GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Photogrammetry and remote sensing in practical applications, PG_00071187						
Field of study	Geodesy and Cartography						
Date of commencement of studies	February 2026		Academic year of realisation of subject	2026/2027			
Education level	second-cycle studies		Subject group				
Mode of study	Full-time studies		Mode of delivery	at the university			
Year of study	1		Language of instruction	Polish			
Semester of study	2		ECTS credits	3.0			
Learning profile	general academic profile		Assessment form	assessment			
Conducting unit	Department of Geodesy -> Faculty of Civil and Environmental Engineering -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Jakub Szulwic					
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	15.0	0.0	0.0	30.0	75
	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	75		0.0	0.0	75	
Subject objectives	The aim of the course is to develop students ability to apply knowledge of photogrammetry and remote sensing in practical contexts through direct engagement with current industry practices and emerging technological developments. The course is based on interaction with domain experts, the analysis of real-world case studies, and the critical review of contemporary methods, tools, and trends, including solutions based on artificial intelligence. Particular emphasis is placed on the ability to evaluate the applicability of technologies, identify innovative solutions, and implement them effectively in engineering, environmental, and economic contexts. The course also develops competencies in interdisciplinary communication, understanding industry needs, and adapting academic knowledge to real-world project conditions.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K7_K101] acknowledges the importance of knowledge related to the field of study in solving cognitive and practical problems, critically assessing the information obtained	The student recognises the importance of up-to-date knowledge and innovative technologies in solving practical problems, critically evaluates information sources and proposed solutions, and demonstrates an awareness of the need for continuous professional development in the rapidly evolving field of geospatial science.	[SK5] Assessment of ability to solve problems that arise in practice
	[K7_U06] creates solutions to complex and unstructured problems taking into account the variability of the environment by synthesising information from different sources, using analytical and simulation methods	The student is able to develop solutions to complex and unstructured engineering and environmental problems by integrating photogrammetric and remote sensing data from multiple sources, taking into account variable conditions and technological constraints. The student applies analytical and conceptual approaches to evaluate and select optimal solutions.	[SU2] Assessment of ability to analyse information
	[K7_U05] can choose, depending on the nature of the study, methods for assessing the quality of photogrammetric and remote sensing products and elaborations.	The student is able to select appropriate methods for assessing the quality of photogrammetric and remote sensing products depending on the intended application, and to compare and critically evaluate different technological solutions in terms of accuracy, reliability, and practical suitability.	[SU3] Assessment of ability to use knowledge gained from the subject [SU2] Assessment of ability to analyse information
	[K7_W01] has the knowledge of basic aerial and satellite photogrammetry and extensive knowledge of the application of photogrammetry, including knowledge of the usage of photogrammetric methods and technologies of data acquisition for the construction of topographic and thematic databases,has the knowledge of numerical terrain models (NMT) and numerical models of land cover (NMPT), as well as building models; knows and is able to apply in practice photogrammetric techniques and technologies, and in particular knows the principles of image mapping, vector maps and altitudinal models, has knowledge of existing sensors and their calibration, terratriangulation of models and 3D visualization	The student has advanced and structured knowledge of contemporary applications of photogrammetry in engineering practice, including the use of data acquired from aerial, satellite, and UAV platforms for the generation of spatial products such as elevation models, 3D models, and cartographic outputs. The student understands the importance of sensor selection, data processing methods, and data integration in real-world project contexts.	[SW1] Assessment of factual knowledge
	[K7_W03] has knowledge of the basic physical remote sensing; knows the available photographic materials and satellite data as well as their potential uses; knows the basics of digital image processing and analysis of aerial and satellite image; has deep knowledge of remote sensing applications including knowledge of the usage of remote-sensing methods and technologies of data acquisition for the construction of topographic and thematic databases purpose	The student has extended knowledge of remote sensing applications in environmental and engineering analyses, including the use of multispectral, thermal, and satellite data. The student understands the relationships between the physical properties of electromagnetic radiation and the interpretative potential of remote sensing data, as well as contemporary methods for their processing and practical application.	[SW1] Assessment of factual knowledge

