GDAŃSK UNIVERSITY OF TECHNOLOGY

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 2024	Academic year of realisation of subject	2027/2028
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] 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_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_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	
	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 27/28 - Moodle ID: 42618 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=42618

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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