Machine Learning

Academic Year: (2021 / 2022) **Review date: 10-06-2021**

Department assigned to the subject: Computer Science and Engineering Department

Coordinating teacher: FUENTETAJA PIZAN, RAQUEL

Type: Electives ECTS Credits : 6.0

Year : 3 Semester : 2

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Programming (Course: 1 / Semester: 1)
Statistics (Course 2 / Semester: 1)
Automata and Formal Language Theory (Course 2 / Semester 1)
Artificial Intelligence (Course 2 / Semester 2)

OBJECTIVES

* Understand the basic techniques of Machine Learning
* Learn to determine when to use Machine Learning in real problems
* Learn to determine which technique is appropriate for each problem
* Learn to apply the techniques in real problems from a practical point of view

DESCRIPTION OF CONTENTS: PROGRAMME

1. Introduction to Machine Learning
2. Classification and regression techniques
   2.1. Decision trees and rules
   2.2. Regression trees and rules
   2.3. Instance based learning
   2.4. Classifier ensembles
3. Unsupervised techniques
   3.1 Clustering
   3.2. Associative learning
4. Reinforcement learning
   4.1. Markov Decision Processes
   4.2. Q-Learning
5. Relational learning
   5.1. Introduction to Inductive Logic Programmimg
6. Methodological issues
   6.1. Machine Learning methodology
   6.2. Evaluation and hypothesis testing

LEARNING ACTIVITIES AND METHODOLOGY

* Lectures: 1 ECTS. Oriented, among others, towards the competences related to the fundamentals, paradigms and techniques useful to build and evaluate intelligent systems based on Machine Learning.

* Practical/Lab sessions: 1 ECTS. Oriented towars the specific instrumental competences and competences about problem solving and application of acquired knowledge.

* Continuous assessment tests (individual work): 1,5 ECTS. Oriented towards the competences related to the fundamentals, paradigms and techniques useful to build and evaluate intelligent systems based on Machine Learning.

* Practical works (team work): 2 ECTS. Oriented to develop and integrate the specific competences related to the resolution and implementation of practical cases, generating a report including the problem definition, the technique applied, the obtained results and their interpretation.

* Tutorials: Individualized or collective tutorials with the teacher.

* Final exam: 0,5 ECTS. Its objective is to influence and complement the development of specific

cognitive abilities, especially the analysis, design, representation and formalization of knowledge and the application of techniques for solving problems.

ASSESSMENT SYSTEM

Final grade will be composed of 50% of individual work and 50% of team work. The individual work will consider both the individual activities performed during the course and a final exam. A minimum calification in the individual work will be required.

Specifically, the activities to develop are:

- Partial exams (20%): exams with theoretical content, to evaluate the knowledge acquired by the students trough the use of basic and advanced bibliography. Those exams permit to evalueta the knowledge in fundamentals, paradigms and techniques in intelligent systems and machine learning.

- Final exam (30%): theoretical-practical exam to evaluate the capacity of the student to represent human knowledge in different formalisms, specifically, in a way that can be handled with machine learning methods, allowing them the analysis, design and implementation of a final solution. The development of the exam requires a global knowledge about the main concepts related to machine learning.

- Tutorials and practices (50%): tutorials will be about the use of machine learning tools and techniques; practices wiil be about practical applications that require the representation of knowledge for the analysis, design and implementation of a computing solution in intelligent systems based on machine learning.

% end-of-term-examination:	30
% of continuous assessment (assigments, laboratory, practicals…):	70

BASIC BIBLIOGRAPHY

- D. Borrajo, J. González y P. Isasi Aprendizaje automático, Sanz y Torres.
- E. Rich y K. Knight Artificial Intelligence, McGraw-Hill.
- S. Russel y P. Norving Artificial Intelligence: a modern approach, Prentice Hall, 2003
- T. M. Mitchell Machine Learning, Mc Graw Hill.

ADDITIONAL BIBLIOGRAPHY

- Basilio Sierra Araujo (Ed.) Aprendizaje automático: conceptos básicos y avanzados. Aspectos prácticos utilizando el software WEKA, Pearson Education.
- J. W. Shavlik y T. G. Dietterich (eds.) Readings in Machine Learning, Morgan Kaufmann.
- P. W. Langley Elements of Machine Learning, Morgan Kaufmann.
- R. Sutton and A Barto Reinforcement Learning: an Introduction, Kluwer Academic Publishers.
- Saso Dzeroski y Nada Lavrac Relational Data Mining, Springer Verlag.