plot a trajectory of clusters in a simple example of the k-means method. Comput the values of Q in a simple deterministic example of a multistages process.</td></tr>
<tr><td>Work placement</td><td colspan="3">Not applicable</td></tr>
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