GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Machine Learning I, PG_00053428		
Field of study	Automation, Robotics and Control Systems		
Date of commencement of studies	February 2024	Academic year of realisation of subject	2024/2025
Education level	second-cycle studies	Subject group	
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	3.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Faculty of Electrical and Control Engineering		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Michał Grochowski	
	Teachers		

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	10.0	35.0	75

Subject objectives

The aim of the course is to introduce students to a comprehensive knowledge of the dynamically developing field of Machine Learning and to indicate its practical applications in widely understood automation and computer science.

Learning outcomes

Course outcome	Subject outcome	Method of verification
K7_U04		
K7_U03		
K7_W08		
K7_W06		
K7_U07	Students will be able to apply known artificial intelligence tools and algorithms to solve research problems e.g. to design a neural classifier.	[SU4] Assessment of ability to use methods and tools
K7_W11	The student in a small team is able to design, prepare and carry out an experiment, and then draw appropriate conclusions. For example, he/she is able to prepare a diagnostic system, which allows to identify damage to a selected system.	[SW3] Assessment of knowledge contained in written work and projects

Subject contents

The programme contents will be realised in three thematic blocks: 1. Data analysis, among others:- exploratory research- data grouping, clustering - feature selection and extraction, - dimension reduction, - data normalization,- multidimensional data visualization. 2. Models and methods of their learning, e.g:- regression models, - Support vector machines, - Neural networks, - recurrent neural networks,- deep neural networks, - learning: supervised, unsupervised, semi-supervised, reinforcement learning- decision trees- random forests- ensembling and gradient boosting methods- automatic machine learning (AutoML)3. Model performance analysis and improvement, including- quality measures of model performance, - regularization techniques,- model validation,- selection of hyperparameters for models,- analysis of algorithm performance using explanatory artificial intelligence (XAI).

<table>
<tr><td>Prerequisites and co-requisites</td><td colspan="3">Basic knowledge of artificial intelligence methods and optimisation</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>Ocena projektu</td><td>50.0%</td><td>50.0%</td></tr>
<tr><td>Kolokwium</td><td>50.0%</td><td>50.0%</td></tr>
</table></td></tr>
<tr><td rowspan="3">Recommended reading</td><td>Basic literature</td><td colspan="2">• Bonaccorso, G. Algorytmy uczenia maszynowego. Zaawansowane techniki implementacji. Helion, 2019
• Szeliga, M. Data Science i uczenie maszynowe. Wydawnictwo Naukowe PWN, 2017.
• Grus, J. Data science od podstaw. Analiza danych w Pythonie. Helion, 2019.
• Bengio, Y., Courville A., Goodfellow I. Deep Learning. Systemy uczące się. Wydawnictwo Naukowe PWN, 2018.
• Alpaydin, E. Introduction to Machine Learning. The MIT Press Cambridge, Massachusetts London, England 2010.
• Chollet, F. Deep Learning. Helion, 2019</td></tr>
<tr><td>Supplementary literature</td><td colspan="2">• Haykin, S. Neural Networks and Learning Machines (3rd Edition), Prentice Hall, 2009.
• Bishop C. M. Pattern Recognition and Machine Learning. Springer, 2006.
• MATLAB Statistics and Machine Learning Toolbox User's Guide, 2021.
• James, Gareth, et al. An introduction to statistical learning. Vol. 112. New York: springer, 2013.
• Murphy, Kevin P. Machine learning: a probabilistic perspective. MIT press, 2012.</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">• Feature mining and knowledge extraction from large data sets, data normalisation, treatment of missing data, dimension reduction, visualisation of multidimensional data.
• Analysis of footballers' characteristics in terms of their suitability for a given team/position.
• Detection of anomalies/diagnosis of processes on the basis of multidimensional analysis of signals from measuring devices.</td></tr>
<tr><td>Work placement</td><td colspan="3">Not applicable</td></tr>
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