Universidad Zaragoza

Academic Year/course: 2023/24

29847 - Computer Vision

Syllabus Information

Academic year: 2023/24
Subject: 29847 - Computer Vision
Faculty / School: 110 - Escuela de Ingeniería y Arquitectura
326 - Escuela Universitaria Politécnica de Teruel
Degree: 440 - Bachelor's Degree in Electronic and Automatic Engineering
      444 - Bachelor's Degree in Electronic and Automatic Engineering
ECTS: 6.0
Year: 4
Semester: 444 - First semester
440 - Second semester
Subject type: Optional
Module:

1. General information

In this subject we study computational methods to analyze the images produced by a digital camera that observes a scene, with the objective of understanding the observed scene. On the one hand, the semantics of the scene is addressed, identifying the elements that integrate it, on the other hand, its 3D geometry.

The methodology is based on a first understanding of the fundamentals of image analysis processes through its mathematical, probabilistic and algorithmic modeling. In a second stage, the design and implementation of algorithms in standard programming environmentsis addressed , evaluating their performance on real images.

The approach and objectives are aligned with SDGs 8 and 8.2, so that the acquisition of the learning results of the subject provides the student with the training and competence to contribute to their achievement.

2. Learning results

- Know and interpret the main parameters that describe the information of an image, its acquisition and storage.
- Know and apply digital image processing techniques.
- Apply pattern recognition and classification methods to images and image sequences and use this information to control a system.
- Be able to retrieve three-dimensional information from flat images and to use this information to control a system.
- Use digital image processing and analysis software.

3. Syllabus

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- Image representation and processing.
- Automatic learning: Regression and classification. Methodology and metrics.
- Artificial neural networks.
- Deep network architectures for computer vision.
- Pre-trained nets and fine tuning.
- Image acquisition and 3D camera model.
- Detection and matching of points of interest.
- Robust adjustment of primitives.
- Geometric relations between two views.
- Structure and movement and adjustment of beams.

Practical activities program:

- Image processing.
- Machine learning fundamentals and methodology.
- Classification of handwritten digit images (MNIST).
- Fine tuning of deep convolutional networks.
- Detection and matching of points of interest.
- Robust fitting of F and H. 3D estimation from two images.

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- Introduction. What is computer vision.
- Image. Basic concepts.
- Image enhancement. Preprocessing.
- Segmentation. Edge and region detection.
- Description. Feature extraction and points of interest.
- Applications.
- Introduction to 3-D vision.

Practical activities program:

- Actions on an image window.
- Taking photographs with different types of lighting.
- Geometric transformations
- Segmentation and labeling.
- Classification by feature extraction.
- Classification using machine learning techniques.
- 3D calibration.

4. Academic activities

Río Ebro Campus (Zaragoza).

- A01 Lectures (30 hours).
- A03 Laboratory practices (18 hours).
- A06 Continued work (36 hours).
- A07 Personal study and work (60 hours).
- A08: Assessment (6 hours).

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- A01 Lectures (20 hours).
- A02 Problem solving and classroom work (28 hours).
- A03A Laboratory practicals (6 hours).
- A03B Computerized practices (6 hours).
- A06 Teaching assignments and other activities (27 hours).
- A07 Study (60 hours).
- A08: Assessment (3 hours).

At EUPT, the course is taught in two different modalities: classroom and blended learning. For the presential modality all of the above applies. In the blended mode, the student will be provided with the materials and software necessary to carry out the practices.

5. Assessment system

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Inaccordance with the regulations of the University of Zaragoza, the student may choose between continuous and global assessment. The subject is passed with an overall grade of 5 out of 10.

Assessment throughout the semester.

- Oral presentations of practical laboratory sessions 1, 2, 3 and 5 will be given in the session immediately following each of them . The weighting of the assessment of these practices will be 10% of the overall grade.
- There will be oral presentations of 2 papers, which will be a continuation of the work developed in the practical laboratory sessions 4 and 6. These assignments will be weighted 60% of the final grade (30% each one of them).
- An individual written test (30%) will be given at the official call.

Global assessment: On the dates established for the official calls:

- There will be oral presentations of 2 papers, which will be a continuation of the work developed in the practical laboratory sessions 4 and 6. These assignments will be weighted 70% of the final grade (35% each one of them).
- There will be an individual written test (30%).

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Ordinary assessment. The summative evaluation will be carried out on an ongoing basis and will have three contributions:

- Teaching assignments in and out of the classroom one per subject (30%).
- 6 laboratory practices (20%).
- Final paper (50%).

A 4/10 must be obtained in each of the parts and a 5/10 overall to pass the subject.

Single test assessment. For those who do not pass the first two contributions of the ordinary assessment or want to obtain a higher grade:

- Theoretical and practical exam: theoretical questions on basic concepts of the subject and performance of tasks of processing and extraction of information from a digital image (50%).
- Final paper (50%).

At EUPT, the course is taught in two different modalities: classroom and blended learning. For the presential modality all of the above applies. In the blended mode of the EUPT students must in any case go to center if they choose to take the exam.