University of Gdańsk

Subject card

Subject name and code	Introduction to Machine Learning, PG_00153499						
Field of study	Mathematical Modeling and Data Analysis						
Date of commencement of studies	October 2025		Academic year of realisation of subject		2025/2026		
Education level	Master's studies		Subject group		Obligatory subject group 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		6.0		
Learning profile	academic		Assessment form		exam		
Conducting unit							
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. inż. Marek Krośnicki				
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	0.0	30.0	0.0	0.0	60
	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	60		10.0		80.0	150
Subject objectives	Familiarization with advanced machine learning methods. Acquiring the ability to use machine learning algorithms - working in the Python environment						

Learning outcomes

Course outcome	Subject outcome	Method of verification
[MMiADMU2_W05] knows and fully understands selected software packages or IT techniques used for symbolic calculations or for statistical data processing	The student is able to perform actual preprocessing of data	[SW2] presentation/project/paper/ report
[MMiADMU2_K04] is ready to understand and appreciate the importance of intellectual honesty in the actions of himself and others; is ready to act ethically	The student knows the rules for handling sensitive data	[SK1] oral statement/conversation/ discussion [SK8] observation of student's independent or team work
[MMiADMU2_K01] is ready to recognize the limitations of his own knowledge and is ready to continue his education	The student is able to work in a team while implementing a group project.	[SK8] observation of student's independent or team work
[MMiADMU2_W04] knows and understands the theoretical basis of computational methods and IT techniques used to solve problems in a selected field of mathematics	The student is able to solve programming problems using mathematical knowledge, design and analyze algorithms in terms of their correctness using dedicated tools and design patterns	[SW1] oral statement/ conversation/discussion [SW2] presentation/project/paper/ report
[MMiADMU2_U11] can evaluate, at a basic level, the usefulness of mathematical methods and IT tools	The student is able to assess the effectiveness of the algorithm	[SU2] presentation/project/paper/ report
[MMiADMU2_K02] is ready to precisely formulate questions to deepen his own understanding of a given topic or to find missing elements of reasoning	The student takes part in discussions during classes	[SK1] oral statement/conversation/ discussion [SK2] presentation/project/paper/ report
[MMiADMU2_U06] is able to apply methods and examples from a selected field of mathematics in related fields	The student is able to create models for data of various types (images, texts, chemical compounds)	[SU1] oral statement/conversation/ discussion [SU2] presentation/project/paper/ report
[MMiADMU2_K05] is ready to independently search for information in literature, also in foreign languages	The student is able to formulate a design task on his own	[SK1] oral statement/conversation/ discussion [SK2] presentation/project/paper/ report
[MMiADMU2_K06] is ready to form an opinion on basic mathematical issues	The student is able to formulate a design task on his own	[SK1] oral statement/conversation/ discussion

Subject contents

1. Introduction to basic terminology and notation. Strategy for creating a machine learning system

2. Python in machine learning. Using Python for machine learning: Anaconda, Jupyter, NumPy, Pandas, Matplotlib, SciPy.

3. Data preprocessing. Best practices for model evaluation.

4. Data analysis using regression analysis, cluster analysis

5. Support Vector Machines

6. Decision trees

7. Training neural networks using torch library

8. Auroencoders

9. Data compression and data dimension reduction

10. Unsupervised learning methods (e.g. k-means algorithm)

11. Application examples: Modeling sequential data using recurrent neural networks, working with text, working with images, working with molecular graphs

<table>
<tr><td>Prerequisites and co-requisites</td><td colspan="3">Knowledge of programming basics, algorithms and complexity, object-oriented programming languages and paradigms in the languages chosen by the student.</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>projects</td><td>100.0%</td><td>70.0%</td></tr><tr><td>oral exam</td><td>51.0%</td><td>30.0%</td></tr></table></td></tr>
<tr><td rowspan="3">Recommended reading</td><td>Basic literature</td><td colspan="2">1. G. James, D. Witten, T. Hastie, R. Tibshirani, J. Taylor n Introduction to Statistical Learning with applications in Python, 2023, https://www.statlearning.com/
2. S. Raschka, V. Mirjalili, Python Machine Learning, Packt 2019</td></tr>
<tr><td>Supplementary literature</td><td colspan="2">N/A</td></tr>
<tr><td>eResources addresses</td><td colspan="2"></td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td colspan="3"></td></tr>
<tr><td>Work placement</td><td colspan="3">Not applicable</td></tr>
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