GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Computer vision, PG_00053374		
Field of study	Biomedical Engineering, Biomedical Engineering, Biomedical Engineering		
Date of commencement of studies	February 2023	Academic year of realisation of subject	2023/2024
Education level	second-cycle studies	Subject group	Optional 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	2	ECTS credits	4.0
Learning profile	general academic profile	Assessment form	exam
Conducting unit	Department of Biomedical Engineering -> Faculty of Electronics, Telecommunications and Informatics		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Magdalena Mazur-Milecka	
	Teachers	dr inż. Magdalena Mazur-Milecka	

Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	0.0	15.0	15.0	0.0	60
	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	60	5.0	35.0	100

Subject objectives	The aim of the course is to familiarize students with computer vision algorithms, with particular emphasis on neural networks and machine learning based methods.

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[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 effect of the learning process is the student's gaining the ability to use the acquired knowledge in practice on computer vision algorithms: the use of appropriate methods and tools, evaluation of their effectiveness through the use of appropriate measures and their correct interpretation.	[SU4] Assessment of ability to use methods and tools
	[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.	The effect of the learning process is the acquisition of knowledge by the student in the field of theories and methods dedicated to solutions to computer vision in biomedical engineering.	[SW1] Assessment of factual knowledge
	[K7_W04] Knows and understands, to an advanced extent, the principles, methods and techniques of programming and the principles of computer software development or programming devices or controllers using microprocessors or programmable elements or systems specific to the field of study, and organisation of systems using computers or such devices	The effect of the learning process is the student's acquisition of knowledge in the field of knowledge and the ability to apply programming methods and techniques as well as libraries used in solving computer vision issues, including detection and segmentation of objects, image recognition or classification.	[SW1] Assessment of factual knowledge
	[K7_U02] can perform tasks related to the field of study as well as formulate and solve problems applying recent knowledge of physics and other areas of science	The effect of the learning process is the ability of the student to correctly solve real problems of computer vision in the field of biomedical engineering, appropriate selection of methods and evaluation of results.	[SU1] Assessment of task fulfilment

Subject contents	1. Introduction to computer vision 2. Analysis of the texture and texture features (motion evaluation) 3. Analysis of the shape and features of the shape description in images 4. Color / intensity analysis and related features 5. Methods of reduction / selection of features, optimization 6. Autoencoders - image quality improvement 7. Classification of images using deep learning methods 8. Image segmentation methods 9. Image segmentation (semantic) 10. Image segmentation (instance) 11. Methods of object location and detection 12. Methods of object location and detection 13. Generation of images, adversarial images, quality improvement 14. GAN models in computer vision 15. GAN models in machine learning (augmentations)
Prerequisites and co-requisites	Prerequisites: • in the field of theoretical knowledge - knowledge of image processing and analysis algorithms and the basics of neural networks, • in the field of practical knowledge - basics of the Python language and knowledge of libraries dedicated to image processing (e.g. OpenCV)

Assessment methods and criteria

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

Recommended reading

Basic literature	1. **Computer Vision: Algorithms and Applications**, *Richard Szeliski* 2. **Programming Computer Vision with Python: Tools and algorithms for analyzing images**, *Erik Solem* ***3.* Computer Vision: A Modern Approach**, *David Forsyth*, *Jean Ponce*
Supplementary literature	1. Deep Learning (Adaptive Computation and Machine Learning series), Ian Goodfellow, Yoshua Bengio, Aaron Courville 2. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems 2nd Edition, Aurélien Géron

	eResources addresses	Adresy na platformie eNauczanie:
Example issues/ example questions/ tasks being completed	1. Autoencoders and GAN 2. Object detection 3. Face recognition 4. Segmentation 5. Image classification - inference on mobile devices	
Work placement	Not applicable	