UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Statistical Learning

2627-1-F9103Q023

Learning objectives

The course aims to acquire the main techniques of statistical learning (SL) and their implementation in the R programming environment. During the course, emphasis will be placed on the algorithmic modelling culture, while also paying attention to the estimation of uncertainty in predictions.

The course contributes to the achievement of the learning objectives in the subject area of the MSc: "Artifical Intelligence".

Contents

Main subjects are:

- Tree-based methods and computational aspects.
- Moving beyond linearity.
- Uncertainty estimation.

Detailed program

Tree-based methods.

- Decision trees: classification and regression.
- Bagging.
- Random forests.
- Boosting and additive trees.

- Ensemble learning
  Focus: gradient boosting algorithm.

Moving beyond linearity.

- Regression splines and smoothing splines.
- Generalized additive models.
- Multivariate adaptive regression splines.

Uncertainty estimation.

- Conformal prediction.

Prerequisites

Knowledge of topics covered in the course “Advanced Foundetions of Statistics for AI”.

Teaching methods

Lessons are held both in classroom and in lab, integrating theoretical principles with practicals aspects of data analysis and programming in R.

The 54 hours of teaching are organized as follows:

- 32 hours of lectures, in person;
- 24 hours of laboratory.

Assessment methods

The examination consists of a written.

(31 points out of 31) Written examination with open and closed questions, in which the theoretical aspects of the course are assessed. There will also be practical questions about R.

The student may carry out a project, which is not compulsory, where he/she can achieve a maximum of 2 points.

Textbooks and Reading Materials

T. Hastie, R. Tibshirani, J. Friedman (2017) The Elements of Statistical Learning. Springer.
D. Efron, T. Hastie (2016) Computer-Age Statistical Inference: Algorithms, Evidence, and Data Science. Cambridge University Press.
M. Kuhn, L. Johnson (2019) Feature Engineering and Selection: A Practical Approach for Predictive Models. Chapman & Hall/CRC Data Science.

Further readings will be suggested during the course.

Semester

Second semester.

Teaching language

The lessons are held in English, but the materials and textbooks are in English.

Sustainable Development Goals

QUALITY EDUCATION