GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Artificial Intelligence Methods, PG_00038279		
Field of study	Automation, Robotics and Control Systems		
Date of commencement of studies	October 2025	Academic year of realisation of subject	2025/2026
Education level	second-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	Part-time studies	Mode of delivery	at the university
Year of study	1	Language of instruction	Polish
Semester of study	2	ECTS credits	3.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Department Of Control Engineering -> Faculty Of Electrical And Control Engineering -> Wydziały Politechniki Gdańskiej		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Krzysztof Armiński	
	Teachers		

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	20.0	0.0	10.0	0.0	0.0	30

E-learning hours included: 0.0

Adresy na platformie eNauczanie:

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	5.0	40.0	75

Subject objectives

The aim of the course is to introduce students to the practical application of neural networks and evolutionary algorithms. Students will learn to train neural networks using the backpropagation algorithm and apply genetic algorithms, adapting them to various problems.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_W05] has knowledge of artificial intelligence computing techniques, inference, learning and solution-finding methods in algorithmic terms applied to automation and robotics systems	The student knows the methods and algorithms of artificial intelligence used in simple problems in the field of automation.	[SW1] Assessment of factual knowledge
[K7_U08] has the necessary preparation to work in an industrial environment, carry out research, apply principles of health and safety at work	The student knows the basics of Python and can write a genetic algorithm to solve an optimization problem.	[SU1] Assessment of task fulfilment [SU4] Assessment of ability to use methods and tools

Subject contents

LECTURE: Neural networks: training of multilayer perceptrons and reinforcement learning, including task formulation, value function, and the backpropagation method. Solution space exploration using genetic algorithms (GA), covering their structure and operation, population representation, initialization, fitness function, genetic operators, and algorithm parameters. Theoretical foundations of genetic algorithms and their application to optimization problems. Fuzzy logic: representation and processing of qualitative knowledge, fuzzy sets and operations on them, fuzzy inference, fuzzy controllers, and the development of fuzzy rule bases based on numerical data.

LABORATORY EXERCISES: Implementation and analysis of the properties of an evolutionary algorithm, including the examination of a selected genetic operator. Solving a constrained optimization problem using an evolutionary method, exemplified by path optimization in a static environment.

Prerequisites and co-requisites

Knowledge of the basics of automation, familiarity with linear algebra, and programming skills.

<table>
<tr><td>Assessment methods and criteria</td><td colspan="2"><table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>RepoEvaluation of laboratory exercises</td><td>50.0%</td><td>40.0%</td></tr>
<tr><td>Colloquium</td><td>50.0%</td><td>60.0%</td></tr>
</table></td></tr>
<tr><td rowspan="3">Recommended reading</td><td>Basic literature</td><td>1. G. Luger, Artificial intelligence, Prentice Hall, 2008. 2. A. Zilouchian, M. Jamshidi, Intelligent Control Systems Using Soft Computing Methodologies, CRC Press, 2001 3. P. Cichosz, Systemy uczące się, Wydawnictwa Naukowo-Techniczne, Warszawa 2000. 4. S. Osowski, Sieci neuronowe w ujęciu algorytmicznym, Wydawnictwa Naukowo-Techniczne, Warszawa 1999. 5. J. Arabas, Wykłady z algorytmów ewolucyjnych, Wydawnictwa Naukowo-Techniczne, Warszawa 2001. 6. Andrzej Piegat, Modelowanie i sterowanie rozmyte. Exit, 1999 7. L. Rutkowski , Metody i techniki sztucznej inteligencji. Wydawnictwo Naukowe PWN, Warszawa, 2005</td></tr>
<tr><td>Supplementary literature</td><td>1. David E. Goldberg, Algorytmy genetyczne i ich zastosowania. WNT, 1995 2. D. Rutkowska, M. Piliński, L. Rutkowski, Sieci neuronowe, algorytmy genetyczne i systemy rozmyte. PWN, 1997 3. Zbigniew Michalewicz, Algorytmy genetyczne + struktury danych = programy ewolucyjne. WNT, 1999</td></tr>
<tr><td>eResources addresses</td><td></td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td colspan="2">The tasks of artificial intelligence - formal and approximate reasoning, learning from the information search space of solutions.
Fuzzy sets, operations on sets, fuzzy inference, fuzzy controller.
Neural networks, multilayer perceptron learning, learning by reinforcement.
Design and functionality of AG, the representation of the population, the population of initial adjustment function, genetic operators, parameters of the algorithm.</td></tr>
<tr><td>Work placement</td><td colspan="2">Not applicable</td></tr>
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