GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Programming languages for artificial intelligence, PG_00053334		
Field of study	Biomedical Engineering, Biomedical Engineering, Biomedical Engineering		
Date of commencement of studies	February 2025	Academic year of realisation of subject	2024/2025
Education level	second-cycle studies	Subject group	Optional subject group Specialty 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 Biomedical Engineering -> Faculty of Electronics, Telecommunications and Informatics		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Paweł Syty	
	Teachers	dr inż. Paweł Syty mgr inż. Natalia Kowalczyk	

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	3.0	17.0	50

Subject objectives	Introduction to the implementation of artificial intelligence algorithms in selected programming languages and with the use of selected tools and libraries.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_W04] knows and understands, to an increased extent, the principles, methods and techniques of programming and the principles of computer software development or programming devices or controllers using microprocessors or other elements or programmable devices specific to the field of study, and organization of work of systems using computers or such devices	The student is able to use the selected programming language to implement selected artificial intelligence algorithms.	[SW3] Assessment of knowledge contained in written work and projects
[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 configure the work environment and select the appropriate tools and programming methods to solve the given problem.	[SU2] Assessment of ability to analyse information [SU4] Assessment of ability to use methods and tools
[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 critically refer to the practical issues that arise in the subject matter.	[SK5] Assessment of ability to solve problems that arise in practice
[K7_U01] can apply mathematical knowledge to formulate and solve complex and non-typical problems related to the field of study by: - appropriate selection of source information and its critical analysis, synthesis, creative interpretation and presentation, - application of appropriate methods and tools	The student is able to use his mathematical knowledge to solve basic problems of artificial intelligence,	[SU1] Assessment of task fulfilment

Subject contents

Lecture

- Introduction to the implementation of artificial intelligence algorithms. General overview of the programming languages most commonly used for programming artificial intelligence (eg Python, Prolog, R, Julia, MTT). Configuration of the development environment and basic tools, including configuration management.
- Data preparation (e.g. using the Pandas package). Data visualization (e.g. using Matplotlib package). Basic statistics research (e.g. using NumPy package).
- Implementation of selected supervised and unsupervised learning algorithms and machine learning classifiers, e.g. using scikit-learn, SciPy libraries.
- Implementation (from scratch) of a simple perceptron with training supervised by the gradient method (e.g. using the NumPy package).
- The use of selected programming libraries (eg TensorFlow / Keras) for the implementation of a one-way, multi-layer neural network.
- Tools for viewing the learning process in real time (e.g. TensorBoard library). Techniques of data augmentation and the use of generators. Evaluation of models.
- Elements of parallel programming and the use of GPU in machine learning. Optimization of programs and algorithms. Good programming practices. Complete case studies (e.g. related to the processing of biomedical data).

Laboratory

- Preparation and cleaning of data with the use of programming libraries. Visualization of data and results. (e.g. Pandas, NumPy, Matplotlib)
- Using programming libraries in machine learning tasks (e.g. SciKit)
- Creating and using neural network models in a programming environment (eg TensorFlow, Pytorch) - part 1.
- Creating and using neural network models in the programming environment (eg TensorFlow, Pytorch) - part 2. Using programming libraries for model evaluation.
- Use of programming libraries in machine learning for multimedia data (image, signal / sequence)

Prerequisites and co-requisites

<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>passing the laboratory part (projects)</td><td>50.0%</td><td>60.0%</td></tr>
<tr><td>passing the lecture part</td><td>50.0%</td><td>40.0%</td></tr>
</table></td></tr>
<tr><td rowspan="3">Recommended reading</td><td>Basic literature</td><td>M.Lutz, Learning Python, 5th Edition, O'Reilly, 2020

J. Nunez-Iglesias, S. van der Walt, H. Dashnow, Elegant SciPy - THE ART OF SCIENTIFIC PYTHON, O'Reilly, 2017

F. Nelli, Python Data Analytics: With Pandas, NumPy, and Matplotlib, Apres, 2018

M. Gorelick, I. Ozsvald, High Performance Python. Practical Performant Programming for Humans.(2nd ed.), O'Reilly, 2021</td></tr>
<tr><td>Supplementary literature</td><td>A. Géron, Hands-on Machine Learning with Scikit-Learn, Keras, and TensorFlow, O'Reilly, 2020</td></tr>
<tr><td>eResources addresses</td><td>Adresy na platformie eNauczanie:</td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td colspan="2">List the metrics used to evaluate the machine models. Describe one of them in one sentence, and the method of its calculation in Python.

Implement a simple perceptron in Python using the Tensorflow library and the Keras interface.</td></tr>
<tr><td>Work placement</td><td colspan="2">Not applicable</td></tr>
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