Universidad Zaragoza

Academic Year/course: 2024/25

67243 - Electronic neural networks

Syllabus Information

Academic year: 2024/25
Subject: 67243 - Electronic neural networks
Faculty / School: 110 - Escuela de Ingeniería y Arquitectura
Degree: 622 - Master's in Electronic Engineering
ECTS: 6.0
Year: 1
Semester: Second semester
Subject type: Optional
Module:

1. General information

ENN is an elective subject (limited places), whose main objective is to provide electronic engineering students with the knowledge and tools to **incorporate intelligence into electronic systems and devices**. Taking into account the degrees that give access to the master's degree, no additional knowledge is required.

The first objective of ENN is to train students in the fundamentals of **artificial intelligence**, specifically in **neural networks** and other techniques of ***machine learning*****,** with a very practical orientation and special emphasis on **hardware implementation**. This is a differential feature with respect to other subjects, allowing intelligent applications in fiedls such us home automation, home appliances, internet of things, computer vision, etc.

2. Learning results

1. To apply artificial neural networks and other intelligent techniques to solve problems in new environments or with imprecise or ill-defined information.
2. To know the basics of artificial neural networks and other related techniques.
3. To be able to develop a project based on neural networks and other intelligent systems, dividing the problem into parts, selecting the most suitable technique in each case and simulating it on a computer.
4. To be able to select the appropriate electronic implementation technology in each case: ASIC, FPGA, microcontroller, DSP or computer.

3. Syllabus

ENN covers the entire field of *machine learning*, from linear models to the latest *deep learning* and generative models such as chatGPT.

Theory program

Topic 1. Fundamentals of *machine learning*
Topic 2. Supervised learning
Topic 3. Unsupervised learning
Topic 4. Kernel and temporal models
Topic 5. Deep learning
Topic 6. Generative models
Topic 7. Digital neural networks
Topic 8. Analog neural networks and bioinspired systems

Indicative practice program

Tools and introduction to *machine learning*
Dimension reduction and unsupervised models
Supervised models: linear and SVM
MLP and *Deep learning*
Deep learning(II)

4. Academic activities

The subject has a practical orientation, illustrating the fundamentals of *machine learning* with examples of real applications carried out by the teachers (the teachers of this subject have more than twenty-five years of experience in this field). For instance: smart home appliances, electricity consumption forecasting, recognition of activities in a house from sensor data, analysis of material properties, computer vision, recognition of speech commands, etc.

Teaching activities:

1. Master Class (20 hours)
2. Case studies (10 hours)

3. Practical sessions: (18 hours)
4. Teaching assignments (36 hours)
5. Study and personal work (60 hours)
6. Assessment tests (6 hours)

5. Assessment system

The subject will be evaluated by the continuous assessment system by means of the following activities:

1. Written exam (30%)

Multiple-choice exam with penalties for failures, to be taken on the date of the official call.

2. Laboratory practices (30%)

They will be evaluated in each session by observation of the student's work and by means of a Moodle questionnaire on the practice. Anyone unable to attend a laboratory session should contact the teacher.

3. Project work (40%)

It consists of applying NN or other intelligent techniques to a specific real problem. Evaluation items: difficulty and development, results obtained, quality of the report, oral presentation and defence.

- They will preferably be carried out in groups of two students.
- In order to pass in the 1st call, the report must be submitted one week before the official date of the 1st call established by EINA (May). The oral presentations will take place on the day of the official call, following the exam.
- In order to pass in the 2nd call, the report must be submitted one week before the official date of the extraordinary call established by EINA (June-July).

Alternatively, there is the possibility of passing the subject by means of a global evaluation to be carried out in the official calls for exams by means of an oral and/or written theoretical-practical test.

6. Sustainable Development Goals

8 - Decent Work and Economic Growth
9 - Industry, Innovation and Infrastructure