GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Image Processing, PG_00067972						
Field of study	Automatic Control, Cybernetics and Robotics						
Date of commencement of studies	October 2025		Academic year of realisation of subject		2026/2027		
Education level	first-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	4		ECTS credits		4.0		
Learning profile	general academic profile		Assessment form		assessment		
Conducting unit	Department of Decision Systems and Robotics -> Faculty of Electronics Telecommunications and Informatics -> Wydziały Politechniki Gdańskiej						
Name and surname of lecturer (lecturers)	Subject supervisor		dr inż. Krzysztof Oliński				
	Teachers						
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	30.0	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		4.0	36.0	100	
Subject objectives	The aim of the course is to present students with contemporary image processing methods used in the manufacturing industry, areas related to automotive and mobile robots. In the course of the lectures, classic methods related to image filtration, object detection algorithms and stereovision techniques are discussed. The final part of the lecture covers an introduction to image processing methods based on machine learning. The course concludes with a discussion of issues related to Visual SLAM problems.						

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_U03] can design, according to required specifications, and make a simple 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	can design the architecture of a vision system that meets the defined assumptions	[SU4] Assessment of ability to use methods and tools
[K6_W02] knows and understands, to an advanced extent, selected laws of physics and physical phenomena as well as methods and theories explaining the complex relationships between them, constituting the basic general knowledge in the field of technical sciences related to the field of study	understands the theoretical foundations on which the SW components used in projects are based on, is able to correctly configure/modify canonical methods in order to implement a vision system with desired properties	[SW1] Assessment of factual knowledge
[K6_W03] knows and understands, to an advanced 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	can select appropriate methods and required parameters in order to implement a vision system with desired properties	[SW1] Assessment of factual knowledge
[K6_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	can create software using SW components (libraries) that are implementations of selected image processing methods	[SU1] Assessment of task fulfilment

Subject contents

The course is compreised of a lecture and a complementary laboratory excersises covering the following topics:

- image acquisition
- spatial filters
- image processing techniques in the frequency domain
- image reconstruction techniques
- morphological surgeries
- detection of image features
- optical flow
- Visual SLAM
- machine learning methods in image processing

Prerequisites and co-requisites

- knowledge of the basics of mathematical analysis

- knowledge of Python language

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
	50.0%	50.0%
	50.0%	50.0%

Recommended reading	Basic literature	Chris Solomon and Toby Breckon. 2011. Fundamentals of Digital Image Processing: A Practical Approach with Examples in Matlab (1st. ed.). Wiley Publishing. Gonzalez, R. & Woods, R. (2017). *Digital Image Processing*. (4th ed.). Pearson International. https://elibrary.pearson.de/book/99.150005/9781292223070
	Supplementary literature	Peter Corke. 2013. Robotics, Vision and Control: Fundamental Algorithms in MATLAB (1st. ed.). Springer Publishing Company, Incorporated.
	eResources addresses	Basic https://docs.opencv.org/4.x/index.html - OpenCV documentation
Example issues/ example questions/ tasks being completed	Design a vision system that reconstructs a 3D environment based on images captured from a stereovision camera system. Design a vision system that stops the PKM train model when an obstacle is detected on a track.	
Work placement	Not applicable	

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