GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Systems with Machine Learning, PG_00055235		
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	Obligatory subject group in the field of study 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	English
Semester of study	1	ECTS credits	3.0
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. Tomasz Boiński	
	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	15.0	0.0	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	37.0	75

Subject objectives	The main goal of the subject is to present practical methods of solving problems using artificial intelligence techniques: dataset construction, architecture choice, artificial intelligence algorithms training, model selection and testing.

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	The student is able to assess the difficulty of problems solved by machine learning methods and search for information helpful in solving them.	[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.	The student has in-depth knowledge of mechanics of artificial intelligence systems. He understands the training and testing methods of self-learning algorithms. Student knows how train and test data sets should be constructed in order to achieve optimal results. Student understands how tests should be carried out to minimize errors. The student has the knowledge necessary to effectively and efficiently conduct the training process of commonly used classifiers based on artificial intelligence methods	[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	The student is able to choose the appropriate libraries, tools and programming environments that implement machine learning algorithms in order to achieve the required goals. He can use them in the correct way to build data analysis systems. The student is able to use the appropriate methods, in order to assess whether the created artificial intelligence system meets the requirements, in particular whether the system achieves the minimum required quality and performance.	[SU1] Assessment of task fulfilment
	[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	The student has the advanced knowledge necessary to design systems based on artificial intelligence. The student understands the principles of operation and ways of using commonly used libraries and environments providing self-learning algorithms. The student knows the practical limitations and the best ways to apply methods and systems of artificial intelligence. The student understands the reasons of these limitations and their practical effects.	[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	The student is able to plan work on the construction of systems utilizing machine learning techniques. Student can choose the appropriate methods of artificial intelligence in the context of the problem being solved, and can perform training and testing of self-learning algorithms. Student is able to select the good hyperparameter values using the experimental method. Student can identify and solve typical problems encountered while training machine learning algorithms.	[SU1] Assessment of task fulfilment

<table>
<tr><td>Subject contents</td><td>1. General information about practical aspects of training artificial intelligence algorithms
2. Environments, tools and helper libraries in machine learning
3. Preparation of training, validation and test data sets
4. Preprocessing, normalization and augmentation of training data
5. Choosing machine learning methods in the context of problem requirements
6. Methods of performing training of artificial intelligence algorithms
7. Methods of machine learning hyperparameter assignment
8. Methods of testing and measuring effectiveness and performance of artificial intelligence algorithms
9. Identifying and solving typical problems in machine learning
10. Deployment of machine learning algorithms in the target environment</td></tr>
<tr><td>Prerequisites and co-requisites</td><td>Basic knowledge of artificial intelligence area, basic knowledge of Python programming language</td></tr>
<tr><td>Assessment methods and criteria</td><td><table><tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr><tr><td>written test</td><td>50.0%</td><td>50.0%</td></tr><tr><td>laboratory</td><td>50.0%</td><td>50.0%</td></tr></table></td></tr>
<tr><td>Recommended reading</td><td><table><tr><td>Basic literature</td><td>1. James, Gareth, et al. An introduction to statistical learning. Vol. 112. New York: springer, 2013.
2. Ian Goodfellow, Yoshua Bengio and Aaron Courville, Deep Learning, http://www.deeplearningbook.org/
3. Scikit-learn Tutorials, http://scikit-learn.org/stable/tutorial/index.html</td></tr><tr><td>Supplementary literature</td><td>1. Andrew Ng, Machine Learning Yearning, http:// www.mlyearning.org/</td></tr><tr><td>eResources addresses</td><td>Adresy na platformie eNauczanie:</td></tr></table></td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td>Sample issues:
- Training and testing datasets preparation for classifier training
- Performing training and testing of a neural network or other artificial intelligence algorithm
- Description of methods and measures for quality, efficiency and performance of machine learning algorithms</td></tr>
<tr><td>Work placement</td><td>Not applicable</td></tr>
</table>