

Academic Year: (2023 / 2024)

Review date: 25-05-2023

Department assigned to the subject: Computer Science and Engineering Department

Coordinating teacher: BELLUCCI , ANDREA

Type: Electives ECTS Credits : 3.0

Year : 1 Semester : 1

OBJECTIVES

The subject introduces the fundamental principles, methods and technologies for the development of Ambient Intelligence (Aml) systems, physical spaces that are sensitive and respond to the presence of people. The Aml paradigm requires the application of artificial intelligence to process data from sensors embedded in the environment (cameras, microphones or touch screens, accelerometers, etc.) and thus assist people in a multitude of scenarios through of a natural user interface. The applications of the Aml paradigm cover the domestic, industrial, hospital or vehicle environment, among others.

In this subject, following a responsible and Human-Centered Artificial Intelligence approach, the concepts and main characteristics of an Aml system will be examined, as well as methodologies for developing Aml applications. The subject will have a practical nature, facilitating experimentation with the main technologies for the implementation of prototypes of Aml systems. In addition, the main challenges for the development of Aml systems will be analyzed.

The objective of the course is to train students to:

- Analyze the application of the Ambient Intelligence paradigm
- Develop prototypes of Ambient Intelligence systems

DESCRIPTION OF CONTENTS: PROGRAMME

1. Concept and approaches of the Ambient Intelligence (Aml) paradigm
 - Ubiquitous Computing
 - Internet of Things
 - Context Awareness
 - Human-centric Artificial Intelligence
2. Main characteristics of an Aml system
 - Sensitive
 - Responsive
 - Adaptive
 - Transparent
 - Intelligent
3. Design methodologies for Aml
 - End-user development and artificial intelligence
4. Interaction in Aml
 - User interaction requirements
 - Presence and proxemic interaction
 - Voice interaction
 - Gestures and body movements
5. Practical programming of Aml systems
 - Machine Learning with sensors data (microcontrollers, mobile devices, cameras, etc.)
 - Voice processing as a means of interaction
 - Technologies for the development of Aml prototypes
 - + Tensorflow.js
 - + Web programming for Aml

LEARNING ACTIVITIES AND METHODOLOGY

Learning activities

- AF1 - Theoretical class
- AF2 - Practical classes

- AF3 - Theoretical-practical classes
- AF5 - Tutorials
- AF6 - Group work
- AF7 - Individual student work

Teaching methodology

- MD1 - Lectures with the support of computer and audiovisual media, in which the main concepts of the subject are developed and the bibliography is provided to complement the students' learning.
- MD2 - Critical reading of texts recommended by the professor of the subject: press articles, reports, manuals and / or academic articles, either for later discussion in class, or to expand and consolidate the knowledge of the subject.
- MD3 - Resolution of practical cases, problems, etc. individually or in groups.
- MD5 - Preparation of work and reports individually or in groups.

ASSESSMENT SYSTEM

- SE1 (10%) - Participation in class and in the course forum
- SE2 (90%) - Individual or group work done during the course
 - + Group work (pairs)
 - (20%) Critical analysis and in-class discussion of the literature on the Aml paradigm
 - + Individual work
 - (10%) Machine learning practice with Tensorflow.js
 - (20%) Web programming for Aml practice
 - (40%) Aml case study development

- Extraordinary call:
 - + Individual work
 - (100%) Aml case study development

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

BASIC BIBLIOGRAPHY

- Ben Shneiderman Human-centered AI, Oxford University Press, 2022
- Hamid K. Aghajan, Juan Carlos Augusto & Ramón López-Cózar Delgado Human-centric interfaces for ambient intelligence, Academic Press, 2010
- Shanqing Cai, Stanley Bileschi, Eric D. Nielsen & François Chollet Deep learning with JavaScript : neural networks in TensorFlow.js, Manning, 2020

ADDITIONAL BIBLIOGRAPHY

- John Krumm Ubiquitous computing fundamentals, Chapman & Hall/CRC Press, 2010

BASIC ELECTRONIC RESOURCES

- Albert Haque, Arnold Milstein & Li Fei-Fei . Illuminating the dark spaces of healthcare with ambient intelligence: https://www.nature.com/articles/s41586-020-2669-y
- Brian Epstein . Ambient Intelligence: <https://epstein.org/ambient-intelligence/>
- Rob Dunne, Tim Morris & Simon Harper . A Survey of Ambient Intelligence: https://dl.acm.org/doi/abs/10.1145/3447242?casa_token=osp61lhi04YAAAAA:JRFBHn6zF5X2uDMOYwSP0vi2t-AUi380mcQ576BXSiq948TejVw3l4X578gYehQvaqdeAGZ2TQ