



Subject card

Subject name and code	Digital photogrammetry with elements of computer vision, PG_00069052						
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		8.0		
Learning profile	general academic profile		Assessment form		exam		
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. Paweł Tysiąc				
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	45.0	45.0	30.0	0.0	0.0	120
	E-learning hours included: 0.0						
	eNauczanie source address: https://enauczanie.pg.edu.pl/2025/course/view.php?id=2040						
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	120		0.0		0.0	120
Subject objectives	Introduction to methods for acquiring and processing image data for photogrammetric and remote-sensing purposes, and to selected computer vision algorithms used in 3D reconstruction, calibration, and image analysis. Emphasis will be placed on product quality (orthophotos/orthomosaics, DTM/DSM), validation, and engineering applications.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K7_U01] can use in the practice photogrammetric techniques and technologies and in particular knows the principles of creating image maps, vector maps and elevation models; is able to carry out photogrammetric engineering measurements	Student: is able to independently perform a photogrammetric survey in a geodetic task and, using appropriate software, produce vector maps and elevation models.	[SU4] Assessment of ability to use methods and tools
	[K7_U04] can use the techniques of digital image processing in digital photogrammetry and remote sensing	Student: is able to perform digital image processing in digital photogrammetry and remote sensing using appropriate software.	[SU4] Assessment of ability to use methods and tools
	[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	Student: has knowledge of photogrammetry and remote sensing for building topographic and thematic databases; has the knowledge necessary to construct DTMs and DSMs, as well as building models; has the knowledge needed to create vector and image maps and elevation models.	[SW3] Assessment of knowledge contained in written work and projects
	[K7_U05] can choose, depending on the nature of the study, methods for assessing the quality of photogrammetric and remote sensing products and elaborations.	Student: has the skills required to assess the quality of photogrammetric data (e.g., satellite imagery) and to select photogrammetric products for geodetic tasks.	[SU4] Assessment of ability to use methods and tools
	[K7_W02] knows the basics of data acquisition using laser scanning, has the knowledge of the block alignment (scan orientation); knows methods for assessing the quality of photogrammetric and remote sensing products; knows the Act of May 17, 1989 - Geodetic and cartographic law, together with its implementing provisions	Student: possesses the knowledge needed to adjust laser-scanning strips/scans and the knowledge necessary to acquire numerical data from laser scanners. Student: has knowledge of the legal basis for performing geodetic tasks in photogrammetry and remote sensing.	[SW3] Assessment of knowledge contained in written work and projects
	[K7_U02] can perform and elaborate 3D models based on laser scanning data; can apply methodologies in advanced geodetic observation	Student: is able to use software to develop numerical 3D models from laser scanning data.	[SU4] Assessment of ability to use methods and tools
Subject contents	Course content – lecture Imaging sensors and geometry; camera calibration; SfM and bundle adjustment; block aerotriangulation; orthorectification and mosaicking; DTM/DSM; laser scanning and ICP; SAR/InSAR basics; integration with GIS/BIM and standards. Course content – exercises Algorithm schematics (SfM, ICP, segmentation); computational tasks (parallax, scale, transforms); flight-plan design and GCP/ICP selection; quality report analysis. Course content – laboratory Camera calibration and feature matching; orthophoto and DTM/DSM; point-cloud processing (CloudCompare/PDAL); InSAR basics in SNAP. Google Earth Engine		
Prerequisites and co-requisites	Basics of photogrammetry and remote sensing; analytic geometry and linear algebra; basic GIS; introductory programming (e.g., Python); recommended: fundamentals of image processing.		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Final exam	50.0%	50.0%
	Laboratory reports	60.0%	40.0%
	Presentation	60.0%	10.0%

Recommended reading	Basic literature	1. Z. Kurczyński, <i>Fotogrametria</i>, PWN, Warszawa. 2. W. Malina, M. Śmiatacz, In Polish: <i>Cyfrowe Przetwarzanie Obrazów</i>, EXIT, ISBN 978-83-60434-54-3. 3. Google Earth Engine Manual: https://developers.google.com/earth-engine/guides/getstarted 4. MOST Wiedzy articles review: https://mostwiedzy.pl/pl/ 5. MDPI articles review: https://www.mdpi.com/
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	Supplementary literature	• Wolf, DeWitt, Wilkinson (2014), <i>Elements of Photogrammetry with Applications in GIS</i>, 4e. • Luhmann, Robson, Kyle, Böhm (2019), <i>Close-Range Photogrammetry and 3D Imaging</i>, 3e. • Kraus (2007), <i>Photogrammetry: Geometry from Images and Laser Scans</i>, 2e. • Hartley & Zisserman (2004/2006), <i>Multiple View Geometry in Computer Vision</i>, 2e. • Szeliski (2022), <i>Computer Vision: Algorithms and Applications</i>, 2e. • Triggs et al. (2000), <i>Bundle Adjustment A Modern Synthesis</i>. • Lowe (2004), <i>SIFT</i>. • Fischler & Bolles (1981), <i>RANSAC</i>. • Nistér (2004), <i>Five-Point Relative Pose</i>. • Schönberger & Frahm (2016), <i>Sfm Revisited</i> (COLMAP). • Schönberger et al. (2016), <i>Pixelwise View Selection</i> (ECCV). • Hirschmüller (2008), <i>SGM</i>. • Furukawa & Ponce (2010), <i>PMVS</i>. • Strecha et al. (2008), <i>Benchmarking Calibration and MVS</i>. • Jensen et al. (2014), <i>Large Scale MVS Evaluation</i> (DTU). • Schöps et al. (2017), <i>ETH3D Benchmark</i>. • Rupnik, Daakir, Pierrot-Deseilligny (2017), <i>MicMac</i>. • Kümmerle, Grisetti et al. (2011), <i>g2o</i>. • Agarwal et al. (2022+), <i>Ceres Solver</i> dokumentacja, tutoriale. • Moulon, Monasse, Marlet (2016), <i>OpenMVG</i>.
	eResources addresses	

Example issues/ example questions/ tasks being completed	Sample topics / questions / tasks • Please explain the difference between parallax and disparity, including their dependence on baseline and focal length. • Please describe the SfM pipeline, including Bundle Adjustment. • Please discuss quality criteria for orthophotos and DTMs/DSMs, and the design of GCP/ICP points (ground control points / independent check points). • Please describe a drone flight plan for orthophoto production (GSD, overlaps/coverage, GCP).
Practical activities within the subject	Not applicable

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