COURSE DESCRIPTION CARD - SYLLABUS

Course name
SCANING AND MODELLING OF THREE-DIMENSIONAL OBJECTS. METHODS AND APPLICATIONS [S5AEEITK>SMOP]

Course

Proposed by Discipline
–

Year/Semester
2/3

Level of study
Doctoral School

Course offered in
English

Form of study
full-time

Requirements
elective

Number of hours

Lecture
4

Laboratory classes
0

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

1,00

Coordinators

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Lecturers

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Prerequisites

A doctoral students starting this course should possess knowledge of computer graphics (particularly regarding the modeling and visualization of 3D objects) and optical measurement methods.

Course objective

The aim of the course is to familiarize doctoral students with methods and techniques for acquiring 3D data and merging scans, as well as with specific aspects of photogrammetry. The scope also covers topics related to modern scene visualization methods—such as NeRF (Neural Radiance Fields) and Gaussian Splatting—generated from 2D images.

Course-related learning outcomes

Knowledge (The student knows and understands):
SzD_W03: Key developmental trends of disciplines of science in which education at the Doctoral School takes place.
SzD_W03: Scientific research methodology in disciplines represented at the Doctoral School.

Skills (The student is able to):
SzD_U02: Critically analyze and assess scientific research results.

SzD_U05: Share results of scientific activity also in a popular form.

Social Competences (The student is ready to):
SzD_K01: Critically assess achievements within a given scientific and practical task.
SzD_K03: Acknowledge the importance of knowledge in solving practical problems.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

A practical task involving the photogrammetry modeling method of any 3D object based on photographs.

Programme content

1. 3D Scanning
2. Photogrammetry
3. 3D Rendering and Visualization

Course topics

3D Scanning
1. Definitions and methods
• Laser Triangulation
• Structured Light
• Time Of Flight
• Photogrammetry
2. Scan matching
• Common Algorithms – ICP, NDT
3. 3D scanning results and models
4. 3D modelling using AI

Photogrammetry
1. Definition and working steps
• Images acquisition
• Feature Extraction
• Keypoint Matching
• Results

3D Rendering and Visualization
1. Neural radiance field (NeRF).
2. Gaussian Splatting.

Teaching methods

1. Multimedia lecture presentations.
2. Scanning examples of different objects.

Bibliography

Basic:
1. Gary C. Confalone, John Smits, Thomas Kinnare, 3D Scanning for Advanced Manufacturing, Design, and Construction, John Wiley & Sons, 1 mar 2023 – 224.
2. Wilfried Linder. Digital Photogrammetry. A Practical Course. Springer-Verlag Berlin Heidelberg 2016. DOI https://doi.org/10.1007/978-3-662-50463-5

Additional:
1. https://www.matthewtancik.com/nerf.
2. https://repo-sam.inria.fr/fungraph/3d-gaussian-splatting/.

Breakdown of average student's workload

	Hours	ECTS
Total workload	25	1,00
Classes requiring direct contact with the teacher	4	0,00
Doctoral student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation)	21	1,00