

DOI-MBD-524 Machine Learning II

SEMESTER: Spring

CREDITS: 6 ECTS (4 hrs. per week)

LANGUAGE: Spanish/English

DEGREES: Master in Big Data Technologies and Advanced Analytics

Course overview

This course focuses on a set of Machine Learning tools for modeling and understanding complex datasets. In particular, the course describes the selected tools grouped according to three main approaches: Ensemble methods, deep learning and reinforcement learning. These main approaches are complemented with other topics such as genetic algorithms and recommender systems. To accomplish this objective, the course aims to find a good balance between theory and practice.

Prerequisites

Basic knowledge of Calculus and Algebra is required (understand and manipulate equations, manipulate exponents and logarithms using their basic rules, full understanding of functions and inverse functions, understand limits, derivatives and integrals, know rules for product and summation, etc). It is also required basic knowledge of Statistics (descriptive statistics, discrete and continuous probability distribution models, sampling and basics of statistical inference), as well as knowledge about standard Machine learning methods (regression, classification and unsupervised learning).

Basic knowledge of Programming in R and Python is required for the practice sessions.

Course contents

Theory:

1. Ensemble learning. Boosting, Bagging and Stacking. Random Forest and Gradient Boosting.
2. Genetic algorithms.
3. Deep learning. Convolutional Networks and Autoencoders.
4. Deep learning applications. Computer Vision and speech recognition.
5. Reinforcement learning.
6. Association rules and collaborative filtering in recommender Systems.

Textbook

- **Goodfellow, I., Bengio, Y. and Aaron Courville, A.** (2016). *Deep Learning*. Sixth Edition. Springer.
- **James, G., Witten, D., Hastie, T. and Tibshirani, R.** (2015). *Introduction to Statistical Learning with applications in R*. Sixth Edition. Springer.
- **Hastie, T., Tibshirani, R., Friedman, J.**, The Elements of Statistical Learning: Data Mining, Inference and Prediction. 2nd Ed., Springer, New York, N.Y., 2009

Grading

The following conditions must be accomplished to pass the course:

- A minimum overall grade of at least 5 over 10.
- A minimum grade in the final exam of 4 over 10.

The overall grade is obtained as follows:

- Final exam accounts for 35% of the final grade if the grade in this exam is at least 4. In other case, final exam accounts for 100 % of the overall grade.
- Mid-term exam accounts for 15%.
- Practical assignment account for 50% of the final grade.