GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Computer Vision, PG_00048269						
Field of study	Informatics						
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	1		Language of instruction	Polish			
Semester of study	2		ECTS credits	5.0			
Learning profile	general academic profile		Assessment form	exam			
Conducting unit	Department of Intelligent Interactive Systems -> Faculty of Electronics, Telecommunications and Informatics						
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Agata Kołakowska					
	Teachers	dr inż. Maciej Smiatacz					
Lesson types and methods of instruction	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		10.0	70.0	125	
Subject objectives	The aim of the subject is to make students familiar with the basic problems and algorithms of computer vision (in particular feature selection and extraction, classification and motion analysis), and to allow them to acquire the practical skills necessary to implement their own computer vision systems.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[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	Student is able to select computer vision methods appropriate to solve a given problem.	[SW1] Assessment of factual knowledge
	[K7_W04] knows and understands, to an increased extent, the principles, methods and techniques of programming and the principles of computer software development or programming devices or controllers using microprocessors or other elements or programmable devices specific to the field of study, and organization of work of systems using computers or such devices	Student presents basic problems related to the development of computer vision systems, such as the small sample size problem.	[SW1] Assessment of factual knowledge
	[K7_W02] knows and understands, to an increased extent, selected laws of physics and physical phenomena, as well as methods and theories explaining the complex relationships between them, constituting advanced general knowledge in the field of technical sciences related to the field of study	Student describes the basic algorithms of training and classification.	[SW1] Assessment of factual knowledge
	[K7_U03] can design, according to required specifications, and make a complex device, facility, system or carry out a process, specific to the field of study, using suitable methods, techniques, tools and materials, following engineering standards and norms, applying technologies specific to the field of study and experience gained in the professional engineering environment	Student implements basic classification algorithms using C++ language.	[SU1] Assessment of task fulfilment
Subject contents	1. Introduction to computer vision 2. Patterns and their features 3. Shape parameters 4. Haar-like features 5. Local binary patternes 6. Histogram of oriented gradients 7. Scale invariant feature transform 8. Image data preprocessing 9. The role of feature selection and extraction 10. Filter feature selection 11. Wrapper feature selection 12. Embedded feature selection 13. Principal components analysis 14. Multidimensional scaling 15. Linear discriminant analysis 16. Neural networks as feature extractors 17. Combining multiple classifiers 18. Bagging 19. Random forests and rotation forests 20. AdaBoost 21. Face detection using Viola Jones algorithm 22. Evaluating classification accuracy 23. Computer vision models 24. Multilayer perceptrons 25. Convolutional neural networks 26. Transformers 27. Image classification 28. Object detection 29. Image segmentation 30. Image generation		
Prerequisites and co-requisites			

Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Midterm colloquium	50.0%	30.0%
	Practical exercise	50.0%	40.0%
	Written exam	50.0%	30.0%
Recommended reading	Basic literature	Richard Szeliski, Computer Vision: Algorithm and Applications, Springer 2022 Ch. Bishop, Pattern Recognition and Machine Learning. Springer Science, New York, Elgendy, Mohamed. *Deep learning for vision systems*. Simon and Schuster, 2020. Zhang, Aston, et al. *Dive into deep learning*. Cambridge University Press, 2023.	
	Supplementary literature	G. Bradski, A. Kaehler, Learning OpenCV: Computer Vision With The OpenCV Library. O'Reilly, 2008	
	eResources addresses	Adresy na platformie eNauczanie:	
Example issues/ example questions/ tasks being completed	1. Describe the mathematical model of a pattern recognition system. 2. Present the principles of the statistical bayesian classifier. How can this type of classifier be trained? 3. Derive the perceptron training algorithm. 4. Describe the chosen sequential method of feature selection and propose a criterion for feature subset evaluation. 5. Derive the optical flow constraint and describe the simplest algorithm of calculating the optical flow in practice. 6. Develop an application demonstrating different methods of optical flow calculation using OpenCV library.		
Work placement	Not applicable		

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