Subject card

Subject name and code	Deep neural networks for data analysis, PG_00053025
Field of study	Data Engineering

Date of commencement of studies	October 2023	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	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

Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Jan Cychnerski
	Teachers	dr inż. Jan Cychnerski

Lesson types and methods of instruction	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_W01] has advanced knowledge in the field of mathematics, including mathematical analysis, algebra, geometry, probability calculus, statistics and numerical methods, necessary to formulate and solve simple tasks in the field of IT	Student knows how artificial neural network is constructed, how is trained and how it works.	[SW1] Assessment of factual knowledge
	[K6_W08] Knows the models and structure of the data mining process and their multidimensional analysis and can assess the results of such analyses	Based on analysis of available data, student is able to assess the usefulness of deep learning methods in a given problem.	[SW1] Assessment of factual knowledge
	[K6_U03] analyses problems and creates appropriate models, data structures and algorithms (including heuristic and numerical ones), assesses their computational complexity, estimates errors of the received solutions	Student uses the available deep learning tools to build / select, train and evaluate performance of the designed model to solve a chosen problem.	[SU2] Assessment of ability to analyse information [SU4] Assessment of ability to use methods and tools

Subject contents	
	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

Prerequisites and co-requisites	
	Basic knowledge of linear algebra and statistics.
	Intermediate programming skills in Python.

Assessment methods and criteria	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	Ian Goodfellow, Yoshua Bengio and Aaron Courville, Deep Learning, MIT Press, 2016, url: http://www.deeplearningbook.org/ Michael Nielsen, "Neural Networks and Deep Learning", http://neuralnetworksanddeeplearning.com/
	Supplementary literature	Andrew Ng, "Machine Learning Yearning", http://www.mlyearning.org/ Tutorials on deep learning frameworks pages, such as: https://www.tensorflow.org/tutorials, http://torch.ch/docs/tutorials.html
	eResources addresses	Adresy na platformie eNauczanie: Deep neural networks for data analysis 26/27 - Moodle ID: 42620 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=42620

Example issues/ example questions/ tasks being completed	
	Present the architecture of a convolutional neural network, show its advantages over traditional networks and describe typical applications.
	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.

Work placement	Not applicable

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