



Subject card

Subject name and code	MACHINE LEARNING AND NEURAL NETWORKS, PG_00069908						
Field of study	InfoBioChem						
Date of commencement of studies	February 2027		Academic year of realisation of subject		2027/2028		
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	Full-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 Teleinformation Networks -> Faculty of Electronics Telecommunications and Informatics -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor		dr inż. Bartosz Czaplewski				
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	0.0	15.0	0.0	0.0	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		5.0		25.0	75
Subject objectives	The aim of the course is to introduce students to the fundamentals of artificial intelligence, machine learning and deep learning, practical aspects of model training, and their applications.						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	[K7_K04] is ready to effectively organize their work time, including reliably meeting deadlines for completing specific tasks.		Is ready to independently plan and complete, in a timely manner, tasks involving data analysis and the application of artificial intelligence and machine learning methods.		[SK1] Assessment of group work skills [SK2] Assessment of progress of work [SK3] Assessment of ability to organize work		
	[K7_W07] has a thorough knowledge and understanding of the structure and operating principles of components and systems related to the field of study, including theories, methods, and complex relationships between them, as well as selected specific issues relevant to the curriculum InfoBioChem		Knows and understands the operating principles, structure, and interrelationships of selected methods, algorithms, and models of artificial intelligence and machine learning.		[SW1] Assessment of factual knowledge		
	[K7_U07] can apply machine learning and artificial intelligence methods to analyze large sets of biological data.		Is able to select, apply, and evaluate machine learning and artificial intelligence methods for the analysis of large datasets.		[SU1] Assessment of task fulfilment [SU2] Assessment of ability to analyse information [SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools		

Subject contents	Course content – lecture		
	<div>1. Introduction to ML in Chemistry and Microbiology - What are AI, ML, and DL? - Why does a chemist need AI? - What constitutes data in chemistry?</div> <div>2. Fundamental AI Techniques - Types of problems - Types of learning - Loss function - Backpropagation - Optimization algorithms - Activation functions - Architectures of popular models - Other machine learning models</div> <div>3. Practical Aspects of Model Training - Dataset management - Data augmentation - Evaluation metrics - Overfitting and underfitting - Methods for preventing overfitting - Batch normalization - Learning rate schedules - Hyperparameter tuning - Weight initialization - Transfer learning</div> <div>4. Applications of AI in Chemistry - Examples of real-world applications - Challenges and limitations of applying AI in chemistry - How to start working independently with AI</div>		
	Course content – laboratory		
	<div>Basic level:</div> <div>Exercise 1: Loading and Understanding the Data (2h)</div> <div>Exercise 2: Building Classification Models (3h)</div> <div>Exercise 3: Training, Validation, and Testing (3h)</div> <div>Advanced level:</div> <div>Exercise 4: AMC – Automatic Modulation Classification (7h)</div>		
Prerequisites and co-requisites			
Assessment methods and criteria			
	Subject passing criteria	Passing threshold	Percentage of the final grade
	Lecture test	50.0%	70.0%
	Laboratory report	50.0%	30.0%
Recommended reading	Basic literature		<div>Jon Krohn, Grant Beylerveld, Aglae Bassens: Uczenie głębokie i sztuczna inteligencja. Interaktywny przewodnik ilustrowany / Deep Learning Illustrated: A Visual, Interactive Guide to Artificial Intelligence, Addison-Wesley Data & Analytics Series, Helion, 2022.</div> <div>Maxim Lapan: Głębokie uczenie przez wzmacnianie. Praca z chatbotami oraz robotyka, optymalizacja dyskretna i automatyzacja sieciowa w praktyce. Wydanie II / Deep Reinforcement Learning Hands-On: Apply modern RL methods to practical problems of chatbots, robotics, discrete optimization, web automation, and more, Helion, 2022.</div> <div>Valentino Zocca, Gianmario Spacagna, Daniel Slater, Peter Roelants: Deep Learning. Uczenie głębokie z językiem Python. Sztuczna inteligencja i sieci neuronowe / Python Deep Learning, Helion, 2018.</div>
	Supplementary literature		Wojciech Jędruch: Sztuczna Inteligencja, wykład, WETI PG, 2011.
	eResources addresses		
Example issues/ example questions/ tasks being completed	Training, validation, and testing of neural networks with architecture, complexity, and purpose specified by the laboratory instructor.		
Practical activites within the subject	Not applicable		

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