Machine learning I

Academic Year: (2023 / 2024) **Review date: 25-04-2023**

Department assigned to the subject: Computer Science and Engineering Department

Coordinating teacher: FERNANDEZ REBOLLO, FERNANDO

Type: Compulsory ECTS Credits : 6.0

Year : 2 Semester : 2

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Programming
Probability and Data Analysis

OBJECTIVES

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

Competences:
CB1: The students must demonstrate to understand knowledge in an area of study which origin is the secondary education, and will be in a level that, supported with books and other bibliographic references, includes aspects in the frontiers of knowledge.
CB2: The students know to apply their knowledge to their work in a professional way and own the competences usually required to solve problems in its area of study
CB3: The students own the capacity to interpret relevant data to elaborate claims that include an analysis in social, scientific and ethics topics
CB4: The student can transmit information, ideas, problems and solutions to both specialized and non-specialized audience.
CB5: Students have developed the learning capabilities to begin new studies with a high degree of autonomy

CE13: Capacity to apply and design machine learning methods in classification, regression and clustering for tasks in supervised, unsupervised and reinforcement learning
CE2: Capacity to correctly identify predictive problems for a given data and goals, and use the basic results of the regression analysis as a fundamental predictive method.
CE3: Capacity to correctly identify classification problems associated to specific goals and data, and to use the results of multivariate analysis as a basics of the classification, clustering and dimensionality reduction methods

CG1: Knowledge and abilities to analyze and synthesize basic problems related with engineering and data science, and to solve them and report the results
CG2: Knowledge of basic scientific and technical topics that enable for learning new methods and technologies
CG3: Capability to solve problems with initiative, decision making, creativity, and communication skills, understanding the ethical, social and professional responsabilities of the data management. Leading, innovation and entrepreneurship capabilities.
CG4: Capability to solve technological, computing, mathmatical and statistic problems which can arise in engineering and data science.
CG5: Capability to solve problems formalized mathematically and applied to different topics, using numeric algorithms and computational methods.
CG6: Capability to synthesize conclusions obtained from performed analysis, and to report in a clear and convincing way, both orally and written.

RA1: Advanced knowledge and comprehensiono of the theoreticat and practical aspects of the working methodology in the area of data science with a depth that close to the frontier of knowledge
RA2: Capability to apply knowledge in complex working environments and specialized areas which require the use of creative and innovative ideas.
RA3: To have the capability to collect and understand data and information over which to create

conclusions including, when needed, a reflection about social, ethic or scientific issues.
RA4: To be able to manage complex situations which require the development of new solutions both in academic and professional environments in its area of study
RA5: To know how communicate to different audiences knowledge, methodologies, ideas, problems and solutions in a clear and precise way
RA6: Be able to identify his/her own formative requirements in is area of study or professional environment, and to organize its own learning process with a high degree of autonomy in different contexts.

DESCRIPTION OF CONTENTS: PROGRAMME

· Introduction to machine learning
· Learning decision trees and rules
· Methodological aspects
· Learning regression trees and rules
· Ensembles of learning methods
· Frequent itemsets and association rules
· Reinforcement learning
· Relational learning

LEARNING ACTIVITIES AND METHODOLOGY

AF1: Presential classes, with theoretical and practical contents
AF3: Student work
AF8: Practical labs.
AF9: Final exam. Evaluation of the abilities that have been acquired along the course.
MD1: Classes with theoretical contents
MD2: Practices, with cases and problems
MD3: Individual and group tutories
MD6: Lab practices with support of assistant

ASSESSMENT SYSTEM

Formative assessment will be done through continuous feedback that would allow the student to assess what s/he knows and is expected from her/him.

Final grade will be composed of 50% of individual work and 50% of team work. Among the individual activities, assessment of activities performed during the course will be a 70% of each student grade, and a final exam will be a 30% of the grade, although mechanisms to pass the course only with the final exam will be provided. A minimum qualification in each part could 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

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

BASIC BIBLIOGRAPHY

- 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

- 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.