GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Introduction to artificial intelligence, PG_00053333
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	Obligatory subject group in the field of study
			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	3.0
Learning profile	general academic profile	Assessment form	assessment

Conducting unit	Laboratorium Akustyki Fonicznej -> Faculty of Electronics, Telecommunications and Informatics

Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. inż. Bożena Kostek
	Teachers	prof. dr hab. inż. Bożena Kostek
		dr hab. inż. Piotr Szczuko

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	15.0	45
	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	45	3.0	27.0	75

Subject objectives	The course aims to familiarize students with the bases of artificial intelligence, understood as intelligent computing techniques, learning systems, decision-making systems or expert systems. Additionally, an important element of the lecture is to familiarize students with selected methods of intelligent signal and data processing and knowledge processing based on inference formulated in the form of decision rules. The knowledge gained in the lecture will be used in the preparation of the project and seminar classes.

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: - 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 apply methods of signal and data acquisition and processing. Student knows rules of creating neural networks structures, decision trees. He or she knows how to apply fuzzy and rule-based inference. Student knows metrics of classification and can use them in practice.	[SU1] Assessment of task fulfilment [SU2] Assessment of ability to analyse information [SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools [SU5] Assessment of ability to present the results of task
	[K7_K01] is ready to create and develop models of proper behaviour in the work and life environment; undertake initiatives; critically evaluate actions of their own, teams and organisations they are part of; lead a group and take responsibility for its actions; responsibly perform professional roles taking into account changing social needs, including: - developing the achievements of the profession, - observing and developing rules of professional ethics and acting to comply to these rules	The student is able to apply the acquired knowledge of artificial intelligence in practice. The student is able to select appropriate methods to perform a design task. Understands the risks associated with the use of artificial intelligence. The student knows how to realize the project, maintains the linguistic correctness and meets the deadline for the submission of the work.	[SK3] Assessment of ability to organize work [SK4] Assessment of communication skills, including language correctness [SK5] Assessment of ability to solve problems that arise in practice [SK1] Assessment of group work skills [SK2] Assessment of progress of work
	[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 understands the neuro-biological basis of artificial intelligence. The student is able to apply the acquired knowledge of artificial intelligence in practice. The student is able to use programming environments and platforms.	[SU1] Assessment of task fulfilment [SU2] Assessment of ability to analyse information [SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools [SU5] Assessment of ability to present the results of task
	[K7_W08] knows and understands, to an increased extent, the fundamental dilemmas of modern civilisation, the main development trends of scientific disciplines relevant to the field of education	Student is competent in creating decision-making systems and optimization of their parameters. Students is able to find relationship between the problems of modern civilization and the possible solutions that are available through artificial intelligence.	[SW1] Assessment of factual knowledge [SW2] Assessment of knowledge contained in presentation [SW3] Assessment of knowledge contained in written work and projects

Subject contents	Introduction - scope of subject and literature. Definitions of artificial intelligence (AI). Objectives of artificial intelligence. Natural versus artificial AI.
	Neuro-biological basis of artificial intelligence. Anatomy of the nervous system. Inter-sensory correlations. Neuropsychological basis of human cognition and action. Mapping of selected human abilities.
	Cognitive processing of information. Modeling of brain activity. Human-computer communication. Threats associated with artificial intelligence. Requirements for the creation and application of artificial intelligence. Algorithms and human rights.
	Representation of knowledge. Databases. Big Data. Examples of databases.
	Data mining. Data visualization.
	Signal processing and analysis. Parameterization.
	Machine learning schema. AI vs machine learning. Activity planning and decision making. Division of machine learning methods. Criteria of division. Uncertainty in AI.
	Artificial neural networks. Types of networks. Supervised learning. Unsupervised learning.
	Validation methods. Performance measures and metrics.
	Decision trees. Definitions.
	Genetic algorithms. Fundamentals and characteristics of genetic algorithms. Selection methods, crossover, mutation.
	Rule-based systems. Fuzzy logic. Fuzzy inference: Mamdani and Sugeno inference.
	Approximate sets.
	Review of applications of AI and machine learning methods.

Prerequisites and co-requisites	

Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Each part of the course must be passed in 51%, with 50% of the credit going to the lecture, and the remaining 50% going to the seminar and the project.	51.0%	100.0%

Recommended reading	Basic literature	
		Aggarwal C. C., Neural Networks and Deep Learning. A Textbook. Springer International Publishing AG, part of Springer Nature, Cham, Switzerland 2018.
		Russel S. J. and Norvig P., Artificial intelligence : a modern approach, Prentice Hall Series in Artificial Intelligence Always Learning, 2016.
		https://ebookcentral-1proquest-1com-13yl7b8p90cad.han.bg.pg.edu.pl/lib/pgpl/detail.action?docID=5495854

	Supplementary literature	Haenlein, M., Kaplan A., A Brief History of **Artificial Intelligence**: On the Past, Present, and Future of **Artificial Intelligence**, *California Management Review.* Aug2019, Vol. 61 Issue 4, p5-14. 10p. DOI: 10.1177/0008125619864925.
		Kostek **B.**, Perception-Based Data Processing in Acoustics. Applications to Music Information Retrieval and Psychophysiology of Hearing, Springer Verlag, Series on Cognitive Technologies, Berlin, Heidelberg, New York 2005.
	eResources addresses	Adresy na platformie eNauczanie:
Example issues/ example questions/ tasks being completed		Lecture - credit includes the issues given in the lecture. Project1.Presentation of the requirements for the development of project documentation.2. Theoretical elaboration on a selected design issue 3. Selection of learning algorithm, preparation of data for training and testing. 4. software implementation.Seminar: topic selection, preparation of the topic and its presentation within the framework of the seminar speech.
Work placement	Not applicable	

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