Subject card

Subject name and code	Machine Vision in Automatic Control, PG_00049078					
Field of study	Automatic Control, Cybernetics and Robotics					
Date of commencement of studies	October 2022		Academic year of realisation of subject		2025/2026	
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	4		Language of instruction		Polish	
Semester of study	7		ECTS credits		3.0	
Learning profile	general academic profile		Assessment form		exam	
Conducting unit	Department of Automatic Control -> Faculty of Electronics, Telecommunications and Informatics					
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Marcin Pazio				
	Teachers	dr inż. Marcin Pazio				

Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	0.0	0.0	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	3.0	42.0	75

Subject objectives	Introducing methods of digital images processing and principles of vision systems design.

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K6_W01] Knows and understands, to an advanced extent, mathematics necessary to formulate and solve simple issues related to the field of study	Students know the basic methods of analyzing two-dimensional signals	[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	Students know the basic methods of acquisition, analysis and processing of digital images. They are able to independently design and program vision systems.	[SW1] Assessment of factual knowledge

Subject contents	1. Applications of machine vision 2. Perception and printing of images human eye and its characteristics, characteristics of light sources 3. Luminance, brightness, saturation, metamerism 4. Color analysis and synthesis 5. Digital image formation characteristics of the optical subsystem 6. Digital image formation sampling and quantization 7. Digital image formation hardware 8. Image distortions. Typical disturbances. 9. Graphic file formats (BMP, TIF) 10. Lossless compression of digital images (LZW) 11. Lossy compression of digital images (JPEG) 12. Image histogram. Histogram-based image transformations 13. Memoryless image transformations (point operations) 14. Linear transformations of digital images finite impulse response (FIR) digital filters 15. Two-dimensional discrete Fourier transform (DFT) and its application for the linear convolution calculation 16. Linear filtration in the frequency domain 17. Median filter and its properties 18. Other nonlinear digital filters based on order statistics 19. Elimination of the image blurr 20. Detection of edges gradient-based methods 21. Detection of edges Laplacian-based approach 22. Line detection Hough transform 23. Application of mathematical morphology to image processing erosion and dilation. 24. Opening and closing of digital images. 25. Determination of a morphological skeleton. 26. Morphological transforms of grey-scale images 27. Image segmentation the region growing approach 28. Image segmentation the region split approach 29. Image segmentation the watershed approach 30. Geometrical shape descriptors shape features 31. Geometrical shape descriptors moment descriptors 32. Geometrical shape descriptors chain codes 33. Image recognition basic facts and definitions 34. Image recognition basic methods

Prerequisites and co-requisites	No requirements

Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Midterm colloquium	50.0%	100.0%

Recommended reading	Basic literature	Tadeusiewicz R., Korohoda P., "Komputerowa analiza i przetwarzanie obrazów",Wydawnictwo Fundacji Postępu Telekomunikacji, 1997
	Supplementary literature	Pitas I., "Digital Image Processing Algorithms", Prentice Hall, 1993
	eResources addresses	Adresy na platformie eNauczanie:

Example issues/ example questions/ tasks being completed	
Work placement	Not applicable