COURSE DESCRIPTION

COURSE DETAILS

Title (of the course): **FUNDAMENTOS DE SISTEMAS INTELIGENTES EN VISIÓN**
Code: 101421
Degree/Master: **GRADO DE INGENIERÍA INFORMÁTICA** Year:
Name of the module to which it belongs: OBLIGATORIO ESPECIALIDAD COMPUTACIÓN
Field: FUNDAMENTOS DE SISTEMAS INTELIGENTES EN VISIÓN
Character: OBLIGATORIA Duration: FIRST TERM
ECTS Credits: 6.0 Classroom hours: 60
Face-to-face classroom percentage: 40.0% Study hours: 90
Online platform: http://www.uco.es/moodle

LECTURER INFORMATION

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PREREQUISITES AND RECOMMENDATIONS

Prerequisites established in the study plan

None

Recommendations

None specified

INTENDED LEARNING OUTCOMES

CB4	To make students able to share information, ideas, problems and solutions with an audience of specialists and non-specialists
CTEC4	Ability to know the fundamentals, paradigms and techniques of intelligent systems and analyze, design and build systems, services and computer applications that use these techniques in any field of application.
CTEC5	Ability to acquire, obtain, formalize and represent human knowledge in a computable way to solve problems through a computer system in any field of application, particularly those related to aspects of computing, perception and performance in intelligent environments.

COURSE DESCRIPTION

OBJECTIVES

The main goal of this course is to provide a basic knowledge to analyze, design and implement intelligent systems based on computer vision.
This includes:
- Design of acquisition systems: selecting the appropriate sensors and configuring their parameters.
- Understanding the basis of digital images: projective geometry, camera calibration and correction of lens aberrations.
- Learning the main techniques of digital image processing: processing in space and frequency domains.
- Understanding the segmentation techniques and their uses.
- Grasp the principles of feature extraction and description and their utility.
- Becoming familiar with the fundamentals of 3D reconstruction from 2D images.

CONTENT

1. Theory contents

BLOCK 1: Digital image processing. Image acquisition. Pixelwise operations. Linear and non-linear filtering. Applications.
BLOCK 2: 3D scene reconstruction. Main stereo techniques, structured light and Shape-from-X. Applications.
BLOCK 3: Image understanding. Segmentation and feature extraction. Representation and description. Modern Computer Vision approaches.

2. Practical contents

Introduction to the use of the OpenCV software package and its application to the field of Computer Vision. To this end, several practical exercises will be carried out using this package where the student will learn the following skills:
-Installation and optimised configuration of the OpenCV package in Linux/Windows environments.
-Basic loading and manipulation of monochrome/colour images.
-Video capture/recording with USB cameras.
-Point processing of images: histogram equalisation/enhancement.
-Camera calibration and application to camera distortion correction.
-Camera pose estimation and application to augmented reality.
-Reconstruction of the 3D scene from its 3D projections.
-Feature extraction such as gradients, lines, optical flow, texture.
-Application of machine learning for image classification: Nearest Neighbour and Support Vector Machine.
- Deep Learning applied to Computer Vision problems.

SUSTAINABLE DEVELOPMENT GOALS RELATED TO THE CONTENT

Quality education
Industry, innovation and infrastructure

COURSE DESCRIPTION

METHODOLOGY

Methodological adaptations for part-time students and students with disabilities and special educational needs

The teacher will meet with the students concerned to establish the most appropriate adaptations for each individual case.

Face-to-face activities

Activity	Large group	Medium group	Total
Assessment activities	3	-	3
Lab practice	-	24	24
Lectures	28.5	-	28.5
Tutorials	4.5	-	4.5
Total hours:	***36.0***	***24***	***60.0***

Off-site activities

Activity	Total
Exercises	40
Information search	10
Self-study	40
Total hours	***90***

WORK MATERIALS FOR STUDENTS

Case studies
Exercises and activities
Lessons summary

EVALUATION

Intended learning	Exams	Laboratory Practice	Real and/or simulated tasks
CB4	X	X	X
CTEC4	X	X	X
CTEC5	X	X	X

COURSE DESCRIPTION

Intended learning	Exams	Laboratory Practice	Real and/or simulated tasks
Total (100%)	*35%*	*30%*	*35%*
Minimum grade	*5*	*0*	*5*

(*)Minimum mark (out of 10) needed for the assessment tool to be weighted in the course final mark. In any case, final mark must be 5,0 or higher to pass the course.

Attendance will be assessed?:

No

General clarifications on instruments for evaluation:

In January and February, the students must do a final exam both theoretical and practical. The final mark will be the weighted average of the exams and the laboratory practicals. The exercises of the laboratory practicals must be handed in before the exam of January.
After the February exam (September and others), the evaluation criteria are based exclusively on the final exams (theoretical and practical).

Clarifications on the methodology for part-time students and students with disabilities and special educational needs:

At the beginning of the course, the student should contact the course instructor to handle each situation in a particular manner.

Clarifications on the evaluation of the extraordinary call and extra-ordinary call for completion studies:

After February, the evaluation criteria are based only on the final exams.

Qualifying criteria for obtaining honors:

The current regulations will be applied.

BIBLIOGRAPHY

1. Basic Bibliography

Adrian Kaehler y Gary Bradski , "Learning OpenCV 3: Computer Vision in C++ with the OpenCV Library", O'Reilly Media, 2016, ISBN: 978-1491937990
Richard Szeliski, "Computer Vision: Algorithms and Applications", 2nd Edition, Springer, 2022 - Online: https://szeliski.org/Book/

2. Further reading

Alberto Fernandez Villan, "Mastering OpenCV 4 with Python", Packt, 2019
Aurelien Geron, "Hands-on Machine Learning with Scikit-Learn, Keras, and TensorFlow", O'Reilly, 2019
Jeremy Howard y Sylvain Gugger, "Deep Learning for Coders with fastai and PyTorch", O'Reilly, 2020.

COURSE DESCRIPTION

COORDINATION CRITERIA

Common learning outcomes
Common tasks for different courses
Joint activities: lectures, seminars, visits ...
Tasks deadlines

The methodological strategies and the evaluation system contemplated in this Course Description will be adapted according to the needs presented by students with disabilities and special educational needs in the cases that are required.