GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Digital image processing methods in remote sensing - lecture, PG_00070921		
Field of study	Informatics		
Date of commencement of studies	February 2025	Academic year of realisation of subject	2025/2026
Education level	second-cycle studies	Subject group	
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	2	Language of instruction	Polish
Semester of study	3	ECTS credits	1.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Department of Geoinformatics -> Faculty of Electronics Telecommunications and Informatics -> Faculties of Gdańsk University of Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. Marcin Ciecholewski	
	Teachers	dr hab. Marcin Ciecholewski	

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	15.0	0.0	0.0	0.0	0.0	15

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	15	1.0	9.0	25

Subject objectives

The aim of the course is to familiarise students with the methods and algorithms of digital image processing in remote sensing using optical and radar apparatus.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[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	Students can explain how algorithms and digital image processing methods work. They can also list the advantages and limitations of the approaches presented.	[SW1] Assessment of factual knowledge
[K7_W10] knows and understands, to an increased extent, the basic processes occurring in the life cycle of equipment, objects and technical systems, as well as methods of supporting processes and functions, specific to the field of study	The student has a good understanding of the relationships between the various stages of processing.	[SW1] Assessment of factual knowledge

Subject contents

Course content – lecture
1. Introduction to imaging methods used in remote sensing. 2. Point transformations of digital images 3. Filtering: convolution and discrete correlation. 4. Noise in optical and radar images, methods of reducing noise: filtering based on arithmetic and geometric mean, median filtering, adaptive filtering. 5. Methods and applications of mathematical morphology for greyscale and binary images: noise reduction, edge and shape extraction, image reconstruction. 6. Gradient approximation methods in digital images. 7. Application of gradient methods in shape extraction in digital images. 8. Selected topics in segmentation of digital images as applied to remote sensing: global and local binarization methods, area growing method, segmentation using clustering and superpixels, segmentation using graph cuts, watershed segmentation.

<table>
<tr><td>Prerequisites and co-requisites</td><td></td></tr>
<tr><td>Assessment methods and criteria</td><td>
<table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>Written colloquium</td><td>50.0%</td><td>100.0%</td></tr>
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<tr><td>Recommended reading</td><td>
<table>
<tr><td>Basic literature</td><td>1. Gonzalez R.C., Woods R.E.: Digital Image Processing, 4rd ed.,Pearson, 2018.
2. Parker, Jim R. Algorithms for image processing and computer vision. John Wiley & Sons, 2010.
3. Szeliski, R. (2022). Image Processing. In: Computer Vision. Texts in Computer Science. Springer, Cham
4. Serra, J., & Soille, P. (Eds.). (2012). Mathematical morphology and its applications to image processing (Vol. 2). Springer Science & Business Media.</td></tr>
<tr><td>Supplementary literature</td><td>No requirements.</td></tr>
<tr><td>eResources addresses</td><td></td></tr>
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<tr><td>Example issues/ example questions/ tasks being completed</td><td>1. Explain and derive relationships for point operations in digital images such as equalization, normalization and histogram adjustment. 2. Computationally efficient algorithms for determining dilation and erosion for binary and greyscale images. 3. Give global and local binarization methods and explain their operation. For which image classes is it best to apply the specified methods? 4. Explain the operation of k-means and superpixel methods for segmentation of digital images. 6. Implement and compare the results of watershed segmentation and graph cut methods.</td></tr>
<tr><td>Practical activites within the subject</td><td>Not applicable</td></tr>
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