GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Computer Vision, PG_00048269		
Field of study	Informatics		
Date of commencement of studies	February 2024	Academic year of realisation of subject	2024/2025
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	2	Language of instruction	Polish
Semester of study	3	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. Maciej Smiatacz	
	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, 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_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_W43] Knows and understands, to an increased extent, the nformal, technical and social aspects of the operation of complex information systems in the information society and in the global information n infrastructure.	Student is able to select computer vision methods appropriate for solving a given problem.	[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	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_U42] can solve engineering and research problems including design, assessment and maintenance of information systems and applications, using experimental methods and management techniques	Student creats a computer vision application with the use of OpenCV library.	[SU1] Assessment of task fulfilment
[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. Mathematical model of pattern recognition system 4. Measures of classification quality 5. Statistical classifier 6. The optimal classifier for normally distributed patterns 7. Linear and partially-linear classifiers 8. Gradient descent method of finding a local minimum of a function 9. Selected algorithms of training 10. Optimal linear algorithms 11. Perceptron algorithm 12. Multi-class algorithms of training and classification 13. The role of feature selection and extraction 14. Heuristic methods of feature selection 15. Feature selection methods based on the information theory 16. Linear transformation methods 17. Sebestyen criterion 18. Principal components analysis 19. Classic Fisher criterion for two-class problems 20. Extended Fisher criterion for two-class problems 21. Multi-class Fisher criterion 22. Sequential algorithm of class separation 23. The concept of multi-stage classification 24. Methods of multi-stage classifier training 25. Clasterization of objects 26. Fuzzy clasterization algorithms 27. Neural networks in pattern recognition 28. Motion detection and analysis 29. Optical flow 30. Object localization - AdaBoost 31. Object localization - active shape models 32. Textures

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	Ch. Bishop, Pattern Recognition and Machine Learning. Springer Science, New York,
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