

Subject card

Subject name and code	Introduction to Neural Network, PG_00155289						
Field of study	Mathematical Modeling and Data Analysis						
Date of commencement of studies	October 2024		Academic year of realisation of subject		2026/2027		
Education level	Bachelor's studies		Subject group		Obligatory subject group in the field of study		
Mode of study	full-time studies		Mode of delivery		at the university		
Year of study	3		Language of instruction		Polish		
Semester of study	6		ECTS credits		6.0		
Learning profile	academic		Assessment form		exam		
Conducting unit							
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. inż. Marek Krośnicki				
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	0.0	30.0	0.0	0.0	60
	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	60		10.0		80.0	150
Subject objectives	The aim of the course is to familiarize students with the basics of artificial neural networks and their application in machine learning, present the most important network architectures currently used, and make them aware of the limitations of models based on neural networks.						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	[MMiADL3_W09] knows and understands the basics of computational and programming techniques supporting mathematician's work and understands their limitations		knows and understands the basics of computational techniques necessary to implement selected neural networks		[SW4] test/exam - oral or written [SW2] presentation/project/paper/report		
	[MMiADL3_K03] is ready to work in a team; understands the need for systematic work on all projects that have a long-term character		is ready for teamwork; understands the need for systematic work		[SK8] observation of student's independent or team work		
	[MMiADL3_U11] knows how to arrange and analyse an algorithm in accordance with the specification and save it in the selected programming language		is able to create and analyze an algorithm while working on a project implementing a selected neural network		[SU2] presentation/project/paper/report		
	[MMiADL3_U12] can compile, run and test a self-written computer programme		can compile and run a self-written program while working on a project implementing a selected neural network		[SU2] presentation/project/paper/report		
	[MMiADL3_U10] is able to recognise problems, including practical issues, that can be solved algorithmically; can make a specification of such a problem		can recognize problems that can be solved using neural networks		[SU2] presentation/project/paper/report [SU4] test/exam - oral or written		

Subject contents	1. Introductory concepts to supervised learning and optimization - linear regression, logistic regression, gradient descent, softmax regression, cost functions, network overfitting and other method limitations. 2. Regularization and data preparation for processing. 3. Supervised neural networks: single neuron, multi-layer perceptron. 4. PINN networks (Physics informed neural networks). 5. Supervised convolutional neural networks. 6. Recurrent neural networks. 7. Elements of unsupervised learning: autodecoder networks. 8. GANN networks (Generative Adversarial Network).		
Prerequisites and co-requisites	Knowledge of probability calculus, elementary knowledge of stochastic processes.		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	exam	51.0%	25.0%
	partial projects	51.0%	75.0%
	observation of the student's attitude	100.0%	0.0%
Recommended reading	Basic literature	Uczenie maszynowe z użyciem Scikit-Learn i TensorFlow. Aurelian Geron, Helion SA, 2020 Deep Learning. Ian Goodfellow and Yoshua Bengio and Aaron Courville. MIT Press 2016. http://www.deeplearningbook.org Online Course: Machine Learning for Physicists by Florian Marquardt https://pad.gwdg.de/s/Machine_Learning_For_Physicists_2021 Studies found independently by students in scientific publications and on technical blogs regarding solving specific problems using neural networks (work on a final project)	
	Supplementary literature	N/A	
	eResources addresses		
	Example issues/ example questions/ tasks being completed		
Work placement	Not applicable		

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