Perception Systems

Academic Year: (2019 / 2020) **Review date: 26/04/2020 12:00:12**

Department assigned to the subject: Systems Engineering and Automation Department

Coordinating teacher: ESCALERA HUESO, ARTURO DE LA

Type: Electives ECTS Credits : 6.0

Year : 4 Semester :

OBJECTIVES

By the end of this content area, students will be able to have:
1. coherent knowledge of their branch of engineering including some at the forefront of the branch in perception systems;
2. the ability to apply their knowledge and understanding of perception systems to identify, formulate and solve engineering problems using established methods;
3. the ability to apply their knowledge and understanding to develop and realise designs to meet defined and specified requirements;
4. an understanding of design methodologies, and an ability to use them.
5. the ability to select and use appropriate equipment, tools and methods;
6. the ability to combine theory and practice to solve problems of perception systems
7. an understanding of applicable techniques and methods in perception systems, and of their limitations;

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

% end-of-term-examination/test:	40
% of continuous assessment (assigments, laboratory, practicals…):	60

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.

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