

Academic Year: (2019 / 2020)

Review date: 01-04-2019

Department assigned to the subject: Department of Systems Engineering and Automation

Coordinating teacher: ESCALERA HUESO, ARTURO DE LA

Type: Electives ECTS Credits : 6.0

Year : 4 Semester :

COMPETENCES AND SKILLS THAT WILL BE ACQUIRED AND LEARNING RESULTS.

The main objective of this course is to familiarise the student with computer image analysis , through the use of Computer Vision applications.

These perception systems has been established in the industry with two aims:

1. - To achieve greater interaction between machines and their surrounding environment.
2. - To obtain total visual quality control of manufactured products.

Nevertheless, the appearance of new algorithms and digital camera sensors have caused the range of applications has been expanded during the recent years. One example of this type of application can be found in digital cameras and apps, where faces of the people who appear in the photos are detected. Another examples are the automatic detection of license plates, or the new 3D cameras, which are able to provide information, not only of the object colour but also the distance to the appearing in the image are. These progresses allow new fields of application, such as security or autonomous diving, as well as new ways of interacting with computers, e.g. using had gestures or eye movements.

Due to the practical implications of the course, half of the classes will be Lab Sessions, where the students will learn how to use the OpenCV library, which represents nowadays, a de facto standard for Computer Vision applications because it allows creating real time image analysis applications fastly.

DESCRIPTION OF CONTENTS: PROGRAMME

1.- Introduction to Computer Vision.

- 1.1. Definitions.
- 1.2. History
- 1.3. Modules
- 1.4. Human vision sense
- 1.5. Applications

2.- Elements of Computer Vision systems

- 2.1. Lenses
- 2.2. Digital cameras
- 2.3. Image processing boards
- 2.4. Software

3.- Digital images.

- 3.1. Spatial sampling, grey levels.
- 3.2. Pixels.
- 3.3. Arithmetical and logical Operations.
- 3.4. Colour.

4.- Spatial filtering

- 4.1. Image Transformations.
- 4.2. Convolution.
- 4.3. Correlation.
- 4.4. Geometrical Transformations.

5.- Image Pre-processing.

- 5.1. Contrast
- 5.2. Histogram modification

- 5.3. Noise reduction
- 5.4. Image sharpening
- 5.5. False colour

6.- Feature extraction.

- 6.1. Edge detection.
- 6.2. Movement detection.

7.- Segmentation.

- 7.1. Thresholding and labelling.
- 7.2. Region growing.
- 7.2. Split & Merge.
- 7.3. Mean-Shift

8.- Morphological Transforms and object description.

- 8.1. Morphological Transforms for binary images
- 8.2. Morphological Transforms for grey level images
- 8.3. Region descriptors.
- 8.4. Shape descriptors.

9.- Object recognition.

- 9.1. Basic concepts.
- 9.2. Classifier evaluation
- 9.3. Bayes¿ classifier.
- 9.4. Clustering.

LEARNING ACTIVITIES AND METHODOLOGY

The learning activities and methodology are:

- Lectures, classes for resolution of doubts in small groups, student presentations, tutorials and individual work of students; aimed at the acquisition of knowledge (3 ECTS).
- Laboratory practices and sections of problems in small groups, individual tutorials and individual work of students, aimed at the acquisition of practical skills related to the syllabus of the subject (3 ECTS).

ASSESSMENT SYSTEM

The evaluation system includes continuous assessment of student work (papers, reports of laboratory practice, class participation and skills assessment tests of theoretical (20%) and practical knowledge (40%)) and the final assessment through a written final exam (40%) in which the knowledge, skills and abilities acquired throughout the course will be evaluated comprehensively.

% end-of-term-examination:	40
% of continuous assessment (assignments, laboratory, practicals...):	60

BASIC BIBLIOGRAPHY

- GONZALEZ, R Digital image processing, Addison-Wesley.

ADDITIONAL BIBLIOGRAPHY

- Gary Bradski, Adrian Kaehler Learning OpenCV: Computer Vision with the OpenCV Library, O'Reilly Media, 2008

BASIC ELECTRONIC RESOURCES

- . CONCEPTOS Y METODOS EN VISIÓN POR COMPUTADOR:
<http://intranet.ceautomatica.es/sites/default/files/upload/8/files/ConceptosyMetodosenVxC.pdf>