Subject contents	Course content – lecture The lecture component provides an overview of contemporary applications of photogrammetry and remote sensing in engineering, environmental, and economic contexts, with particular emphasis on current technological trends and developments in the geospatial industry. Real-world case studies are discussed, demonstrating the use of data acquired from aerial, satellite, and low-altitude platforms (UAV) across a range of applications. The course examines modern approaches to the processing and integration of photogrammetric and remote sensing data, including point clouds, 3D models, multi-sensor datasets, and digital twin technologies. It also addresses the increasing role of automation in data processing workflows, as well as the application of artificial intelligence and machine learning methods in classification, segmentation, and spatial data analysis. Particular emphasis is placed on the critical evaluation of available technological solutions, including their suitability for specific applications and the identification of limitations related to data quality, acquisition conditions, and methodological assumptions. Practical aspects of technology implementation are also considered, including project requirements, organisational constraints, and economic factors. An important element of the course is the presentation of professional experience from industry practitioners and the analysis of real project challenges, enabling students to confront theoretical knowledge with real-world conditions. The course also includes a review of recent scientific literature and emerging innovations, with particular attention to rapidly developing applications of artificial intelligence in geospatial sciences. Course content – exercises An important element of the course is the presentation of professional experience from industry practitioners and the analysis of real project challenges, enabling students to confront theoretical knowledge with real-world conditions. The course also includes a review of recent scientific literature and emerging innovations, with particular attention to rapidly developing applications of artificial intelligence in geospatial sciences. Course content – seminar The seminar component has a problem-oriented and discussion-based format, focusing on the analysis of real-world challenges in photogrammetry and remote sensing applications. The sessions include presentations and discussions of case studies based on current professional projects, as well as the critical review of selected scientific publications and industry reports. Students engage in the evaluation of applied technologies and methodologies, identifying their limitations and assessing their suitability for different engineering and environmental contexts. Particular emphasis is placed on the interpretation of results, the validity of conclusions, and the ability to formulate well-founded recommendations. An important element of the seminar is the involvement of industry practitioners and the discussion of real project scenarios, enabling students to confront academic approaches with practical requirements. The seminar also addresses current technological trends, including the use of artificial intelligence, process automation, and multi-sensor data integration. The seminar develops competencies in presentation and argumentation, teamwork, interdisciplinary communication, and informed decision-making based on available data and the current state of knowledge.
Prerequisites and co-requisites	
Assessment methods and criteria	

Subject passing criteria	Passing threshold	Percentage of the final grade
Presentation	60.0%	100.0%

<table>
<tr><td rowspan="3">Recommended reading</td><td>Basic literature</td><td>Colomina, I., Molina, P. (2014).
Unmanned aerial systems for photogrammetry and remote sensing: A review.
ISPRS Journal of Photogrammetry and Remote Sensing, 92, 7997.
(klasyczny, ale nadal fundamentalny artykuł przeglądowy dla UAV wciąż cytowany i aktualny koncepcyjnie)

Ma, L., Liu, Y., Zhang, X., et al. (2019).
Deep learning in remote sensing applications: A meta-analysis and review.
ISPRS Journal of Photogrammetry and Remote Sensing, 152, 166177.
(solidne wprowadzenie do AI w teledetekcji nadal aktualne metodologicznie)</td></tr>
<tr><td>Supplementary literature</td><td>Torresan, C., Berton, A., Carotenuto, F., et al. (2017).
Forestry applications of UAVs in Europe: A review.
International Journal of Remote Sensing, 38(810), 24272447.

Zhu, X. X., Tuia, D., Mou, L., et al. (2017).

Deep learning in remote sensing: A comprehensive review and list of resources.IEEE Geoscience and Remote Sensing Magazine, 5(4), 836.

(bardziej techniczne uzupełnienie AI dobre dla ambitniejszych osób)</td></tr>
<tr><td>eResources addresses</td><td></td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td colspan="2">Selection of technologies and data
Which photogrammetric and remote sensing technologies should be applied to address a specific engineering or environmental problem (e.g. construction monitoring, vegetation assessment, change detection)? Justify the choice in terms of accuracy, cost, data availability, and field conditions.

Critical analysis of a real-world solution (case study)
Analyse a selected real-world study (scientific publication, industry report, or project) and evaluate the applied methods, data quality, and validity of conclusions. Identify potential improvements or alternative approaches.

Application of artificial intelligence in data analysis
Evaluate the potential and limitations of machine learning or deep learning methods in the classification of photogrammetric or remote sensing data. In which cases does AI provide real added value, and when is its use questionable?

Interpretation of results and project recommendations
Based on provided data or analytical results, propose an interpretation and formulate recommendations for a specific application (e.g. spatial planning, environmental management, infrastructure projects). Consider data uncertainty and methodological limitations.</td></tr>
<tr><td>Practical activites within the subject</td><td colspan="2">Not applicable</td></tr>
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