67230 - Electronic Neural Networks

Información del Plan Docente

Academic Year	2017/18
Faculty / School	110 - Escuela de Ingeniería y Arquitectura
Degree	527 - Master's in Electronic Engineering
ECTS	5.0
Year	1
Semester	First semester
Subject Type	Optional
Module	---

1.General information

1.1.Introduction

1.2.Recommendations to take this course

1.3.Context and importance of this course in the degree

1.4.Activities and key dates

2.Learning goals

2.1.Learning goals

2.2.Importance of learning goals

3.Aims of the course and competences

3.1.Aims of the course

3.2.Competences

4.Assessment (1st and 2nd call)

4.1.Assessment tasks (description of tasks, marking system and assessment criteria)

5.Methodology, learning tasks, syllabus and resources

5.1.Methodological overview

The methodology followed in this course is oriented towards achievement of the learning objectives. A wide range of teaching and learning tasks are implemented, such as:

- Lectures will provide the theoretical background on fundamentals of artificial neural networks (ANN) and machine learning, and how these systems can be implemented in computers and electronic circuits.
- Case studies and real engineering applications of ANN will be worked out at the classroom, with special emphasis

on intelligent environments (sensor data processing, computer vision, embedded intelligence for home appliances...).
- The students will do laboratory work, developing ANN applications in MATLAB by using real databases.
- Individual or group assignments (course project) will be proposed.

Student participation is considered very important in order to acquire the learning outcomes and skills needed.

5.2.Learning tasks

The course includes the following learning tasks:

Classroom activities (1.96 ECTS: 49 hours):

- **Lectures** (A01) (20 hours). Fundamentals of ANN and machine learning will be developed, mixing theoretical concepts and practical applications. Course materials are available in advance at https://moodle2.unizar.es/add/
- **Case studies** (A02) (10 hours). Different case studies will be worked out at the classroom, related to fields such as computer vision, speech recognition, quality of service of communications, home appliances with embedded intelligence, etc.
- **Laboratory sessions** (A03) (15 hours). Five laboratory sessions will be carried out in small groups, consisting of MATLAB simulations of ANN. Each session will be evaluated in the laboratory.
- **Tutorials** (A06) (2 hours). Guidance and supervision of course assignments and projects.
- **Evaluation activities** (A08) (2 hours). Assessment will be based on coursework (laboratory work and assignments) and final examination.

Autonomous work (3.04 ECTS: 76 hours):

- **Assignments** (T6) (51 hours). Individual or group assignments will be proposed, in the form of a course project. The project assessment will be based on difficulty, development, achieved results, quality of the written report and oral presentation.
- **Study** (T7) (25 hours). This activity includes personal study, preparation of laboratory work and the required time for preparing the final exam. Students can also attend tutorials to solve the specific problems they can face in the course.

5.3.Syllabus

The course will address the following topics:

Topic 1. Fundamentals of Artificial Neural Networks and Machine Learning

Topic 2. Unsupervised learning: SOM

Topic 3. Supervised learning: MLP

Topic 4. RBF, Support Vector Machines, Deep Learning and other models

Topic 5. Electronic implementations

Topic 6. Digital circuit implementations

Topic 7. Applications development

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Laboratory sessions

- 1: Data preprocessing and competitive networks
- 2: Perceptrons: application to binary and real data
- 3: Hybrid neural networks and applications
- 4: Development of pattern classification applications
- 5: Development of applications related to data fitting

5.4.Course planning and calendar

Further information concerning the timetable, classroom, office hours, assessment dates and other details regarding this course, will be provided on the first day of class or please refer to the EINA website https://eina.unizar.es/ and Moodle https://moodle2.unizar.es/add/.

5.5.Bibliography and recommended resources

Basic resources: Bibliography:

- In http://moodle2.unizar.es
- **Slides (course notes) and laboratory notes**.

- Marsland, S. Machine Learning, CRC Press 2015
- Martín del Brío, Bonifacio. Redes neuronales y sistemas borrosos / Bonifacio Martín del Brío, Alfredo Sanz Molina ; prólogo de Lofti A. Zadeh . - 3ª ed. rev. y amp. Paracuellos de Jarama (Madrid) : RA-MA, D. L. 2006
- Haykin, S.. Neural Networks and Learning Machines / S. Haykin Pearson, 2009
- Witten, Ian H.. Data mining : practical machine learning tools and techniques / Ian H. Witten, Eibe Frank . - 2nd ed. Amsterdam [etc.] : Morgan Kaufman, cop. 2005
- Bishop, Christopher M.. Pattern recognition and machine learning / Christopher M. Bishop New York : Springer, cop. 2006
- Kohonen, Teuvo. Self-organizing maps / Teuvo Kohonen Berlin [etc] : Springer, cop. 1995
- Duda, Richard O.. Pattern classification / Richard O. Duda, Peter E. Hart, David G. Stork . - 2nd ed. New York [etc.] : John Wiley and Sons, cop. 2001