Summary

This course introduces several machine learning techniques for the data analysis and classification in Bioengineering applications. Following an application-oriented approach, each technique is illustrated with examples from fields such as neural engineering, movement analysis and bioinformatics.

Content

1 Introduction to Machine learning
   Supervised vs Unsupervised approach, Training and testing techniques

2 Regression methods
   Linear methods, Other methods, Statistical models

3 Feature selection
   Filters, wrappers, Information theory

4 Dimensionality reduction
   Principal component analysis (PCA); Independent component analysis (ICA), Clustering approaches

5 Temporal pattern recognition / Sequence analysis
   Hidden Markov Models

6 Case studies - Prosthetics
   Application specific constraints (e.g. single trial, compliance, time lag), Wearable robots, Neuroprosthetics

Learning Prerequisites

Important concepts to start the course

Basic Matlab programming. Students with little previous experience are strongly encouraged to follow online tutorials before starting the course. For example:

MATLAB fundamental course: https://matlabacademy.mathworks.com/R2015a/

Teaching methods

Lectures, exercises

Expected student activities

Students will have to carry out weekly exercises and provide a written report.

Assessment methods
Written exam. Final grade: 60% Exam, 40% Exercises.

Resources

Bibliography
The course has no textbook (it is based on several sources). Suggested reading material will be provided periodically.

The following books are suggested:
- C. Bishop: Neural Networks for Pattern Recognition
- R.O. Duda, P.E. Hart and D.G. Stork: Pattern Classification
- C. Bishop: Pattern Recognition and Machine Learning

Ressources en bibliothèque
- Pattern Recognition / Stork
- Neural Networks for Pattern Recognition / Bishop
- Pattern Recognition and Machine Learning / Bishop

Moodle Link