GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Deep Learning with Reinforcement, PG_00048248		
Field of study	Informatics		
Date of commencement of studies	February 2025	Academic year of realisation of subject	2025/2026
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	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_U12] is able, to an increased extent, to analyze the operation of components and systems related to the field of study, as well as to measure their parameters and study their technical characteristics, and to plan and carry out experiments related to the field of study, including computer simulations, interpret the obtained results and draw conclusions	Is able to plan and conduct neural network training using a selected reinforcement learning algorithm.	[SU1] Assessment of task fulfilment [SU3] Assessment of ability to use knowledge gained from the subject [SU5] Assessment of ability to present the results of task
[K7_W10] knows and understands, to an increased extent, the basic processes occurring in the life cycle of equipment, objects and technical systems, as well as methods of supporting processes and functions, specific to the field of study	The student knows and understands reinforcement learning algorithms and their application in the life cycle of technical systems, including the processes of implementation, monitoring, and adaptation under changing operational conditions.	[SW3] Assessment of knowledge contained in written work and projects [SW2] Assessment of knowledge contained in presentation
[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_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

<table>
<tr><td>Prerequisites and co-requisites</td><td colspan="3">Knowledge of Python programming language

Basic calculus, linear algebra and probabilistic theory

Machine Learning and Deep Learning fundamentals</td></tr>
<tr><td>Assessment methods and criteria</td><td colspan="3"><table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>Project</td><td>50.0%</td><td>60.0%</td></tr>
<tr><td>Lecture tasks</td><td>50.0%</td><td>40.0%</td></tr>
</table></td></tr>
<tr><td rowspan="3">Recommended reading</td><td>Basic literature</td><td colspan="2">Reinforcement Learning, Richard S. Sutton and Andrew G. Barto

"Neural Networks and Deep Learning",Michael A. Nielsen</td></tr>
<tr><td>Supplementary literature</td><td colspan="2">"Deep Reinforcement Learning Hands-On", Maxim Lapan</td></tr>
<tr><td>eResources addresses</td><td colspan="2">Adresy na platformie eNauczanie:</td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td colspan="3">Design and conduct the training of an agent playing a selected video game.

Design and conduct training for a control network of an autonomous vehicle.</td></tr>
<tr><td>Work placement</td><td colspan="3">Not applicable</td></tr>
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