Universidad Zaragoza

Academic Year/course: 2023/24

30263 - Computer Vision

Syllabus Information

Academic year: 2023/24
Subject: 30263 - Computer Vision
Faculty / School: 110 - Escuela de Ingeniería y Arquitectura
Degree: 439 - Bachelor's Degree in Informatics Engineering
ECTS: 6.0
Year: 4
Semester: Second semester
Subject type:
Module:

1. General information

The objective of the subject is to provide an introductory view of the most relevant techniques and algorithms in the development of Computer Vision systems, starting from the most basic concepts of artificial vision to the most relevant methods of greater relevance at present, developing a knowledge applied to different practical cases.

These approaches and goals are aligned with the following Sustainable Development Goals (SDGs) of the United Nations Agenda 2030 (https://www.un.org/sustainabledevelopment/es/), so that the acquisition of the learning results of the subject provides training and competence to contribute to some extent to their achievement: Goal 5, Objective 5.b and Goal 9, Objectives 9.1, 9.4 and 9.5.

It is recommended to have taken the previous subjects of Mathematics II (linear algebra), Artificial Intelligence (probabilistic reasoning and intelligent systems) and Machine Learning (supervised and unsupervised learning).

2. Learning results

The student, in order to pass this subject, must demonstrate the following learning results:

- Understand the fundamentals of image formation, acquisition, and representation.
- Apply image processing, feature detection and segmentation techniques.
- Implement learning and image recognition functions.
- Understand the fundamentals and applications of three-dimensional vision.
- Be able to develop simple practical applications of computer vision.

3. Syllabus

Since its inception, Computer Vision has served as a catalyst in the advancement of knowledge or the rescue from oblivion of other disciplines. At the beginning of the 21st century, computer vision has already been the benchmark for the advancement of different machine learning methodologies such as probabilistic learning models or deep learning (Deep Learning), which detonated by winning a visual recognition contest in 2012. Undoubtedly, the scientific and technological advances of humanity in the rest of the century will be conditioned by advances in this area of knowledge.

Computer Vision is a very promising discipline for companies as the great advances in Machine Learning are being motivated by artificial vision applications of interest to companies and their customers and many of the intelligent systems that are produced make use of the visual interpretation of the environment to perform their functions. The machine vision is one of the pillars in Industry 4.0, where process automation through cameras or robots equipped with optical devices would not be possible without advanced vision algorithms. In addition, Computer Vision is of great relevance in medicine, where hospitals incorporate in many of their diagnostic and treatment protocols by image, many surgical operations are performed with the help of augmented reality, etc.

Program:

1. Image formation and acquisition. Image representation models.
2. Basic image processing methods.
3. Feature detection (points of interest, contours, etc.)

4. Segmentation. Shape analysis.
5. 3D vision.
6. Optical flow.
7. Deep-learning.
8. Computer vision applications.

4. Academic activities

The learning will be obtained from two types of contributions: the explanatory sessions of the teaching staff and the competences developed from the realization of the practices. The activities will be organized on the basis of the theory sessions and problems, the practicals, and the activities proposed for assessment.

In order to carry out the practices, students must do a previous work consisting of the study of the contents of the theoretical sessions of the subject and a proposal for a solution to the problem posed in the practice, which will be discussed with the teachers. Once the problem posed in the practice has been solved, the students must deliver the codes designed for the solution of the problem together with a report explaining all the work done and will make an oral defense of the work done. The calendar of the subject will be defined in the academic calendar of the Center.

The schedule of practical sessions and presentation of papers will be available in the Digital Teaching Ring (ADD), and will be presented on the first day of class. The detailed calendar of the various activities to be carried out will be established once the University has approved the academic calendar for the corresponding academic year. In any case, important dates will be announced well in advance.

The practical work is carried out in a computer laboratory. In the practice sessions the students will work in teams and will carry out a series of programming tasks directly related to the topics studied in the subject. The work will be delivered within the deadlines set in each case.

The student's dedication to achieve the learning results in this subject is estimated in 150 hours, distributed as follows:

- 60 hours of activities with the teacher (theoretical, problem and practical classes).
- 84 hours of effective personal study (study of notes and texts, problem solving, class preparation, program development).
- approximately 6 hours of evaluation tests.

5. Assessment system

In accordance with the current Regulation of Learning Evaluation Standards of the University of Zaragoza, two assessment systems will be established for the subject. For the First Call of the subject, a system of continuous assessment and a global test will be carried out, to which all students who do not opt for continuous assessment, who do not pass the subject by this process, or who wish to improve the grade obtained, are entitled to. The Second Round will be carried out by means of a global test according to the regulations. This global test will coincide in form with the one proposed for the first call. In either case, the evaluation will be coherent with the objectives and contents of program of the subject. The two assessment systems are detailed below.

Continuous assessment system

By means of this system, the evaluation of the subject is considered in a formative and continuous way, so this system is more recommendable in the student's learning process. Theoretical and practical knowledge of the subject will be evaluated. Given the relevance that the acquisition of practical skills has in the subject, all the work developed by the student for the realization of the practical activities proposed in the subject will be evaluated to verify that the student has achieved the learning results. The evaluable activities will be indicated during the term with sufficient anticipation.

In order to pass the subject, a final grade higher than 5 must be obtained in the assessment of the work done by the student.

Overall assessment system

For each session, a final exam will be divided into a theory part and a practical part. The criteria for the summative assessment will be as follows:

1. Theory exam - 30 %

2. Practical exam - 70 %

In order to pass the subject a minimum of 4 points in each of the parts (PI and PE) and a score of 5 points or more out of 10 in the final grade will be required.