GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Computational basics of artificial intelligence, PG_00053332		
Field of study	Biomedical Engineering, Biomedical Engineering, Biomedical Engineering		
Date of commencement of studies	February 2024	Academic year of realisation of subject	2023/2024
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
Semester of study	1	ECTS credits	3.0
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. Artur Poliński	
	Teachers	dr inż. Artur Poliński	

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	3.0	42.0	75

Subject objectives

The aim of the course is introduction the computational foundations of artificial intelligence

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_U01] can apply mathematical knowledge to formulate and solve complex and non-typical problems related to the field of study by:n- appropriate selection of source information and its critical analysis, synthesis, creative interpretation and presentation,n- application of appropriate methods and toolsn	has a basic knowledge of data analysis	[SU1] Assessment of task fulfilment
[K7_W01] Knows and understands, to an increased extent, mathematics to the extent necessary to formulate and solve complex issues related to the field of study.	has a basic knowledge of optimization methods	[SW1] Assessment of factual knowledge
[K7_W03] Knows and understands, to an increased extent, the construction and operating principles of components and systems related to the field of study, including theories, methods and complex relationships between them and selected specific issues - appropriate for the curriculum.	has a basic knowledge of computing fundamentals of artificial intelligence	[SW1] Assessment of factual knowledge
[K7_K02] is ready to provide critical evaluation of received content and to acknowledge the importance of knowledge in solving cognitive and practical problems	has a basic knowledge of computing fundamentals of artificial intelligence	[SK5] Assessment of ability to solve problems that arise in practice

Subject contents	1. Elements of linear algebra and analytical geometry (norms, bilinear mappings, length and distance of vectors, angle between vectors, basis of linear space, orthogonal projection, rotations) 2 Matrix decomposition, vectors and eigenvalues, SVD decomposition 3 Elements of mathematical analysis (differentiation, Jakobi matrix, Hesse matrix, introduction to gradient methods, Newton's method for equations and systems of nonlinear equations) 4 Selected elements of the probability theory (random variable, moments, distributions, Bayes' theorem) 5 Optimization methods in artificial intelligence (optimization, optimization with constraints, linear programming) 6 Modeling (cost functions, parameter estimation) 7 Data analysis using linear regression 8 Methods for reducing the dimension of data - principal component analysis 9 Methods of heuristic solution search (including simulated annealing)
Prerequisites and co-requisites	Knowledge of mathematics at the level of engineering studies

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
project	50.0%	50.0%
lecture	50.0%	50.0%

Recommended reading

Basic literature

Deisenroth, M. P., Faisal, A. A., & Ong, C. S. (2020). *Mathematics for machine learning*. Cambridge University Press.

Arora, S. A. N. J. E. E. V. (2018, January). Mathematics of machine learning: An introduction. In *Proceedings of the International Congress of Mathematicians (ICM 2018)* (pp. 377-390).

Burges, C. J. (2003, February). Some notes on applied mathematics for machine learning. In *Summer School on Machine Learning* (pp. 21-40). Springer, Berlin, Heidelberg.

Billingsley, P. (2008). *Probability and measure*. John Wiley & Sons.

Von Zur Gathen, J., & Gerhard, J. (2013). *Modern computer algebra*. Cambridge university press.

Rao, S. S. (2019). *Engineering optimization: theory and practice*. John Wiley & Sons.

Supplementary literature

Peterson, J. C., & Smith, R. D. (2015). *Mathematics for Machine Technology*. Cengage Learning.

Bender, E. A. (1996). Mathematical methods in artificial intelligence.

Gnedenko, B. V. (2018). *Theory of probability*. Routledge.

Rédei, L. (2014). *Algebra*. Elsevier.

Sra, S., Nowozin, S., & Wright, S. J. (Eds.). (2012). *Optimization for machine learning*. Mit Press.

eResources addresses

Adresy na platformie eNauczanie:

Obliczeniowe podstawy sztucznej inteligencji - lato 2024 - Moodle ID: 37108
https://enauczanie.pg.edu.pl/moodle/course/view.php?id=37108

Example issues/ example questions/ tasks being completed	
Work placement	Not applicable