2EL1730 – Machine Learning

Instructors: Nora Ouzir
Department: DÉPARTEMENT MATHÉMATIQUES
Language of instruction: ANGLAIS
Campus: CAMPUS DE PARIS - SACLAY
Workload (HEE): 60
On-site hours (HPE): 35,00
Elective Category : Fundamental Sciences
Advanced level : Yes

Description

Machine learning is the scientific field that provides computers the ability to learn without being explicitly programmed (definition by Wikipedia). Machine learning lies at the heart of many real-world applications, including recommender systems, web search, computer vision, autonomous cars and automatic language translation.

The course will provide an overview of fundamental topics as well as important trends in machine learning, including algorithms for supervised and unsupervised learning, dimensionality reduction methods and their applications. A substantial lab section will involve group projects on a data science competition and will provide the students the ability to apply the course theory to real-world problems.

Quarter number
SG6

Prerequisites (in terms of CS courses)

Notions of linear algebra, probabilities, and scientific programming in Python (numpy).

Syllabus
The course will cover the following topics:

- Introduction to Machine Learning
- Model selection and evaluation
- Linear and logistic regression
- Probabilistic classifiers and linear discriminant analysis

- Non-parametric learning and nearest neighbour methods
- Tree-based methods and ensemble learning
- Support Vector Machines
- Neural networks
- Dimensionality reduction
- Unsupervised learning: clustering
- Introduction to reinforcement learning

More details about the syllabus of the will be given in the website of the course: http://fragkiskos.me/teaching/2E1730-F22/

Class components (lecture, labs, etc.)

- Lectures (12 sessions x 1h30)
- Labs (10 sessions x 1h30)
- Written exam (2 hours)

Grading

The evaluation of the course will be based on the following:Two assignments: the assignments will include theoretical questions as well hands-on practical questions that will familiarize the students with basic machine learning tasks.Project: The students are expected to form groups of 3-4 people, propose a topic for their project, and submit a final project report. Final exam: Final exam in the material covered in the course.The grading will be as follows: Assignment 1 (individually):10%; Assignment 2 (individually):10%; Project (groups of 3-4 students):20%; Final exam:60%

Course support, bibliography

There is no single requiered textbook for the course. We will recommend specific chapters from the following books:

- Shai Shalev-Shwartz and Shai Ben-David. Understanding Machine Learning: From Theory to Algorithms. Cambridge University Press, 2014.
- Christopher M. Bishop. Pattern Recognition and Machine Learning. Springer, 2011.
- Trevor Hastie, Robert Tibshirani, and Jerome Friedman. The Elements of Statistical Learning: Data Mining, Inference, and Prediction. Second Edition, Springer, 2017.
- Jure Leskovec, Anand Rajaraman, and Jeff Ullman. Mining of Massive Datasets. Cambridge University Press, 2014.

Please see the website of the course for more details:
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Resources

The course will be taught jointly by Fragkiskos MALLIAROS and Maria VAKALOPOULOU.
A detailed list of resources is given in the website of the course:
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Learning outcomes covered on the course

We expect that by the end of the course, the students will be able to:

- Identify problems that can be solved using machine learning methodologies.
- Given a problem, identify and apply the most appropriate algorithm(s).
- Implement some of those algorithms from scratch.
- Evaluate and compare machine learning algorithms for a particular task.
- Deal with real-world data challenges.