GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Methods of Image Processing, PG_00053922		
Field of study	Electronics and Telecommunications		
Date of commencement of studies	October 2026	Academic year of realisation of subject	2028/2029
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	assessment
Conducting unit	Department of Biomedical Engineering -> Faculty of Electronics Telecommunications and Informatics -> Faculties of Gdańsk University of Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Mariusz Kaczmarek	
	Teachers	dr hab. inż. Mariusz Kaczmarek	

Lesson types

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	3.0	17.0	50

Subject objectives

The aim of the course is to acquaint students with selected issues related to computer graphics and image processing, and developing the ability to use the methods of analysis and image processing in the tasks in the field of biomedical engineering.
It is assumed that the content of education presented in terms of this subject should be encouraged to broaden the use of shared knowledge in the field of the elements of distance education and other electronic resources.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_U08] while identifying and formulating specifications of engineering tasks related to the field of study and solving these tasks, can:n- apply analytical, simulation and experimental methods,n- notice their systemic and non-technical aspects,n- make a preliminary economic assessment of suggested solutions and engineering work n	Is able to implement basic image processing algorithms in any programming environment: filtration using convolution operations, histogram operations, special effects.	[SU4] Assessment of ability to use methods and tools [SU3] Assessment of ability to use knowledge gained from the subject
[K6_K02] is ready to critically assess possessed knowledge and acknowledge the importance of knowledge in solving cognitive and practical problems	Can search for sources of information on new image processing methods	[SK5] Assessment of ability to solve problems that arise in practice
[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 recognize the format of multimedia files, in particular it distinguishes between different image file formats. Knows how to save monochrome and color images saved in different color models. Knows the basic image processing algorithms: filtering by convolution operations, histogram operations, special effects.	[SW1] Assessment of factual knowledge

Subject contents	Course content – lecture 1. Models and representation of images. 2. Acquisition and synthesis of images. 3. Storage and presentation of images. 4. Typical images, source (digital photography, satellite images, reconstructed images). 5. Colour Systems (systems 3 and 4 dimensional RGB, HSI, YUV, Lab, Luv, CMYK). 6. Colour Systems (color plates). 7. Reading and writing data. 8. The digital image file formats (three component). 9. The digital image file formats (one-component). 10. Applications of the DFT transformation in image processing. 11. Applications DCT transformation in image processing. 12. Format JPEG / MPEG. 13. Techniques for improving image quality: convolution, filtering dolnoprzepu-asso and High Pass. 14. Techniques for improving image quality: filtration nielinowa (median filters). 15. Techniques for improving the quality of the images: the histogram operations - stretching the histogram. 16. Techniques for improving the quality of the images: the histogram operations: alignment and fit. 17. Processing of geometry: the transformation of rigid and flexible. 18. Processing of geometry: affine transformations and perspective. 19. Recording of images in a common coordinate system. 20. interpolation methods: nearest neighbor interpolation, duplication and bilinear. 21. Methods of interpolation interpolation polynomials of higher degree (cubic convolution). 22. Detection of contours in the image: methods Sobel, Prewitt. 23. Detection of contours in the image: Frei-Chen; Laplacian. 24. Detection of contours in the image: Canny, Hough transformation. 25. Binarization and thresholding images. 26. Threshold optimal (Otsu method, the maximum similarity). 27. Release of segments of region growing method. 28. Release of segments: split and merge method regions. 29. Release of segments segmentation evaluation metrics. 30. Applications of image processing methods.
Prerequisites and co-requisites	1. The Fourier transform 1.1. Dimensional, discrete Fourier transform (definition, complexity, fast Fourier transform algorithm) 1.2. Weave (definition and the compound Fourier Transform) 1.3. Low Pass and High Pass Filter (definition, the basic implementation in the frequency and time domains). 2. Income matrix 2.1. Matrix notation, equations 2.2. matrix inversion 3. Transformation geometry (geometric transformations rigid and flexible). 4. Introduction to Programming

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Class test 2	51.0%	20.0%
Laboratory Excercise	51.0%	60.0%
Class test 1	51.0%	20.0%

Recommended reading

Basic literature	Malina W., Ablameyko S., Pawlak W., Podstawy cyfrowego przetwarzania obrazów, EXIT, Warszawa, 2002 A. Watt, 3D Computer Graphics, Addison Wesley, 2000. Fedak J., Fotografia cyfrowa od A do Z. Encyklopedia. MUZA SA, Warszawa 2006.
Supplementary literature	Russ J.C., The Image Processing Handbook Second Edition, CRC Press, 1995. I. N. Bankman (eds.) Handbook of medical Imaging, Processing and Analysis, Academic Press, 2000. B. Jahne, Practical handbook on Image Processing for scientific applications, CRC Press, 1997
eResources addresses	

Example issues/ example questions/ tasks being completed	Read and write operations images: file formats. Image representation methods. Improving the quality of images: filtration and operations histograms Digital filtering and geometric operations The use of the Fourier transform and the Cosine Special transformation and segmentation
Practical activites within the subject	Not applicable

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