GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Applications of Artificial Intelligence in E&T, PG_00066222		
Field of study	Electronics and Telecommunications		
Date of commencement of studies	February 2026	Academic year of realisation of subject	2025/2026
Education level	second-cycle studies	Subject group	
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 Multimedia Systems -> Faculty of Electronics Telecommunications and Informatics -> Faculties of Gdańsk University of Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Piotr Szczuko	
	Teachers	dr hab. inż. Piotr Szczuko mgr inż. Mateusz Groth dr hab. inż. Łukasz Kulas dr inż. Bartosz Czaplewski prof. dr hab. inż. Andrzej Czyżewski dr inż. Krzysztof Cwalina	

Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	0.0	15.0	0.0	0.0	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	0.0	0.0	45

Subject objectives	
	The aim of the subject is to familiarise students with the applications of machine learning and artificial intelligence in broadly understood scientific and technical fields related to telecommunications and electronics. The subject will present selected modern, important and popular technologies and trends in the development of artificial intelligence, including: large language models, deep neural networks, convolutional networks, and will discuss their applications in: knowledge processing and acquisition, image and signal data analysis, detection, segmentation and classification of objects in images, and others. Directions and trends in the development of knowledge engineering systems, human-computer interfaces, prediction, recommendation, diagnostics will be discussed. Problems of data preparation for machine learning, assessing the accuracy of models, building and training them correctly, ethical and responsible implementation will be addressed.

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K7_W10] knows and understands, to an increased extent, the basic processes occurring in the life cycle of equipment, objects and technical systems, as well as methods of supporting processes and functions, specific to the field of study	Has in-depth knowledge and understanding of the basic processes taking place in the life cycle of technical systems based on AI — from the design phase, through data preparation, model creation and training, deployment in technical systems, to maintenance, monitoring, and further development. Understands the methods supporting analytical, decision-making, and diagnostic processes in telecommunications and electronics using artificial intelligence systems. Is aware of the specific characteristics and challenges associated with integrating AI solutions with existing technical systems and the impact of such solutions on the product and service life cycle.	[SW1] Assessment of factual knowledge
	[K7_W11] knows and understands, to an increased extent, the general principles of creation and development of forms of individual entrepreneurship and the economic, legal and other conditions of various types of activities related to the awarded qualification, including the principles of protection of industrial property and copyright law	Has in-depth knowledge and understanding of the principles of creating and developing individual entrepreneurship in the area of artificial intelligence and teleinformatics technologies, including business models based on AI. Understands the economic, legal, and ethical conditions of activities related to the implementation of AI systems, particularly in the context of industrial property protection and copyright in relation to models, algorithms, and data. Is familiar with current regulations, legal challenges, and ethical issues related to the practical application of artificial intelligence in engineering practice.	[SW1] Assessment of factual knowledge
	[K7_U12] is able, to an increased extent, to analyze the operation of components and systems related to the field of study, as well as to measure their parameters and study their technical characteristics, and to plan and carry out experiments related to the field of study, including computer simulations, interpret the obtained results and draw conclusions	Is able to thoroughly analyze the operation of AI-based components, circuits, and systems used in telecommunications and electronics, such as machine learning models and neural networks. Can measure and assess parameters and technical characteristics of AI models (e.g., accuracy, precision, sensitivity, response time, resource consumption), both in real-world environments and simulation conditions. Is capable of planning and conducting experiments related to the implementation and testing of AI systems — including computer simulations of image and signal data processing, as well as predictive and classification analyses. Can interpret the results of experiments and draw conclusions regarding the effectiveness, reliability, and usability of the examined solutions, taking into account technical, practical, and ethical aspects.	[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

Course outcome	Subject outcome	Method of verification
[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 in-depth knowledge and understanding of the structure and operating principles of modern components and systems utilizing artificial intelligence and machine learning in telecommunications and electronics. Understands the theories, methods, and complex interdependencies between neural network architectures (including deep, convolutional, and large language models) and their applications in image, signal data analysis, and information processing systems. Has detailed knowledge of data preparation, model training processes, performance evaluation, and integration with technical systems specific to telecommunications and electronics.	[SW3] Assessment of knowledge contained in written work and projects [SW1] Assessment of factual knowledge

Subject contents

Course content – lecture
Introduction to AI, overview of popular AI tools
Application of AI in audio and video processing and analysis
Preparation of data for AI learning and testing
Ethical and energy aspects and problems of AI development and deployment
Application of AI in radio communication
Application of AI in data communication systems
Neural network architectures, model decision explanations
AI in sensing for biomedical and environmental purposes
AI in wireless embedded systems
AI in situational awareness systems of autonomous vehicles

Prerequisites and co-requisites

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Colloquy	51.0%	50.0%
Laboratory	51.0%	50.0%

Recommended reading

Basic literature	Sanchez-Lengeling, et al., "A Gentle Introduction to Graph Neural Networks", Distill, 2021. DOI:10.23915/distill.00033 Cho A, et al., "Transformer Explainer: Interactive Learning of Text-Generative Models" IEEE VIS 2024, DOI: 10.48550/arXiv.2408.04619. https://poloclub.github.io/transformer-explainer/ Goodfellow I, et al. Deep Learning, 2016 https://www.deeplearningbook.org/
Supplementary literature	Goodfellow I, et al. Deep Learning, 2016 https://www.deeplearningbook.org/
eResources addresses	Supplementary https://enauczanie.pg.edu.pl/moodle/course/view.php?id=44556 -

Example issues/ example questions/ tasks being completed

Explain the differences between classical neural networks and convolutional networks (CNNs). What are the applications of convolutional networks in image and signal data analysis?

List and characterise methods for evaluating the quality of machine learning models. Give examples for classification, segmentation and text generation tasks.

Discuss the importance of ethical, legal and technical aspects in implementing AI solutions.

Practical activites within the subject

Not applicable

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