**Summary**

The objective of this course is to give an overview of machine learning techniques used for real-world applications, and to teach how to implement and use them in practice.

**Content**

**Fundamentals**
- Notion of learning, cross validation and performance evaluation
- Recalls in probability and information theory
- Optimization (gradient, newton, stochastic gradient, etc.)

**Generative models**
- Directed / non-directed models, conditional independence, naive Bayesian
- k-Mean, GMM, E-M
- PCA and probabilistic PCA
- Bayesian networks, belief propagation
- HMM and extensions
- Sub-space clustering

**Regression**
- Least-square + weighted least-square
- 2) GMR + GPR

**Discriminative models**
- SVMs and Kernelization (perceptron, PCA, etc.)
- Perceptron, MLP, convolution networks
- Decision trees

**Meta-algorithms**
- Bagging and boosting
• Feature selection, regularization and sparsity

Keywords
Machine learning, pattern recognition, regression.

Learning Prerequisites
Required courses
At least one prior course in probabilities, linear algebra and programming (C, Java or equivalent).

Learning Outcomes
By the end of the course, the student must be able to:
• Select appropriately in practice standard learning-based inference techniques for regression, classification and density modeling.

Assessment methods
Multiple.