UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Machine Learning and Optimization

2526-1-F7703M009-F7703M009-2

Learning objectives

By the end of the course, students will be able to analyse and solve machine learning problems in a business context, using nonlinear optimization techniques. In particular, students will be able to:

- understand the basic theoretical and algorithmic principles of nonlinear optimization;
- understand the main machine learning models for solving supervised classification, unsupervised classification and regression problems, using specific software and tools;
- identify the type of a real classification (supervised/unsupervised) or regression problem that arises in the business environment and apply the most appropriate machine learning and optimization techniques to solve it.

Contents

Nonlinear optimization problems: theory and algorithms.
Machine learning models for classification and regression problems.

Detailed program

1. Nonlinear unconstrained optimization: existence of optimal solutions, optimality conditions, solution algorithms.
2. Constrained nonlinear optimization: existence of optimal solutions, optimality conditions, solution algorithms.
3. Machine learning models for supervised classification problems.
4. Machine learning models for unsupervised classification problems.

5. Machine learning models for regression problems.
6. Examples and case studies in the business environment solved with open source software.

Prerequisites

Linear algebra: sum and product between matrices, determinant and trace of a matrix, eigenvalues and eigenvectors of a matrix, solving linear systems. Basic notions of probability. Basics of differential calculus in several variables.

Teaching methods

The module will provide a teaching activity of 21 hours divided as follows:

- 15 hours of face-to-face lectures conducted in in-person delivery mode;
- 6 hours of exercises conducted in interactive in-presence mode.

Assessment methods

The examination consists of a compulsory oral test (interview on the topics covered in the course). The oral test is designed to test knowledge of optimization and machine learning techniques for solving classification and regression problems introduced during the course.

Textbooks and Reading Materials

Material will be provided during the course in the form of slides, exercises, datasets and workflows.

Semester

Second semester.

Teaching language

Italian.

Sustainable Development Goals

QUALITY EDUCATION