# UNIVERSIDAD DE CASTILLA - LA MANCHA

# GUÍA DOCENTE

## 1. General information

| | | | |
|---|---|---|---|
| **Course:** | COMPUTER VISION | **Code:** | 56521 |
| **Type:** | ELECTIVE | **ECTS credits:** | 6 |
| **Degree:** | 359 - UNDERGRAD. IN INDUSTRIAL ELECTRONICS AND AUTOMAT. ENGINEERING (CR) | **Academic year:** | 2023-24 |
| **Center:** | 602 - E.T.S. INDUSTRIAL ENGINEERING OF C. REAL | **Group(s):** | 20 |
| **Year:** | 4 | **Duration:** | C2 |
| **Main language:** | Spanish | **Second language:** | English |
| **Use of additional languages:** | | **English Friendly:** | Y |
| **Web site:** | | **Bilingual:** | N |

## 2. Pre-Requisites

Basic knowledge using and programming computers

## 3. Justification in the curriculum, relation to other subjects and to the profession

Computer Vision is a field widely used in industrial applications such as control quality, process control, navigation, medical imaging, etc. This subject provides knowledge and skills to design and develop a computer vision system. Software applications are the main element for these systems which are based on image analysis. The subject is closely related to other programming subjects, such as Computer Science, Industrial Computing and Advanced Computer Science.

The subject is also related to Biomedical Engineering and the Signal Processing subject, due to the image can be considered as a two-dimensional signal.

## 4. Degree competences achieved in this course

**Course competences**

| Code | Description |
|---|---|
| A02 | To know how to apply knowledge to work or vocation in a professional manner and possess the competences that are usually demonstrated by the formulation and defence of arguments and the resolution of problems in the field of study. |
| A08 | Appropriate level of oral and written communication. |
| A13 | Ability to take the initiative to solve problems, take decisions, creativity, critical reasoning and ability to communicate and transmit knowledge, skills and abilities in Industrial Electronic Engineering and Automation. |
| E02 | Knowledge of technologies that enable processes of automatization and complex systems to be dealt with. |
| E04 | Ability to automatize manufacturing and production processes. |
| E06 | Knowledge to develop automatic quality control systems. |
| E08 | Knowledge of hardware and software necessary for the development of specialized computer systems used in automatized and robotic systems. |

## 5. Objectives or Learning Outcomes

**Course learning outcomes**

Description

Ability to design and implement discrete systems for processing signals on a computer

Know how to improve the benefits of circuits using the SPICE tool in combination algorithms

Anticipate and reosolve communication problems in noisy surroundings

Know how to apply circuit simulation tools in the analysis of noise, analysis of circuits with analogue and digital devices and analysis of worst case scenario

Know how to apply the tool SPICE in iterative analyses of circuits with elements affected by tolerances

Knowledge and use of design flows and synthesis relating to programmable and configurable devices.

Ability to select and programme microcontrollers in the design of built-in control systems

Ability to analyze signals and discrete systems in the domain of frequencies

**Additional outcomes**

## 6. Units / Contents

**Unit 1: Introduction**

**Unit 2: The digital image**

**Unit 3: Pre-processing**

**Unit 4: Contour detection**

**Unit 5: Segmentation**

**Unit 6: Descriptors**

**Unit 7: Recognition**

**Unit 8: Motion**

## ADDITIONAL COMMENTS, REMARKS

| Memoria Verificada | Guía e |
|---|---|

| | |
|---|---|
| Concepts and elements of a vision system | Unit 1 |
| Geometric models of cameras | Unit 2 |
| Visual information processing | Unit 2 |
| Image operators | Units 3, 4 |
| Image processing | Unit 3 |
| Processing and feature extraction | Units 4, 5 y 6 |
| Pattern representation and recognition | Unit 7 |
| Applications | Units 1, 2, 3, 4, 5, 6 y 7 |

## 7. Activities, Units/Modules and Methodology

| Training Activity | Methodology | Related Competences (only degrees before RD 822/2021) | ECTS | Hours | As | Com | Description |
|---|---|---|---|---|---|---|---|
| Class Attendance (theory) [ON-SITE] | Lectures | A02 A04 A05 A07 A08 A12 A13 A18 E01 E02 E03 E04 E05 E06 E08 | 1.2 | 30 | N | - | |
| Laboratory practice or sessions [ON-SITE] | Combination of methods | A02 A04 A05 A07 A08 A12 A13 A18 E01 E02 E03 E04 E05 E06 E08 | 1.2 | 30 | Y | N | |
| Study and Exam Preparation [OFF-SITE] | Self-study | A02 A04 A05 A07 A08 A12 A13 A18 E01 E02 E03 E04 E05 E06 E08 | 3.6 | 90 | Y | N | |
| | | **Total:** | **6** | **150** | | | |
| **Total credits of in-class work: 2.4** | | | **Total class time hours: 60** | | | | |
| **Total credits of out of class work: 3.6** | | | **Total hours of out of class work: 90** | | | | |

As: Assessable training activity
Com: Training activity of compulsory overcoming (It will be essential to overcome both continuous and non-continuous assessment).

