Artificial vision

Academic Year: (2023 / 2024) **Review date: 25-04-2023**

Department assigned to the subject: Signal and Communications Theory Department

Coordinating teacher: DIAZ DE MARIA, FERNANDO

Type: Electives ECTS Credits : 3.0

Year : 4 Semester :

SKILLS AND LEARNING OUTCOMES

Complement the basic, transversal and compulsory knowledge of the Degree according to the student's preferences.

OBJECTIVES

- To know how images and video are digitally represented.
- To know basic concepts of image processing with special emphasis on the operation of spatial filtering.
- To know basic concepts of machine learning in the framework of neural networks: loss functions, regularization, hyperparameters, data augmentation.
- To understand deep neural networks and to know the algorithms used for their training: gradient descent and back-propagation algorithms.
- Understand Convolutional Neural Networks (CNN) and their most common building blocks.
- Understand, design and train CNN architectures for image classification.
- Understand, design and train advanced CNN-based architectures to solve other visual recognition tasks: object detection, image segmentation, image synthesis.

DESCRIPTION OF CONTENTS: PROGRAMME

1. Digital Images and Video
2. Basic concepts in image and video processing
3. Basic concepts in deep learning
4. Convolutional Neural Networks (CNNs) for image classification
5. Deep networks for other image-related tasks

a. Networks for image segmentation
b. Networks for object detection
c. Networks for image matching
d. Networks for image synthesis

LEARNING ACTIVITIES AND METHODOLOGY

Seminars and lectures supported by computer and audiovisual aids.
Practical learning based on cases and problems, and exercise resolution.
Individual and group or cooperative work with the option of oral or written presentation.
Individual and group tutorials to resolve doubts and queries about the subject.
Internships and directed laboratory activities.

ASSESSMENT SYSTEM

The evaluation of the course will be carried out by means of lab exercises and projects.

% end-of-term-examination:	0
% of continuous assessment (assigments, laboratory, practicals…):	100

BASIC BIBLIOGRAPHY

- Francois Chollet Deep Learning with Python, Second Edition, Manning, 2021
- Ian Goodfellow, Yoshoua Bengio, and Aaron Courville Deep Learning, The MIT Press, 2016
- Mohamed Elgendy Deep Learning for Vision Systems, Manning, 2020

ADDITIONAL BIBLIOGRAPHY

- Rafael C. González and Richard E. Woods Digital Image Processing. Fourth Edition, Pearson, 2018

- Wilhelm Burger and Mark J. Burge Principles of Digital Image Processing: Fundamental Techniques, Springer-Verlag, 2009

- Wilhelm Burger and Mark J. Burge Principles of Digital Image Processing: Core Techniques, Springer-Verlag, 2009