



Subject card

Subject name and code	Deep neural networks for data analysis, PG_00053025						
Field of study	Data Engineering, Data Engineering						
Date of commencement of studies	October 2026	Academic year of realisation of subject			2029/2030		
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	4	Language of instruction			English		
Semester of study	7	ECTS credits			4.0		
Learning profile	general academic profile	Assessment form			exam		
Conducting unit	Department of Computer Architecture -> Faculty of Electronics Telecommunications and Informatics -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor		dr inż. Jan Cychnerski				
	Teachers		dr inż. Jan Cychnerski				
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	0.0	30.0	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		4.0		51.0	100
Subject objectives	The aim of the course is to familiarize students with the methods of deep learning for advanced data analysis. Typical areas of application of these types of methods include: image classification, speech recognition and natural language understanding.						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	[K6_U05] develops innovative solutions for data analysis and processing, using appropriate methods and tools		Student uses available deep learning tools to build, train and evaluate the performance of the selected model to solve the given problem.		[SU1] Assessment of task fulfilment [SU5] Assessment of ability to present the results of task		
	[K6_W01] identifies conditioning of the processes occurring in the analyzed systems and selects methods for solving them, using the accumulated knowledge and taking into account the mutual relations between the analyzed phenomena		Based on the analysis of the problem, the available training data, student is able to select the appropriate architecture of a deep neural network and the algorithm for learning this network.		[SW1] Assessment of factual knowledge		
	[K6_W02] demonstrates advanced preparation in methods and techniques for formulating and solving problems		Based on the analysis of training runs and other factors, student is able to select the values of training hyperparameters and pick regularization techniques in order to optimize the model.		[SW1] Assessment of factual knowledge		

Subject contents	<p>Course content – lecture</p> <ol style="list-style-type: none"> 1. Machine learning and artificial neural networks basics 2. Image data analysis with convolutional neural networks 3. Sequence analysis with recurrent neural networks 4. Natural language neural models 5. Generalization improvement techniques 6. Deep learning optimization techniques 7. Practical methodology and tips for deep learning 											
	<p>Course content – project</p> <p>Phase "0" forming two-person groups, selecting the project topic, consultation with the instructor, and obtaining approval</p> <p>Phase 1 familiarization with the problem: problem description, data inspection and preparation, and a brief review of existing solutions</p> <p>Phase 2 implementation phase: development environment setup, implementing and running a basic, non-optimized version of the solution; preparing the code for experiments.</p> <p>Phase 3 research phase: optimizing the solution, experimenting with model and learning algorithm hyperparameter settings, and evaluating the solution</p>											
Prerequisites and co-requisites	<p>Basic knowledge of linear algebra and statistics.</p> <p>Intermediate programming skills in Python.</p>											
Assessment methods and criteria	<table border="1"> <thead> <tr> <th>Subject passing criteria</th> <th>Passing threshold</th> <th>Percentage of the final grade</th> </tr> </thead> <tbody> <tr> <td>Multiple choice written test</td> <td>50.0%</td> <td>50.0%</td> </tr> <tr> <td>Project</td> <td>50.0%</td> <td>50.0%</td> </tr> </tbody> </table>			Subject passing criteria	Passing threshold	Percentage of the final grade	Multiple choice written test	50.0%	50.0%	Project	50.0%	50.0%
Subject passing criteria	Passing threshold	Percentage of the final grade										
Multiple choice written test	50.0%	50.0%										
Project	50.0%	50.0%										
Recommended reading	Basic literature	<p>Ian Goodfellow, Yoshua Bengio and Aaron Courville, Deep Learning, MIT Press, 2016, url: http://www.deeplearningbook.org/</p> <p>Michael Nielsen, Neural Networks and Deep Learning, http://neuralnetworksanddeeplearning.com/</p>										
	Supplementary literature	<p>Andrew Ng, Machine Learning Yearning, http://www.mlyearning.org/</p> <p>Tutorials on deep learning frameworks pages, such as: https://www.tensorflow.org/tutorials, http://torch.ch/docs/tutorials.html</p>										
	eResources addresses											
Example issues/ example questions/ tasks being completed	<p>Present the architecture of a convolutional neural network, show its advantages over traditional networks and describe typical applications.</p> <p>During the development of a deep learning project, a satisfactory level of training error was observed, but at the same time the testing error was unacceptable. What could be the reason for this? Consider several scenarios. Suggest ways to improve.</p>											
Practical activities within the subject	Not applicable											

Document generated electronically. Does not require a seal or signature.