## 8. Evaluation criteria and Grading System

| Evaluation System | Continuous assessment | Non-continuous evaluation* | Description |
|---|---|---|---|
| Assessment of problem solving and/or case studies | 25.00% | 25.00% | An extensive practical exercise |
| Projects | 25.00% | 25.00% | |
| Theoretical exam | 50.00% | 50.00% | |
| **Total:** | **100.00%** | **100.00%** | |

*According to art. 4 of the UCLM Student Evaluation Regulations, it must be provided to students who cannot regularly attend face-to-face training activities the passing of the subject, having the right (art. 12.2) to be globally graded, in 2 annual calls per subject , an ordinary and an extraordinary one (evaluating 100% of the competences).*

**Evaluation criteria for the final exam:**

**Continuous assessment:**

The evaluation will consist of:
- Practical sessions exercises
- An extensive practical exercise focused on solving and developing a computer vision application
- Theorical work (report and presentation) related to the subject
- Final test

To pass the subject in the ordinary call the student must reach the minimum score of 5/10.

**Non-continuous evaluation:**

Evaluation criteria not defined

**Specifications for the resit/retake exam:**

The evaluation conditions are the same. If the student has reached in a previous part a minimum score of 5 (except the written test), that score may be reused for this evaluation.

## 9. Assignments, course calendar and important dates

**Not related to the syllabus/contents**

| Hours | hours |
|---|---|

**Unit 1 (de 8): Introduction**

| Activities | Hours |
|---|---|
| Class Attendance (theory) [PRESENCIAL][Lectures] | 2 |
| Laboratory practice or sessions [PRESENCIAL][Combination of methods] | 2 |

**Unit 2 (de 8): The digital image**

| Activities | Hours |
|---|---|
| Class Attendance (theory) [PRESENCIAL][Lectures] | 4 |
| Laboratory practice or sessions [PRESENCIAL][Combination of methods] | 4 |

**Unit 3 (de 8): Pre-processing**

| Activities | Hours |
|---|---|
| Class Attendance (theory) [PRESENCIAL][Lectures] | 4 |

| | |
|---|---|
| Laboratory practice or sessions [PRESENCIAL][Combination of methods] | 4 |
| **Unit 4 (de 8): Contour detection** | |
| **Activities** | **Hours** |
| Class Attendance (theory) [PRESENCIAL][Lectures] | 4 |
| Laboratory practice or sessions [PRESENCIAL][Combination of methods] | 4 |
| **Unit 5 (de 8): Segmentation** | |
| **Activities** | **Hours** |
| Class Attendance (theory) [PRESENCIAL][Lectures] | 4 |
| Laboratory practice or sessions [PRESENCIAL][Combination of methods] | 4 |
| **Unit 6 (de 8): Descriptors** | |
| **Activities** | **Hours** |
| Class Attendance (theory) [PRESENCIAL][Lectures] | 4 |
| Laboratory practice or sessions [PRESENCIAL][Combination of methods] | 4 |
| **Unit 7 (de 8): Recognition** | |
| **Activities** | **Hours** |
| Class Attendance (theory) [PRESENCIAL][Lectures] | 4 |
| Laboratory practice or sessions [PRESENCIAL][Combination of methods] | 4 |
| **Unit 8 (de 8): Motion** | |
| **Activities** | **Hours** |
| Class Attendance (theory) [PRESENCIAL][Lectures] | 4 |
| Laboratory practice or sessions [PRESENCIAL][Combination of methods] | 4 |
| **Global activity** | |
| **Activities** | **hours** |
| Laboratory practice or sessions [PRESENCIAL][Combination of methods] | 30 |
| Class Attendance (theory) [PRESENCIAL][Lectures] | 30 |
| **Total horas:** | 60 |

## 10. Bibliography and Sources


| Author(s) | Title/Link | Publishing house | Citv | ISBN | Year | Description |
|---|---|---|---|---|---|---|
| Escalera Hueso, Arturo de la | Visión por computador : fundamentos y métodos | Prentice Hall | | 84-205-3098-0 | 2001 | |
| Escalera Hueso, Arturo de la | Visión por computador : fundamentos y métodos | Prentice Hall | | 978-84-205-3098-7 | 2006 | |
| Fuente López, Eusebio de la | Visión artificial industrial : procesamiento de imágenes par | Universidad de Valladolid, Secretariado de Publ | | 978-84-8448-730-2 | 2012 | |
| Pajares Martinsanz, Gonzalo | Visión por computador : imágenes digitales y aplicaciones | Ra-Ma | | 84-7897-472-5 | 2001 | |
| Pajares Martinsanz, Gonzalo | Visión por computador : imágenes digitales y aplicaciones | Ra-Ma | | 978-84-7897-831-1 | 2007 | |