

Academic Year: (2023 / 2024)

Review date: 28-04-2023

Department assigned to the subject: Computer Science and Engineering Department

Coordinating teacher: ALER MUR, RICARDO

Type: Electives ECTS Credits : 6.0

Year : 4 Semester :

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Programming II

OBJECTIVES**1.) OF KNOWLEDGE:**

- Know the different tasks that can be solved with machine learning
- Know machine learning techniques and their typology
- Know the methodology of machine learning and the phases it entails
- Know tools available for machine learning

2.) UNDERSTANDING:

- Understand the fundamentals and motivations of machine learning
- Understand the work methodology and the different phases of machine learning
- Understand the usefulness of different machine learning techniques
- Understand the relationship between model complexity, amount of data, problem characteristics and overlearning

3.) APPLICATION:

- Analyze the domains and design knowledge extraction processes according to the problem.
- Evaluate the performance and efficiency of the different machine learning methods
- Work on specific domains and contrast different techniques to check their performance in machine learning

4.) CRITICISM OR ASSESSMENT

- Selection of algorithms, selection of models and adjustment of parameters.
- Consider the relationship between computational cost and marginal improvement of different solutions
- Assessment of whether the results obtained are adequate, compared with chance or basic algorithms

DESCRIPTION OF CONTENTS: PROGRAMME

1. Introduction to Machine Learning
2. Basic methods for classification and regression:
 - 2.1. Nearest neighbour (KNN)
 - 2.2. Trees and Rules
3. Machine Learning pipeline
 - 3.1. Training
 - 3.2. Hyper-parameter tuning
 - 3.3. Evaluation
 - 3.4. Preprocessing and feature selection
4. Advanced methods for classification and regression
 - 4.1. Ensembles: bagging, random forests, boosting
 - 4.2. Support Vector Machines

LEARNING ACTIVITIES AND METHODOLOGY

Theory: Lectures will be focused on teaching all concepts related to machine learning. They will be carried out in synchronous on-line mode.

Practical computer Sessions: The practical classes will be developed so that, in a supervised way, students learn to solve real problems with machine learning. The practices will be carried out in groups of 2 students. There are several assignments related to topics in the course.

There will be tutorials to help the understanding both of theory and practice.

ASSESSMENT SYSTEM

- A) Final exam, focusing on the theoretical side: 30% (3 points)
- B) Assignments, to be carried out during the semester: 70% (7 points)

The final course grade is calculated by adding the marks obtained in A and B. The final exam has no cutoff grade. $A+B \geq 5$ implies passing this course.

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

BASIC BIBLIOGRAPHY

- Aurélien Géron Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems, O'Reilly Media, 2019
- Brett Lantz Machine Learning with R, Packt Publishing, 2019
- Max Kuhn Applied Predictive Modeling, Springer, 2013

ADDITIONAL BIBLIOGRAPHY

- Hadley Wickham, Garrett Grolemund, R for Data Science: Import, Tidy, Transform, Visualize, and Model Data, O'Reilly Media, 2016

BASIC ELECTRONIC RESOURCES

- MLR . Machine Learning in R: <https://mlr3.mlr-org.com/>
- Scikit-learn team . Scikit-learn: machine learning in Python: <https://scikit-learn.org/>