GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Computer Vision, PG_00058853		
Field of study	Informatics		
Date of commencement of studies	October 2024	Academic year of realisation of subject	2026/2027
Education level	first-cycle studies	Subject group	Obligatory subject group in the field of study Subject group related to scientific research in the field of study
Mode of study	Part-time studies	Mode of delivery	at the university
Year of study	3	Language of instruction	Polish
Semester of study	6	ECTS credits	6.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Department of Intelligent Interactive Systems -> Faculty of Electronics, Telecommunications and Informatics		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Wioleta Szwoch	
	Teachers	dr inż. Wioleta Szwoch dr inż. Jerzy Dembski	

Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	15.0	0.0	0.0	30
	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	30	12.0	108.0	150

Subject objectives	The aim of the subject is to make students familiar with the basic concepts and algorithms of computer vision (in particular methods related to the image processing), and to allow them to acquire the practical skills necessary to implement simple computer vision systems.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_W41] Knows and understands, to an advanced extent, the operation and evaluation criteria of data processing, storage and transfer methods, including computational algorithms, artificial intelligence and data mining	Student explains how the most important image processing and pattern recognition algorithms work.	[SW1] Assessment of factual knowledge
[K6_U01] can apply mathematical knowledge to formulate and solve complex and non-typical problems related to the field of study and perform tasks, in an innovative way, in not entirely predictable conditions, by:n- appropriate selection of sources and information obtained from them, assessment, critical analysis and synthesis of this information,n- selection and application of appropriate methods and toolsn	Student selects image processing and pattern recognition algorithms appropriate for solving practical problems.	[SU1] Assessment of task fulfilment
[K6_U08] while identifying and formulating specifications of engineering tasks related to the field of study and solving these tasks, can:n- apply analytical, simulation and experimental methods,n- notice their systemic and non-technical aspects,n- make a preliminary economic assessment of suggested solutions and engineering work n	Student prepares the sample set and trains the classifier of images.	[SU1] Assessment of task fulfilment
[K6_U43] can analyse date and formulate, apply and assess appropriate formal models and algorithms for solving problems in the field of information systems and applications	Student implements image processing algorithms in C++. Student implements basic classification algorithms in C++.	[SU1] Assessment of task fulfilment
[K6_W01] knows and understands, to an advanced extent, mathematics necessary to formulate and solve simple issues related to the field of study	Student defines basic terms of computer vision. Student explains teoretical foundations of image processing and pattern recognition algorithms.	[SW1] Assessment of factual knowledge

Subject contents

1. Introduction. The role of image processing 2. Simple methods of image processing 3. Histogram and its transformations 4. Global thresholding 5. Local thresholding 6. Segmentation with multiple thresholding 7. Adaptive thresholding 8. Digital filters. Typical image distortions 9. Low-pass filters - characterictsics and examples 10. High-pass filters for edge detection 11. Sharpening filters and corner detection 12. Non-linear filters 13. Canny's edge detection algorithm 14. Introduction to skeletonization 15. Thinning 16. Mathematical morphology in image processing 17. Dilatation and erosion 18. Morphological opening and closing 19. Morphological operations on grayscale images 20. Hough transform 21. Basic image parameters 22. Mathematical model of pattern recognition system 23. Statistical classifier 24. Minimum-distance classifiers 25. Gradient descent method of finding the local minimum of a function 26. Perceptron algorithm

Prerequisites and co-requisites

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Written exam	50.0%	60.0%
Practical exercise	50.0%	40.0%

Recommended reading

Basic literature	R.C. Gonzales, Digital Image Processing, Prentice Hall, 2007. Ch. Bishop, Pattern Recognition and Machine Learning. Springer Science, New York,
Supplementary literature	M. Seul, L. O'Gorman and M. Sammon, Practical Algorithms for Image Processing, Cambridge University Press, USA, 2000.
eResources addresses	Adresy na platformie eNauczanie:

Example issues/ example questions/ tasks being completed	1. What is the difference between histogram equalization and histogram smoothing? What are the applications of these methods? 2. Describe the practical meaning of the parameters of Canny's algorithm. 3. Describe the Otsu algorithm and explain its relation to the discriminant analysis. 4. Describe the mathematical model of a pattern recognition system. 5. Present the principles of the statistical bayesian classifier. How can this type of classifier be trained? 6. Develop an application demonstrating selected methods of image processing.
Work placement	Not applicable