Machine learning II

Academic Year: (2018 / 2019) **Review date: 10-05-2018**

Department assigned to the subject: Signal and Communications Theory Department

Coordinating teacher: ARTES RODRIGUEZ, ANTONIO

Type: Compulsory ECTS Credits : 6.0

Year : 3 Semester : 1

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

None

OBJECTIVES

CB1: That students have demonstrated to possess and understand knowledge in an area of ¿¿study that starts from the base of general secondary education, and is usually found at a level that, although supported by advanced textbooks, also includes some aspects that they imply knowledge coming from the vanguard of their field of study.
CB2: That students know how to apply their knowledge to their work or vocation in a professional manner and have the skills that are usually demonstrated through the elaboration and defense of arguments and the resolution of problems within their area of ¿¿study
CB5: That the students have developed the necessary learning skills to undertake further studies with a high degree of autonomy.
CE1: Ability to solve mathematical problems that may arise in engineering and data science. Ability to apply knowledge about: algebra; geometry; differential and integral calculation; numerical methods; numerical algorithm; statistics and optimization.
CE2: Ability to correctly identify problems of a predictive nature corresponding to certain objectives and data and to use the basic results of regression analysis as the basic basis of prediction methods.
CE21: Ability to use modern optimization tools to solve practical problems efficiently.
CE3: Ability to correctly identify classification problems corresponding to certain objectives and data and to use the basic results of multivariate analysis as a basic foundation of classification, clustering and dimension reduction methods.
CE4: Capacity for mathematical modeling, algorithmic implementation and resolution of optimization problems related to data science.
CE5: Ability to understand and handle fundamental concepts of probability and statistics and be able to represent and manipulate data to extract meaningful information from them.
CG2: Knowledge of basic scientific and technical subjects that enable the learning of new methods and technologies, as well as providing a great versatility to adapt to new situations.
CG4: Ability to solve technological, computer, mathematical and statistical problems that may arise in engineering and data science.
CG5: Ability to solve mathematically formulated problems applied to diverse subjects, using numerical algorithms and computational techniques.
CG6: Ability to synthesize the conclusions obtained from the analyzes carried out and present them clearly and convincingly, both in writing and orally.
CT1: Ability to communicate knowledge orally and in writing, before a specialized and non-specialized public.

LO1 To have acquired advanced knowledge and demonstrated an understanding of the theoretical and practical aspects and the methodology of work in the field of science and data engineering with a depth that reaches the forefront of knowledge
RA4 To be able to cope with complex situations or require the development of new solutions in the academic, work or professional fields within their field of study;
RS6 To be able to identify their own training needs in their field of study and work or professional environment and to organize their own learning with a high degree of autonomy in all types of contexts (structured or not).

DESCRIPTION OF CONTENTS: PROGRAMME

In the subject we introduce advanced concepts in machine learning. In the first part, we concentrate of nonlinear classification and regression methods.
While in the second part, we will focus on advanced topics of non-supervised learning. In the last part of

the course, we will cover transfer learning and multitask learning.
PART 1: Nonlinear classification and regression
Kernel methods
Ensemble methods (boosting y random forests)
Gaussian Processes for classification and regression
PARTE 2: Unsupervised Learning
Introduction to graphical models
Latent variable models
Bayesian nonparametrics
PARTE 3:
Multi-task learning
Transfer learning

LEARNING ACTIVITIES AND METHODOLOGY

Learning activities:
AF1: THEORETICAL-PRACTICAL CLASSES. They will present the knowledge that students should acquire. They will receive the class notes and will have basic texts of reference to facilitate the follow-up of the classes and the development of the subsequent work. Exercises, practical problems on the part of the student will be solved and workshops and evaluation test will be held to acquire the necessary skills.
AF2: Updated to allegation
AF3: INDIVIDUAL OR GROUP WORK OF THE STUDENT.
AF9: FINAL EXAM. In which the knowledge, skills and abilities acquired throughout the course will be assessed globally.

Learning methodology:
MD1: CLASS THEORY. Exhibitions in the teacher's class with support of computer and audiovisual media, in which the main concepts of the subject are developed and the materials and bibliography are provided to complement the students' learning.
MD2: PRACTICES. Resolution of practical cases, problems, etc. raised by the teacher individually or in groups.
MD3: TUTORING. Individualized assistance (individual tutorials) or group (collective tutorials) to students by the teacher.

ASSESSMENT SYSTEM

SE1: FINAL EXAMINATION In which the knowledge, skills and abilities acquired throughout the course will be assessed globally.
SE2: CONTINUOUS EVALUATION. In it, work, presentations, debates, exhibitions in class, exercises, practices and work in the workshops throughout the course will be evaluated.

% end-of-term-examination:	50
% of continuous assessment (assigments, laboratory, practicals…):	50

BASIC BIBLIOGRAPHY

- Christopher M. Bishop Pattern Recognition and Machine Learning, Springer, 2006

ADDITIONAL BIBLIOGRAPHY

- Kevin P. Murphy Machine Learning: A Probabilistic Perspective, The MIT Press, 2012