UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

SYLLABUS DEL CORSO

Performance Evaluation and Data Centric AI

2526-114R-1-06

Title

Performance Evaluation and Data Centric AI

Teacher(s)

Alex Graudenzi
Andrea Maurino

Language

English

Short description

Objectives

The course aims at introducing:

1. approaches for evaluating machine learning model performance and validating results;
2. optimization and hyperparameter tuning techniques to enhance performance;
3. principles, methodologies, and applications of Data-Centric AI;

4. strategies to design, develop, and optimize AI systems that place data at the center of the development cycle.

Prerequisites

- Knowledge of machine learning methods and applications
- Knowledge of algorithmic methods for data analysis
- Basic knowledge of statistics

Content

- Methods and Metrics for Performance Evaluation (Performance evaluation metrics specific to: classification, regression, clustering; Bias-variance trade-off evaluation; Uncertainty estimation: aleatoric, epistemic, conformal prediction) (3 hours) Graudenzi
- Model Validation Techniques (K-fold stratified/non-stratified cross-validation, leave-one-out, bi-cross validation, nested cross-validation; Resampling methods: bootstrap, jackknife) (2 hours) Graudenzi
- Model Tuning and Refinement (Hyperparameter tuning: grid Search, random Search, Bayesian optimization, gradient Descent, genetic algorithms, MCMC, etc.; Ensembling techniques: bagging, boosting, stacking, etc.; Introduction to AutoML and tuning automation) (3 hours) Graudenzi
- Introduction to Data-Centric Artificial Intelligence (DCAI) (2 hours) Maurino
- Data understanding and Data labeling (2 hours) Maurino
- Feature relevance and Feature selection (2 hours) Maurino
- MLOPS (Machine Learning Operations) (2 hours) Maurino

Exam

Presentation and discussion of an individual project by the students, in which some of the techniques covered during the course are applied to their specific doctoral research project.

Course Materials
Provided by the professors

CFU / Hours

2 CFUs
16 hours (lectures)

Teaching period

16 February - 6 March 2026

Sustainable Development Goals

INDUSTRY, INNOVATION AND INFRASTRUCTURE