Machine Learning

ECTS : 6

Description du contenu de l'enseignement :

The course gives a thorough presentation of the machine learning field and follows this outline:

1. general introduction to machine learning and to its focus on predictive performances (running example: k-nearest neighbours algorithm)
2. machine learning as automated program building from examples (running example: decision trees)
3. machine learning as optimization:
    1. empirical risk minimization
    2. links with maximum likelihood estimation
    3. surrogate losses and extended machine learning settings
    4. regularisation and kernel methods (support vector machines)
4. reliable estimation of performances:
    1. over fitting
    2. split samples
    3. resampling (leave-one-out, cross-validation and bootstrap)
    4. ROC curve, AUC and other advanced measures
5. combining models:
    1. ensemble techniques
    2. bagging and random forests
    3. boosting
6. unsupervised learning:
    1. clustering (hierarchical clustering, k-means and variants, mixture models, density clustering)
    2. outlier and anomaly detection

Compétence à acquérir :

After attending the course the students will

- have a good understanding of the algorithmic and statistical foundations of the main machine learning techniques
- be able to select machine learning techniques adapted to a particular task (exploratory analysis with clustering methods, predictive analysis, etc.)
- be able to design a model selection procedure adapted to a particular task
- report the results of a machine learning project with valid estimation of the performances of their model

Mode de contrôle des connaissances :

- quizzes and tests during the course
- machine learning project