Artificial neural networks

Academic Year: (2023 / 2024) **Review date: 02-06-2022**

Department assigned to the subject: Computer Science and Engineering Department

Coordinating teacher: ISASI VIÑUELA, PEDRO

Type: ECTS Credits : 6.0

Year : 4 Semester :

Branch of knowledge: Engineering and Architecture

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Programming. First year, first semester
Linear Algebra. First year, first semester
Statistics. Second year, second semester

OBJECTIVES

The aim of this course is that the student knows and develops computational learning techniques in the context of Artificial Neural Networks in addition designing and implementing applications and systems that use them, including those dedicated to automatic extraction of information and knowledge from data.

DESCRIPTION OF CONTENTS: PROGRAMME

1. Introduction
   1.1. Basics of Neural Networks
   1.2. History of Neural Networks
   1.3. First computational models
2. Perceptron
   2.1. Architecture and parameters
   2.2. Learning algorithm
   2.3. Learning procedure
3. Non supervised neural models
   3.1. Basics of non supervised learning
   3.2. Clustering
   3.3. Self organizing maps
   3.4. Different non supervised models
4. Recurrent Neural Networks
   4.1. Basics of Recurrent Neural Networks
   4.2. Learning in recurrent networks
   4.3. Recurrent models
5. Convolutional Neural Networks
   5.1. Autoencoders
   5.2. Image processing task
   5.3. Fundamentals of Convolutional networks
   5.4. Architecture in convolutional networks
   5.5. Advance Neural Networks models
6. Neural networks in practice
   6.1. Treatment and pre-processing of learning data
   6.2. Generation and validation of neural network models
   6.3. Hyperparameter tuning
   6.4. Model comparison

LEARNING ACTIVITIES AND METHODOLOGY

Theory: Lectures will be focused on teaching all concepts related to neural networks, so that students acquire knowledge on artificial neural networks necessary for professional development and they will be carried out in synchronous on-line mode. 3 ECTS

Practical sessions (small groups): The practical classes will be developed so that, in a supervised way, students learn to solve real problems with artificial neural networks. The practices will be carried out in

groups of 2 students, enhancing teamwork (Soft-skill: teamwork). 3 ECTS

The weekly planification shows the exact distribution for each activity.

ASSESSMENT SYSTEM

Assessment will be done through continuous assessment and final examination.

Continuous assessment: It will allow students to continue their learning process and get 60% of the final grade. To be provided through the assessment of two practices and a partial test about practical contents. The detailed grading are as follows:
Practice 1: 2 points (PO: b, d, e, g)
Practice 2: 2 points (PO: b, d, e, g)
Partial Test: 2 points (PO: a, b, e, k)

There will be a final exam (40%) that will be used to make a global assessment of all the competences knowledge, understanding, practical use, and skills. The exam consists of a series of theoretical and practical issues and / or exercise (PO: a, b, e, k).

Assessment tests could include questions about the practices carried out.

The final grade is calculated by adding the scores for the continuous assessment and final examination. If the student has not conducted ongoing assessment, s/he may conduct an examination worth 60% of the final grade.

% end-of-term-examination:	40
% of continuous assessment (assigments, laboratory, practicals…):	60

BASIC BIBLIOGRAPHY

- Ian Goodfellow, Yoshua Bengio & Aaron Courville Deep Learning , MIT Press, 2016. http://www.deeplearningbook.org
- Simon O. Haykin Neural Networks and Learning Machines, Prentice Hall, 3rd edition, 2008

ADDITIONAL BIBLIOGRAPHY

- Charu C. Aggarwal Neural Networks and Deep Learning: A Textbook, Springer, 2018. http://link.springer.com/978-3-319-94463-0
- Mohamad H. Hassoun: Fundamentals of Artificial Neural Networks , MIT Press, 2003
- T.M. Mitchell Machine Learning, McGraw Hill, 1997