GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Fundamentals of Machine Learning and Deep Learning, PG_00065127		
Field of study	Geodesy and Cartography		
Date of commencement of studies	February 2025	Academic year of realisation of subject	2024/2025
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	Polish None.
Semester of study	1	ECTS credits	2.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Department Of Geoinformatics -> Faculty Of Electronics Telecommunications And Informatics -> Wydziały Politechniki Gdańskiej		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Zbigniew Łubniewski	
	Teachers	mgr inż. Dominika Kalinowska dr hab. inż. Zbigniew Łubniewski dr hab. inż. Piotr Szczuko dr inż. Tomasz Berezowski	

Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	15.0	0.0	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	4.0	16.0	50

Subject objectives	Students will acquire knowledge and practical skills on machine learning methods, including deep learning, and their applications in solving problems in photogrammetry and remote sensing.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_U06] creates solutions to complex and unstructured problems taking into account the variability of the environment by synthesising information from different sources, using analytical and simulation methods	Student Is able to select and apply an appropriate approach, based on machine learning, including deep learning, to solve a complex task from photogrammetry or remote sensing.	[SU1] Assessment of task fulfilment [SU4] Assessment of ability to use methods and tools
[K7_W05] has a well-established knowledge of analytical methods and surveying techniques necessary for creating and solving a variety of problems in geodesy and cartography	Student has knowledge the on machine learning methods, including deep learning, and their applications in photogrammetry and remote sensing.	[SW1] Assessment of factual knowledge

Subject contents	The concept of machine learning, application examples. Classification and regression. Regression on the example of Random sample consensus (RANSAC). Supervised and unsupervised classification. Classification methods: kNN, decision trees, random forest, others. Validation of obtained results. Cross-validation and evaluation of models. Fundamentals of neural networks. Fully connected networks. Convolutional networks. Remote sensing data, satellite images. Image segmentation, image classification. Examples of machine learning applications using remote sensing data. Classification and regression models for remote sensing data. Verification of models for remote sensing data.
Prerequisites and co-requisites	Basic skills in programming in Python

<table>
<tr><td>Assessment methods and criteria</td><td colspan="2"><table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>Lecture final test</td><td>50.0%</td><td>50.0%</td></tr>
<tr><td>Practical exerices</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>1. Aurélien Géron, Machine Learning Using Scikit-Learn, Keras and TensorFlow. 3rd Edition (in Polish). Helion, 2023

2. R.A. Schowengerdt, Remote sensing: models and methods for image processing. 3rd ed. Elsevier, 2011</td></tr>
<tr><td>Supplementary literature</td><td>1. Lei Ma, Yu Liu, Xueliang Zhang, Yuanxin Ye, Gaofel Yind, Brian Alan Johnson, Deep learning in remote sensing applications: A meta-analysis and review. ISPRS Journal of Photogrammetry and Remote Sensing, 152, 166-177, 2019</td></tr>
<tr><td>eResources addresses</td><td>Adresy na platformie eNauczanie:
[Fotogram_teled_2025] Podstawy uczenia maszynowego i głębokiego - Moodle ID: 45670
https://enauczanie.pg.edu.pl/moodle/course/view.php?id=45670</td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td colspan="2">None.</td></tr>
<tr><td>Work placement</td><td colspan="2">Not applicable</td></tr>
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