GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Machine Vision in Automatic Control, PG_00068271		
Field of study	Automatic Control, Cybernetics and Robotics		
Date of commencement of studies	October 2025	Academic year of realisation of subject	2027/2028
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	3	Language of instruction	Polish
Semester of study	6	ECTS credits	2.0
Learning profile	general academic profile	Assessment form	exam
Conducting unit	Department of Automatic Control -> Faculty of Electronics Telecommunications and Informatics -> Wydziały Politechniki Gdańskiej		
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	2.0	18.0	50

Subject objectives

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

Learning outcomes

Course outcome	Subject outcome	Method of verification
[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 understand basic methods of acquiring, analyzing, and processing digital images. They will be able to independently design and program simple vision systems.	[SW1] Assessment of factual knowledge
[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

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

<table>
<tr><td>Prerequisites and co-requisites</td><td colspan="3">No requirements</td></tr>
<tr><td>Assessment methods and criteria</td><td colspan="3"><table><tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr><tr><td>Midterm colloquium</td><td>50.0%</td><td>100.0%</td></tr></table></td></tr>
<tr><td rowspan="3">Recommended reading</td><td>Basic literature</td><td colspan="2">Rafael C. Gonzalez, Richard E. Woods, "Digital Image Processing",Pearson Education, 2018</td></tr>
<tr><td>Supplementary literature</td><td colspan="2">Pitas I., "Digital Image Processing Algorithms", Prentice Hall, 1993</td></tr>
<tr><td>eResources addresses</td><td colspan="2"></td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td colspan="3"></td></tr>
<tr><td>Work placement</td><td colspan="3">Not applicable</td></tr>
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