



Subject card

Subject name and code	Machine learning in Earth research, PG_00054189						
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			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	1	ECTS credits			2.0		
Learning profile	general academic profile	Assessment form			assessment		
Conducting unit	Department of Geoinformatics -> Faculty of Electronics, Telecommunications and Informatics						
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Zbigniew Łubniewski					
	Teachers	dr inż. Tomasz Berezowski dr hab. inż. Zbigniew Łubniewski					
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	2.0		18.0		50
Subject objectives	The aim of the course is to familiarize students with the tools that enable the correct acquisition and processing of data on the earth's surface, in particular with the use of machine learning. The course will mainly use data from satellite remote sensing and sonar. Students will learn examples of how to apply classification and regression with different levels of complexity and for different purposes.						
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	Student is ready to critically evaluate the learned contents and to recognise the importance of knowledge in solving problems with respect to machine learning methods applied in Earth research.			[SK5] Assessment of ability to solve problems that arise in practice [SK2] Assessment of progress of work		
	[K7_U10] can individually plan and pursue their own lifelong education and influence others in this aspect, also by means of advanced information and communication technologies (ICT), and communicate on specialist issues with diverse recipients, appropriately justify points of view, hold debates, present, assess and discuss different opinions and points of view, as well as use specialist terminology related to the field of study in communication	Student is prepared for continuous updating and extending his knowledge and skills in the area of machine learning methods applied in Earth research.			[SU1] Assessment of task fulfilment [SU2] Assessment of ability to analyse information [SU5] Assessment of ability to present the results of task		
	[K7_U09] can carry out a critical analysis of the functioning of existing technical solutions and assess these solutions, as well as apply experience related to the maintenance of advanced technical systems, devices and facilities typical for the field of studies, gained in the professional engineering environment	Student is able to analyse critically possible machine learning solutions and to select the appropriate one from them for a given issue in Earth observation and research.			[SU1] Assessment of task fulfilment [SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools		

Subject contents	<p>Remote sensing methods in Earth research. Satellite imaging, sonar sounding</p> <p>Examples of artificial intelligence and machine learning applications in Earth research. Image segmentation, image classification</p> <p>AI and ML methods used in Earth research</p> <p>Characteristics of remote sensing imagery data</p> <p>Sources of satellite remote sensing data</p> <p>Methodology of model development for classification and regression of remote sensing data</p> <p>Verification of remote sensing data models</p> <p>Current best practices in machine learning for remote sensing</p> <p>Sonar data characteristics. Stages and methods of sonar data pre-processing</p> <p>Machine learning in marine ecosystems research</p>											
Prerequisites and co-requisites	<p>Knowledge of the R or Python scripting language</p> <p>Basic knowledge of machine learning methods</p>											
Assessment methods and criteria	<table border="1"> <thead> <tr> <th>Subject passing criteria</th> <th>Passing threshold</th> <th>Percentage of the final grade</th> </tr> </thead> <tbody> <tr> <td>Practical exercises - lab</td> <td>50.0%</td> <td>50.0%</td> </tr> <tr> <td>Lecture final test</td> <td>50.0%</td> <td>50.0%</td> </tr> </tbody> </table>			Subject passing criteria	Passing threshold	Percentage of the final grade	Practical exercises - lab	50.0%	50.0%	Lecture final test	50.0%	50.0%
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Recommended reading	Basic literature	<p>SCHOWENGERDT, R. A. Remote sensing: models and methods for image processing. 3rd ed. [s. l.]: Elsevier, 2011. ISBN 0123694078.</p> <p>JENSEN, J. R. Remote sensing of the environment: an earth resource perspective. 2nd ed. [s. l.]: Pearson Education, 2014. ISBN 9781292021706.</p> <p>R. Cresson, "A Framework for Remote Sensing Images Processing Using Deep Learning Techniques," in <i>IEEE Geoscience and Remote Sensing Letters</i>, vol. 16, no. 1, pp. 25-29, Jan. 2019, doi: 10.1109/LGRS.2018.2867949.</p>										
	Supplementary literature	<p>Lei Ma, Yu Liu, Xueliang Zhang, Yuanxin Ye, Gaofel Yind, Brian Alan Johnson, Deep learning in remote sensing applications: A meta-analysis and review. <i>ISPRS Journal of Photogrammetry and Remote Sensing</i>, 152, 166-177, 2019</p>										
	eResources addresses	<p>Adresy na platformie eNauczenie:</p> <p>Uczenie maszynowe w badaniach Ziemi - 2023 - Moodle ID: 22241 https://enauczenie.pg.edu.pl/moodle/course/view.php?id=22241</p>										
Example issues/ example questions/ tasks being completed												
Work placement	Not applicable											