UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Foundations of Deep Learning

2122-1-F9101Q054

Aims

The aim of this course is to provide the theoretical foundations of mathematics and statistics for deep learning including linear algebra, optimization, regularization, and dimensionality reduction. The most important deep neural network architectures will be covered in this course. Thanks to a practical part of the course, the student will be able to handle the main tools for deep learning and then design and optimize a deep neural network.

Contents

The course consists of a theoretical part and a part of exercises. The theoretical part aims at exploring applied math, machine learning basics and deep neural networks. The practical part consists in basic and advanced exercises using deep learning frameworks.

Detailed program

- Linear algebra and probability theory;
- Gradient-based optimization, constrained-optimization;
- Machine learning basics;
- Gradient-based learning, back propagation;
- Regularization for deep learning;
- Convolutional Neural Networks;
- Recurrent and Recursive Nets;

- Dimensionality reduction techniques;
- Practical methodology.

Prerequisites

Fundamental of mathematics, fundamental of programming.

Teaching form

Lectures and assisted exercises (at labs when students' personal PC are not available)

Lessons will be held in presence, unless further COVID-19 related restrictions are imposed.

Textbook and teaching resource

- Goodfellow, I., Bengio, Y., Courville, A., & Bengio, Y. (2016). *Deep learning* (Vol. 1, No. 2). Cambridge: MIT press
- Quinn, J., McEachen, J., Fullan, M., Gardner, M., & Drummy, M. (2019). Dive into deep learning: Tools for engagement. Corwin Press.
- Scientific articles suggested by the teacher
- Teachers' slides (http://elearning.unimib.it/)
- GitHub of the course (https://github.com/)

Semester

Second Semester

Assessment method

The exam consists in the design and realization of project assigned by the teacher. The project can be realized by

a single student or a group of students (max 2 students for each group). The project will be discussed as oral presentation and the teacher can ask questions about theoretical parts of the course program. Final evaluation is assigned on the basis of the quality of the project and oral presentation.

Office hours

Paolo Napoletano, Monday from 14 to 16