UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Machine Learning

2425-1-F1801Q160

Aims

The course aims to introduce the basic elements and provide the basic concepts and tools based on computational methods, to represent the learning, knowledge and reasoning under uncertainty.

The student will be able to design and develop software systems based on machine learning techniques to solve simple problems of data analysis, knowledge discovery and decision support in the presence of uncertain or incomplete information.
Acquired skills are the basis for the development of advanced data mining and knowledge discovery and application specific software systems in decision support.

Contents

The course will provide an in-depth discussion of the large collection of methods and tools that have become available for developing autonomous learning systems and for aiding in the analysis of complex multivariate data. These tools include decision trees, neural networks, belief networks, as well unsupervised clustering algorithms and increasingly sophisticated combinations of these architectures. Examples of recent applications will be introduced.

Detailed program

Introduction and terminology

Concept learning
· Decision trees

· ID3 Algorithm

Neural networks
· perceptron; linear separability
· perceptron learning algorithm
· delta rule and gradient descent
· multilayer perceptron
· error backpropagation

Support vector machines
· Optimal separation
· Computation in SVM
· Kernels

Bayesian Learning
· Introduction
· Bayes theorem
· Naive Bayes classifier

Unsupervised learning techniques
· k-means algorithm

Performance evaluation
· evaluation for supervised techniques
· evaluation for clustering

Deep neural network (Deep Learning)
· Introduction
· Main reference models

Prerequisites

Basic knowledge of algorithms and data structures.

Elements of probability and statistics

Teaching form

- 8 frontal lessons of 2 hours each held by the teacher in presence;
- 10 sessions for exercises of 2 hours each held by the teacher in presence, 50% frontal 50% interactive;
- 8 interactive laboratory lessons of 3 hours each held by the teacher in presence;

Textbook and teaching resource

References on the elearning page of this course

Semester

First semester

Assessment method

Overall the exam is split in a written test and a oral discussion, each determining 50% of the score, along the following rules:

1. Written test with open questions on theory and simpe exercises. To continue to the oral discussion this test must earn a score >=6;
2. Oral discussion mainly dedicated to a project prepared by the student (or by a small group of students);
   2-1. the project is evaluated based on its overall quality and on the quality of the individual contribution of the student;
   2-2. during the oral discussion the student could be required to answer some questions about course's contents.

Office hours

by requiring an appointment

Sustainable Development Goals