UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

# COURSE SYLLABUS

## Statistical Learning M

**2122-2-F8204B015**

### Learning objectives

Statistical learning is a recently developed area in statistics and blends with parallel developments in machine learning. The course aims to introduce the main methods of Statistical Learning, discussing both the algorithms and the inferential aspects.

### Contents

Introduction to advanced statistical methods, in particular:

- high-dimensional regression
- variable selection with statistical guarantees
- conformal prediction

### Detailed program

- Prediction, Estimation, and Attribution.
- James-Stein estimation.

- Ridge regression.
- Splines.
- Additive models.

- Classical versus high-dimensional theory.

- Sparse Modeling and the Lasso.
- Best Subsets Selection.

- Data splitting for variable selection.

- Stability selection.

- Knockoff filter.

- Conformal prediction.

## Prerequisites

Knowledge of topics covered in the courses *Probability and Statistics M*, *Advanced Statistics M* and *Data Mining* (module of *Data Science M)* is highly recommended.

## Teaching methods

Lessons are taught in classroom and lab.

## Assessment methods

The exam consists in a written exam and an optional oral examination.

## Textbooks and Reading Materials

- Efron, Hastie (2016) *Computer-Age Statistical Inference: Algorithms, Evidence, and Data Science*. Cambridge University Press
- Hastie, Tibshirani, Friedman (2009). *The Elements of Statistical Learning.* Springer
- Hastie, Tibshirani, Wainwright (2015). Statistical Learning with Sparsity: The Lasso and Generalizations. CRC Press

- Lewis, Kane, Arnold (2019) *A Computational Approach to Statistical Learning*. Chapman And Hall/Crc.

- Shalizi (2021). Advanced Data Analysis from an Elementary Point of View.

- Wainwright (2019) *High-Dimensional Statistics: A Non-Asymptotic Viewpoint*. Cambridge University Press

## Semester

Second semester, first period.

## Teaching language

The lessons are held in Italian, textbooks are in English.