SYLLABUS DEL CORSO

Statistical Learning M

2021-2-F8204B015

Learning objectives

Recent technological development allows scientists and businesses to systematically collect datasets of high complexity and dimension, however traditional statistical methodology may prove inadequate to face the challenges of big data.

- Introduction to deep learning (3 cfu, Prof. Borrotti)
- Modern statistical inference (3 cfu, Prof. Solari)

At the end of the course, the student will have perfected the problem solving and programming skills and will be able to use advanced statistical methods to draw conclusions on the data.

Introduction to *deep learning* -> During Covid-19 emergency, lessons will be on-line.

Contents

Introduction to deep learning

The aim is to introduce deep learning both from a theoretical and applied perspective.

Modern inference

The aim is to introduce advanced statistical methods, focussing on high-dimensional variable selection and conformal inference.

Detailed program

Introduction to deep learning

- Introduction to deep learning

- Neural network

- Shallow and deep neural network

- Recurrent neural network

- Convolutional neural network

Modern inference

- Conformal inference
- The multiple testing problem
- The variable selection problem

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 two parts:

1. Introduction to deep learning
2. Modern statistical inference

and an optional oral examination. The final grade is the average of the grades obtained in 1. and 2.

Introduction to deep learning

Presentation of a project. The project is composed by

- Report
- File Rmarkdown including all the code used to generate the results
- Slides of the presentation

Attending students can form a team (max. 4 persons)

Modern inference

The exams consists on Data Analysis.

Textbooks and Reading Materials

Introduction to deep learning

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Modern inference

- Course repository: https://aldosolari.github.io/MI/
- Efron, Hastie (2016) *Computer-Age Statistical Inference: Algorithms, Evidence, and Data Science*. Cambridge University Press
- Wainwright (2019) *High-Dimensional Statistics: A Non-Asymptotic Viewpoint*. Cambridge University Press

Semester

Second semester, third cycle.

Teaching language

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