



Subject card

Subject name and code	Deep Learning Architecture, PG_00054418						
Field of study	Informatics						
Date of commencement of studies	February 2023		Academic year of realisation of subject		2022/2023		
Education level	second-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	1		Language of instruction		Polish		
Semester of study	1		ECTS credits		4.0		
Learning profile	general academic profile		Assessment form		assessment		
Conducting unit	Department of Algorithms and Systems Modelling -> Faculty of Electronics, Telecommunications and Informatics						
Name and surname of lecturer (lecturers)	Subject supervisor		dr inż. Paweł Kowalski				
	Teachers		Paweł Kowalski				
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	0.0	15.0	0.0	30
	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	30		8.0		62.0	100
Subject objectives	<p>In recent years, a breakthrough in the practical use of deep learning has been made. These methods have become irreplaceable due to the volume of data that requires analysis and processing. Tasks such as image recognition or natural language processing are implemented extremely effectively. In addition, the purpose of scientific research are as abstract tasks as creating art or music.</p> <p>The aim of the course is to present theories, architectures, practical applications of deep neural networks, the results of current scientific research and potential development directions.</p>						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K7_K02] is ready to provide critical evaluation of received content and to acknowledge the importance of knowledge in solving cognitive and practical problems	Know how to translate known neural network methods on other practical problems.	[SK5] Assessment of ability to solve problems that arise in practice
	[K7_W42] Knows and understands, to an increased extent, the principles and trends in the analysis and design of local and distributed IT systems and the basics of computer modeling and computerization of complex cognitive and decision-making processes.	Knows and understands the methods of learning neural networks. He knows the problems associated with creating deep architectures of neural networks and can identify and apply methods to counteract problems.	[SW1] Assessment of factual knowledge
	[K7_U07] can apply advanced methods of process and function support, specific to the field of study	He can analyze the class of problem solved by machine learning algorithms, analyze and select data, and properly divide the training set. Is able to solve problems using various architectures of deep neural networks	[SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools
	[K7_W04] Knows and understands, to an advanced extent, the principles, methods and techniques of programming and the principles of computer software development or programming devices or controllers using microprocessors or programmable elements or systems specific to the field of study, and organisation of systems using computers or such devices	He knows the basics of neural network construction, operations performed in neural network layers, the importance of activation functions, functions used in classification and regression tasks, and is able to select the appropriate loss function. Is able to design selected elements of the neural network in selected programming packages	[SW1] Assessment of factual knowledge [SW3] Assessment of knowledge contained in written work and projects
	[K7_U42] can solve engineering and research problems including design, assessment and maintenance of information systems and applications, using experimental methods and management techniques	He understands the specificity of construction and the areas of application of different deep learning architectures. He can choose models for various problems. He can choose between building a new one and using a ready model for various problems.	[SU2] Assessment of ability to analyse information [SU3] Assessment of ability to use knowledge gained from the subject
Subject contents	1. Basics of neural networks on the example of logistic regression 2. Gradient algorithm and methods for optimizing the learning process 3. Neural networks, training of neural networks 4. Convergent neural networks, the most popular architectures including the VGG network, Resnet, Inception, SENet 5. Application of convolutional networks in computer vision (classification, detection, segmentation) 6. Introduction to NLP (natural language processing), language models 7. Recurrent neural networks including models LSTM, GRU 8. Visualization and an attempt to understand the learning process in neural networks 9. Analysis of selected problems using classical, convolutional and recurrent neural networks		

Prerequisites and co-requisites	Basics of linear algebra		
	Basics of mathematical analysis		
	Basics of probability theory		
	Subject artificial intelligence		
	Knowledge of scripting languages		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Project	50.0%	50.0%
	Midterm colloquium	50.0%	50.0%
Recommended reading	Basic literature	•Deep learning: Ian Goodfellow and Yoshua Bengio and Aaron Courville: http://www.deeplearningbook.org/ •Neural Networks and Deep Learning: Michael Nielsen http://neuralnetworksanddeeplearning.com/index.htm	
	Supplementary literature	no recommendations	
	eResources addresses	Adresy na platformie eNauczanie: Architektury głębokiego uczenia 2022/23 - Moodle ID: 29846 https://enauczenie.pg.edu.pl/moodle/course/view.php?id=29846	
Example issues/ example questions/ tasks being completed			
Work placement	Not applicable		