UNIVERSITÀ DEGLI STUDI DI MILANO-BICOCCA

SYLLABUS DEL CORSO

Supervised Learning

2425-1-F9102Q045-F9102Q04501

Aims

The aim of the course is to develop the skills for solving supervised learning problems.

Contents

In this course we will introduce and develop different machine learning algorithms for different types of data (images, videos, signals, texts, etc.) in different domains.
Course contents:

- Classification and regression frameworks: experiment definition, dataset split, metrics, augmentation, etc.
- Machine learning algorithms design and evaluation for classification and recognition tasks in the image domain such as consumer photos, fashion, medical images, etc.: image classification, image captioning, object detection, face recognition, image segmentation, quality control, etc.
- Machine learning algorithms design and evaluation for classification and recognition tasks in the signal domain such as audio, ecg: identity recognition, activity recognition, etc.
- Machine learning algorithms design and evaluation for regression tasks in different domains and applications such as: quality assessment, forecast, etc.

Detailed program

In detail the topics addressed are:

- Formulation of the learning process, popular learning algorithms (LDA, Decision Trees, NN, k-NN, SVM), evaluation and comparison

- Classification and regression frameworks: experiment definition, dataset split, metrics, augmentation, etc.
- Ensemble methods: Boosting, Bagging, Random Tree ensembles, Stacking
- Object detection with local descriptors: SIFT and BoW
- Viola-Jones Object detection Framework
- Convolutional Neural Networks (CNNs): convolution, training, famous architectures, transfer learning
- Recurrent and Recursive Neural Networks (RNNs): computational graph, training, gated RNNs (LSTM and GRU)
- Neural object detection: two-stage detection (R-CNN, fast R-CNN, faster R-CNN) and one-stage detection (YOLO)
- Transformers
- Self-supervised Learning

Prerequisites

Basic programming skills.
Basic knowledge in statistics and mathematics.

Teaching form

The course will be composed of frontal/theoretical classes concerning the methods and interactive practical classes concerning the case studies and applications using Matlab and/or Python.
The two parts will be based both on delivery mode and interactive mode.

Textbook and teaching resource

Slides, articles, and notes given by the professor in addition to the textbooxs:

- Hastie T., Tibshirani R., Friedman J. (2021). The Elements of Statistical Learning (2nd edition). Springer Verlag.
- Simon J.D. Prince (2023). Understanding Deep Learning. MIT Press.

Semester

Second.

Assessment method

The exam consists of a project, where students divided into small groups must design, implement and write a report about the chosen supervised learning task, and its oral presentation during which theoretical contents of the course can also be verified.

Office hours

After the class or agreed by email.

Sustainable Development Goals

QUALITY EDUCATION