



Subject card

Subject name and code	Deep learning with reinforcement, PG_00048248						
Field of study	Informatics						
Date of commencement of studies	February 2023		Academic year of realisation of subject		2023/2024		
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	2		ECTS credits		2.0		
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		dr inż. 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		4.0		16.0	50
Subject objectives	Introduces Machine Learning methods for optimal behavior using Reinforcement Learning. Shows how to scale Reinforcement Learning to complex problems using Deep Neural Networks. Show most successful Deep Reinforcement Learning methods using Value Function approximation and Policy Gradient.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K7_W03] Knows and understands, to an increased extent, the construction and operating principles of components and systems related to the field of study, including theories, methods and complex relationships between them and selected specific issues - appropriate for the curriculum.	Knows theoretical model for reinforcement learning: Marcov's process Knows algorithms used for reinforced learning	[SW3] Assessment of knowledge contained in written work and projects [SW1] Assessment of factual knowledge
	[K7_U42] can solve engineering and research problems including design, assessment and maintenance of information systems and applications, using experimental methods and management techniques	is able to propose parameters for deep network for selected reinforcement learning algorithm	[SU4] Assessment of ability to use methods and tools [SU2] Assessment of ability to analyse information
	[K7_W41] Knows and understands, to an increased extent, the standards, production methods, life cycle and development trends of software as well as information systems and applications.	Is able to create efficient reinforcement algorithm for existing system /problem	[SW3] Assessment of knowledge contained in written work and projects [SW2] Assessment of knowledge contained in presentation
	[K7_K02] is ready to provide critical evaluation of received content and to acknowledge the importance of knowledge in solving cognitive and practical problems	is able to pick the reinforcement learning algorithm for practical problem	[SK5] Assessment of ability to solve problems that arise in practice [SK4] Assessment of communication skills, including language correctness
	[K7_U04] can apply knowledge of programming methods and techniques as well as select and apply appropriate programming methods and tools in computer software development or programming devices or controllers using microprocessors or programmable elements or systems specific to the field of study, making assessment and critical analysis of the prepared software as well as a synthesis and creative interpretation of information presented with it	is able to reproduce reinforcement learning algorithm	[SU4] Assessment of ability to use methods and tools [SU2] Assessment of ability to analyse information
Subject contents	Imitation learning Reinforcement Learning Introduction Markov Decision Process Dynamic Programming Methods Model Free Learning Deep Learning using value function approximation Deep Learning using policy gradient methods Practical aspects of Deep Reinforcement Learning		
Prerequisites and co-requisites	Knowledge of Python programming language Basic calculus, linear algebra and probabilistic theory Machine Learning and Deep Learning fundamentals		

Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Assignment	50.0%	25.0%
	Test	50.0%	35.0%
	Project	50.0%	40.0%
Recommended reading	Basic literature	“Reinforcement Learning”, Richard S. Sutton and Andrew G. Barto "Neural Networks and Deep Learning",Michael A. Nielsen	
	Supplementary literature	"Deep Reinforcement Learning Hands-On", Maxim Lapan	
	eResources addresses	Adresy na platformie eNauczanie:	
Example issues/ example questions/ tasks being completed			
Work placement	Not applicable		