GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Generative AI, PG_00064442
Field of study	Biomedical Engineering, Biomedical Engineering, Biomedical Engineering

Date of commencement of studies	February 2025	Academic year of realisation of subject	2025/2026
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	2	Language of instruction	Polish
Semester of study	3	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 hab. inż. Mariusz Kaczmarek
	Teachers	

Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	15.0	15.0	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	2.0	28.0	75

Subject objectives	The aim of the course is to familiarize students with generative artificial intelligence algorithms with particular emphasis on large language models and image generation algorithms.

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[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	The student knows and understands issues related to the development of artificial intelligence, in particular generative techniques such as language models and image generation. Can indicate the main directions of development in this field.	[SW2] Assessment of knowledge contained in presentation
	[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 understands the importance of knowledge about AI in solving cognitive and practical problems, such as the ethics of artificial intelligence, automation of creative processes and social and technological implications resulting from the wide implementation of generative technologies.	[SK5] Assessment of ability to solve problems that arise in practice
	[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	The student knows and understands the elements of mathematics, including differential calculus, linear algebra and probability theory. He can apply these mathematical tools to analyze generative models and to interpret their operation in the context of creating new data and optimizing results.	[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	The student is able to analyze the operation of generative algorithms, measure their parameters, examine the efficiency of models, conduct computer simulations and interpret the obtained results.	[SU2] Assessment of ability to analyse information [SU4] Assessment of ability to use methods and tools

Subject contents	
	1. Introduction 2. NLP basics 3. Transformers 4. LLM 5. Basic Gen AI architectures for image (Diffusion Models, GANs, VAEs) 6. Generating images from Text-to-Image Descriptions 7. Other GenAI Models (Sound, Music, Video) 8. Advanced Generative model techniques 9. Advanced "Foundation Model" techniques 10. Reinforcement Learning 11. Training on Big Data 12. Model evaluation and assessment metrics 13. Practical applications of GenAI Models 14. Controlled Data Generation 15. Securing Generative Models

Prerequisites and co-requisites	
	Prerequisites: • in the field of theoretical knowledge - knowledge of image and natural language processing and analysis algorithms and the basics of neural networks, • in the field of practical knowledge - basics of the Python language

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
laboratory	50.0%	30.0%
project	50.0%	30.0%
lectures	50.0%	40.0%

Recommended reading

Basic literature	1. **"Generative Deep Learning: Teaching Machines to Paint, Write, Compose, and Play"** David Foster 2. **"Deep Generative Modeling"** Jakub M. Tomczak
Supplementary literature	n/a
eResources addresses	Adresy na platformie eNauczanie:

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

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