Introduction to Machine Learning

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Timetable: 21 hrs. First lecture on February 5, 2015, 09:30 (dates already fixed, see the calendar), Meeting Room HIT (Human Inspired Technology Research) Centre, Via Luzzati, 4 - 35122 Padova

Course requirements: Basic knowledge of linear algebra, algorithms, calculus, probability.

Examination and grading: The students will be evaluated on an oral presentation on one of the topics covered in the course.

SSD: INF/01

Aim: The aim of the course is to introduce the field of machine learning, mainly considering kernel methods and deep learning techniques, and their application to different domains.

Course contents: The amount of data available in electronic format is increasing at such a rapid pace that intelligent automatic techniques for extraction of relevant information are gaining more and more importance. Machine Learning constitutes one of the main areas that contribute to the development of these techniques.

In this course, we introduce the basic ingredients of Machine Learning with the aim to give an informal intuition of what is the general problem that must be solved by Machine Learning approaches. Different learning paradigms and tasks are presented as well. We complement this informal presentation with a more formal treatment, focussing on two specific approaches: Kernel Methods and Deep Learning. Both traditional methods dealing with vectorial information and approaches able to directly deal with structured data will be presented. In addition, links with specific areas of Computer Science will be highlighted (Logic Programming, Information Theory, Computational Geometry). Finally, examples of applications of Machine Learning techniques to cognitive neuroscience, human-computer interaction, and social sciences will be discussed.

Syllabus:

1. Introduction to some basic notions of Machine Learning
2. Paradigms, learning tasks, and structured domains
3. Statistical Learning Theory
4. Kernel Methods
5. Neural Networks and Deep Learning
6. Links with specific areas of Computer Science
7. Software resources and application examples
8. Future Directions