



Subject card

Subject name and code	Deep Learning Architecture, PG_00054418						
Field of study	Informatics						
Date of commencement of studies	February 2025		Academic year of realisation of subject		2024/2025		
Education level	second-cycle studies		Subject group		Optional subject group Specialty 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_W101] is able to make an in-depth identification of key objects and phenomena related to the field of study, as well as theories that describe them and applicable analytical and design methods	Identifies key architectures of deep neural networks. Also understands their practical applications in tasks such as image processing, audio processing, and natural language processing.	[SW2] Assessment of knowledge contained in presentation [SW3] Assessment of knowledge contained in written work and projects
	[K7_W04] knows and understands, to an increased extent, the principles, methods and techniques of programming and the principles of computer software development or programming devices or controllers using microprocessors or other elements or programmable devices specific to the field of study, and organization of work 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	[SW3] Assessment of knowledge contained in written work and projects [SW1] Assessment of factual knowledge
	[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_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	[SU4] Assessment of ability to use methods and tools [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
	Lecture tasks	50.0%	40.0%
	Project	50.0%	60.0%
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:	
Example issues/ example questions/ tasks being completed	Design and conduct the training of a deep neural network for an image classification task. Implement the selected neural network learning algorithm. Reproduce the experiments presented in a selected scientific article.		
Work placement	Not applicable		

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