3D Visualisation

Code: 104391
ECTS Credits: 6

2025/2026

Degree	Type	Year
Computational Mathematics and Data Analytics	OB	2

Contact

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Teachers

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Teaching groups languages

You can view this information at the end of this document.

Prerequisites

Linear Algebra

Objectives and Contextualisation

The main objective of this lecture is to provide students with the theoretical framework necessary to undertsand the 3D-vision.

Learning Outcomes

1. CM19 (Competence) Use homographic transformations and conformal representation.
2. CM21 (Competence) Select the suitable data compression in each case to preserve the desired properties.
3. KM18 (Knowledge) Identify the group of quaternions and their application to geometry and visualisation.
4. SM18 (Skill) Use quaternions in data representation algorithms.

Content

Representation of a 3D moving scene

- 3D Euclidean space
- Rigid-body motion
- Rotations
- Homogenous representation

Image formation

- Representation of images
- Geometric model of image formation
- Projective geometry

Epipolar geometry

- Essential matrix
- The eight-point linear algorithm
- Planar scenes and homography
- The homography matrix

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Problems	8	0.32	
Seminars	14	0.56	
Theory	27	1.08	
Type: Supervised			
Tutorship sessions	10	0.4	
Type: Autonomous			
Programming	27	1.08	
Solving problems	27	1.08	
Study	29	1.16	

There will be three types of directed activities: theory classes where the concepts of the subject will be introduced, problem classes where the students will manipulate these concepts and seminary classes where specific software will be used to obtain accurate representations of three-dimensional objects.

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Assessment

Continous Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Final exam	40%	3	0.12	CM19, KM18
Midterm exam	40%	3	0.12	CM19, KM18
Seminar work	20%	2	0.08	CM21, SM18

The evaluation will consist of an intrasemestral exam that will count 40% of the note, an examination at the end of the semester that will count 40% of the note and the remaining 20% will be obtained from the work made in the seminar classes. Assistance to the seminars is compulsory

In case that the continuous assessment note thus obtained does not reach 5, the student who has completed 2/3 of the evaluation activities may take a recovery exam whose grade will substitute that of the two partial exams. A student taking the recovery exam and together with the seminar's note passing the course will be awarded the final note of 5 independently of the actual note of the recovery exam.

Awarding an honors matriculation qualification is the decision of the teaching staff responsible for the subject. UAB regulations indicate that MH can only be granted to students who have obtained a final grade equal to or higher than 9.00. Up to 5% of MH of the total number of enrolled students can be awarded.

A student will be considered non-evaluable (NA) if he has not taken part in a set of activities whose weight is equivalent to a minimum of two-thirds of the subject's total grade.

The single assessment of the subject will consist of the following assessment activities:

- Taking the final exam, for 40% of the grade.
- Delivery on the day of the final exam of the assignments requested in the seminars, for 20% of the final grade. In particular, attendance at seminars is mandatory.
- Taking an oral exam, for 40% of the grade.

If necessary the written exam can be re-evaluated. If a student passes with the recovery exam, then the final note will be a 5 independently of the actual note of the recovery exam. The oral exam and seminars can not be re-evaluated.

Bibliography

Faugeras, Olivier, Three-dimensional computer vision : a geometric viewpoint,1993.

Yi Ma and [al.], An Invitation to 3-D vision : from images to geometric models, Ma, Yi, ed., 2004.

Hartley, Richard, Zisserman, Andrew, Multiple view geometry in computer vision, Cambridge Univ. press, 2008

Forsyth, David A., Ponce, Jean, Computer vision : a modern approach,2003.

D. Shreiner, G. Sellers, J. Kessenich, B. Licea-Kane, OpenGL Programming Guide, 8th Eds, 2013, Addison-Wesley. Red book.

OpenGL Superbible - Comprehensive Tutorial and Reference, 7th eds, Addison-Wesley, 2016. Blue book.

Edward Angel, David Shreiner, Interactive Computer Graphics - A top-down approach using OpenGL, 6th ed, Pearson Education, 2012.

Software

OpenGL or similar.

Groups and Languages

Please note that this information is provisional until 30 November 2025. You can check it through this link. To consult the language you will need to enter the CODE of the subject.

Name	Group	Language	Semester	Turn
(PLAB) Practical laboratories	1	Catalan	first semester	morning-mixed
(SEM) Seminars	1	Catalan	first semester	morning-mixed
(TE) Theory	1	Catalan	first semester	morning-mixed