Universidad Zaragoza

Academic Year/course: 2024/25

69717 - Computer Vision

Syllabus Information

Academic year: 2024/25
Subject: 69717 - Computer Vision
Faculty / School: 110 - Escuela de Ingeniería y Arquitectura
Degree: 633 - Master's Degree in Biomedical Engineering
ECTS: 3.0
Year: 1
Semester: Second semester
Subject type: Optional
Module:

1. General information

The objective of the subject is the computerized perception from images obtained through cameras. Vision has demonstrated applicability in motion capture and analysis, biometrics, and three-dimensional measurement from images and sequences, as well as in robotics and augmented reality. This has increasing applications in the biomedical field due to the ease of image acquisition and storage, and the generalization of endoscopic access.

Throughout the course, students are expected to tackle problems related to the estimation of the 3D geometry of a scene over a sequence to perform augmented reality, as well as place recognition with deep learning methods, everything using datasets from the medical domain.

2. Learning results

1. To understand the fundamentals of image acquisition and formation, feature detection and robust matching, 3D vision geometry, image alignment, calibration, and structure from motion in image sequences.

2. To be skilled in the implementation of basic algorithms for perception with vision, and in the handling of standard software in computer vision and three-dimensional estimation.

3. To be skilled in the design and implementation of simple applications combining basic computer vision algorithms.

4. To be able to self-learn by reading research articles, where the latest advances in the field of computer vision are presented.

5. To be skilled in oral and written communication of computer vision based systems, including their description and experimental evaluation.

3. Syllabus

The contents of the subject are:

1. Image acquisition and processing
2. Deep learning for classification and place recognition
3. Automatic matching
4. Attention-based methods
5. Camera model
6. Robust fitting
7. Two-view geometry
8. Structure from motion and Bundle adjustment
9. Depth estimation
10. SLAM inside the human body

The program of practical sessions/problems is:

1. Introduction to image and video processing in Python
2. Deep learning for classification and place recognition
3. Detection and matching of keypoints
4. Structure-from-Motion with COLMAP
5. Augmented reality in colonoscopy

4. Academic activities

- **Lectures (20 hours)**. Presentations by the teachers.
- **Laboratory practices (10 hours)**. Practical exercises programming on a computer.

- **Personal study (42 hours)**. Study of the contents covered in lectures and preparation of course assignments.
- **Assessment tests (3 hours)**. Written test and presentation of course assignments.

5. Assessment system

According to the regulations of the University of Zaragoza, students can choose between continuous and global assessment of their learning. The course is passed with an overall grade of 5 out of 10.

Continuous assessment throughout the semester:

- **Individual written test (30%)**: A test will be conducted during the examination period stipulated by the center.
- **Practical assignments (60%)**: Oral presentations of 2 course assignments, which will be a continuation of the work developed in practical sessions 2 and 5. Each assignment will account for 30%.
- **Laboratory practices (10%)**: The student's performance in each practice that does not extend into the practical assignment will be graded from 0 to 10.

Global assessment on the dates established by the official calls:

- **Practical assignments (70%)**: Oral presentations of 2 course assignments, which will be a continuation of the work developed in practical sessions 2 and 5. Each assignment will account for 35%.
- **Individual written test (30%)**: A test will be conducted during the examination period stipulated by the center.

6. Sustainable Development Goals

3 - Good Health & Well-Being
8 - Decent Work and Economic Growth
9 - Industry, Innovation and Infrastructure