



## Subject card

Subject name and code	Advanced Methods of Analysis of Images, PG_00058846						
Field of study	Informatics						
Date of commencement of studies	February 2023		Academic year of realisation of subject		2022/2023		
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	1		ECTS credits		3.0		
Learning profile	general academic profile		Assessment form		assessment		
Conducting unit	Department of Geoinformatics -> Faculty of Electronics, Telecommunications and Informatics						
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. Marcin Ciecholewski				
	Teachers		dr hab. Marcin Ciecholewski				
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		8.0		37.0	75
Subject objectives	This academic course is intended to enable student to learn about various methods for the processing and analysis of digital images and video sequences. During the laboratory classes, the methods will be implemented in real-time programs with the use of cameras and video recordings.						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	[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 is able to identify and solve occurring problems in the course of realised issues using the acquired		[SK5] Assessment of ability to solve problems that arise in practice		
	[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 student knows and understands the principles of vision systems and understands the interrelationships between the various stages of real-time digital image processing.		[SW1] Assessment of factual knowledge		
	[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 student is able to propose and implement a solution in order to create real-time software for a specific problem, based on the curricular content provided. The student is able to use the available methods and necessary libraries and programming environments in order to realise original software.		[SU1] Assessment of task fulfilment [SU4] Assessment of ability to use methods and tools		

Subject contents	1. Transformations and gradient methods in a digital image, calculation of oriented gradient, histogram of oriented gradients.2. Methods of determining the internal and external contours for shapes in digital images, Ramer-Douglas-Peucker (RDP) algorithm, creating a tree of contours, sorting a set of contours according to the length of the contour.3. Methods for approximating shapes based on a set of points, Bersenham's convex hull algorithm, hole filling algorithm, methods for determining polygons and curves.4. Selected transformations and methods enabling the detection of specific shapes: linear and circular transformations, logarithmic transformation, pattern matching transformation, non-maximal suppression method5. Selected algorithms and methods of motion detection based on the camera and video sequences.6. Methods for removing the background from static scenes to detect moving objects based on the camera and video sequences.7. Digital image clustering, anomaly detection based on Gaussian mixtures.8. Selected topics concerning the recognition of features and patterns with the use of machine learning methods.		
Prerequisites and co-requisites	Recommended: object-oriented programming skills and knowledge of C ++		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Exam	60.0%	50.0%
	Practical exercises	60.0%	50.0%
Recommended reading	Basic literature	1. Gonzalez R.C., Woods R.E.: Digital Image Processing, 4rd ed.,Pearson, 2018.  2. Kaehler, Adrian, and Gary Bradski. Learning OpenCV 3: computer vision in C++ with the OpenCV library. " O'Reilly Media, Inc.", 2016.	
	Supplementary literature	No requirements.	
	eResources addresses	Adresy na platformie eNauczanie: Zaawansowane metody analizy obrazów - Moodle ID: 30030 <a href="https://enauczanie.pg.edu.pl/moodle/course/view.php?id=30030">https://enauczanie.pg.edu.pl/moodle/course/view.php?id=30030</a>	
Example issues/ example questions/ tasks being completed			
Work placement	Not applicable		