GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Artificial intelligence, PG_00064056		
Field of study	Technical Physics		
Date of commencement of studies	October 2025	Academic year of realisation of subject	2026/2027
Education level	first-cycle studies	Subject group	Optional subject group 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	assessment
Conducting unit	Division of Theoretical Physics and Quantum Informaton -> Institute of Physics and Applied Computer Science -> Faculty of Applied Physics and Mathematics -> Faculties of Gdańsk University of Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Paweł Syty	
	Teachers		

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	30.0	0.0	0.0	0.0	15.0	45

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	45	4.0	26.0	75

Subject objectives

The aim of the course is to familiarize students with the scope of research and basic methods of artificial intelligence, including automatic reasoning, two-player game strategies, evolutionary algorithms, machine learning, neural networks, and cellular automata, along with their principles of operation and applications.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_U07] presents facts within the scope of physics and other scientific disciplines in a clear manner	The student has knowledge of artificial intelligence and is able to present it in a popular way.	[SU2] Assessment of ability to analyse information [SU5] Assessment of ability to present the results of task
[K6_W02] has systematized knowledge of the basics of physics, including mechanics, thermodynamics, electricity and magnetism, optics, atomic and particle physics, solid-state physics, nuclear and elementary particle physics	The student has structured knowledge of artificial intelligence and is able to apply it in practice.	[SW1] Assessment of factual knowledge [SW2] Assessment of knowledge contained in presentation
[K6_U08] can prepare written works and speeches in Polish and English, concerning detailed issues of physics and related fields, and scientific disciplines	The student is able to prepare a presentation on a selected topic related to artificial intelligence issues.	[SU5] Assessment of ability to present the results of task [SU1] Assessment of task fulfilment [SU2] Assessment of ability to analyse information
[K6_W01] understands the importance of physics and its applications in connection to civilization	The student understands the importance of artificial intelligence methods in today's world.	[SW1] Assessment of factual knowledge [SW2] Assessment of knowledge contained in presentation

Subject contents	Course content – lecture 1. The importance of intelligence. Natural and artificial intelligence. The scope of research into artificial intelligence. 2. Inference. The syntax and semantics of the language of logic. Construction of automated reasoning. 3. Language PROLOG inference system as an example, the realization of the principle of automatic inference, sample predicates. PROLOG as a declarative language. 4. Genetic algorithms. Encoding function adaptation, mating, mutation. Applications of genetic algorithms to solve NP problems. 5. Fuzzy logic. The role of imperfect knowledge in the inference. Bayesian inference. 6. Inference as the task of searching space. A review of selected strategies search space: search in depth and breadth of the growth method, random walk, simulated annealing. 7. Doubles game strategies. MINMAX algorithm and alpha-beta pruning. 8. Inductive inference. Discussion of conditional attribute properties. The principle of learning from the teacher. Error function. The problem of generalization. Role trenującego and test set. 9. Methods for construction of decision trees. 10. Machine learning and Neural Networks. The problem of multilayer perceptron learning. 11. Recursive neural networks - Hopfield network, Boltzmann machine. Self-organizing maps - Kohonen networks. 12. With reinforcement learning as a method of approximation of functions. Discussion of features. 13. Selected applications of neural networks. 14. Introduction to cellular automata. Gödel"s theorem. Turing machine. 15. Applications of artificial intelligence in the media. Image recognition, speech and speakers. Course content – seminar As part of the project, students develop topics directly related to the lecture subject matter. Some topics are purely theoretical, while others require programming. Examples of topics to be developed: - Expert systems. - Artificial intelligence in the automotive industry. - Artificial intelligence in computer games. - Programming in Prolog. Application of the language to solving logical tasks. - Combating spam using a Bayesian classifier. - Artificial intelligence - opportunities and threats.

	- Neural networks in practice. - Modeling traffic and gas dispersion using cellular automata. - Kalman filtering. - Gödel's theorem.
Prerequisites and co-requisites	

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Presenting a talk	50.0%	40.0%
Interview	50.0%	60.0%

Recommended reading

Basic literature	Mordechai Ben-Ari, Mathematical Logic for Computer Science, 3rd ed., Springer, 2012 Aurélien Géron, Hands-On Machine Learning with Scikit-Learn, Keras & TensorFlow, 3rd ed., OReilly, 2022 Tom M. Mitchell, Machine Learning, McGraw-Hill, 1997 Aurélien Géron, Hands-On Machine Learning with Scikit-Learn, Keras & TensorFlow, 3rd ed., OReilly, 2022 David E. Goldberg, Genetic Algorithms in Search, Optimization, and Machine Learning, Addison-Wesley, 1989
Supplementary literature	U. Nilsson, J. Maluszynski, Logic, Programming and Prolog (2nd ed.), John Wiley & Sons Ltd, NY, 2000 Simon Haykin, Neural Networks and Learning Machines, 3rd ed., Pearson, 2009
eResources addresses	
Example issues/ example questions/ tasks being completed	Lecture: Methods of teaching neural networks. Seminar: Application of the Prolog language to solving logical tasks.
Practical activites within the subject	Not applicable

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