

EE-516

Data analysis and model classification

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Cursus	Sem.	Type
Bioengineering	MA1, MA3	Opt.
Computational Neurosciences minor	H	Opt.
Neuroprosthetics minor	H	Opt.
Sciences du vivant	MA1, MA3	Opt.

Language of teaching	English
Credits	4
Session	Winter
Semester	Fall
Exam	Written
Workload	120h
Weeks	14
Hours	4 weekly
Courses	2 weekly
Exercises	2 weekly
Number of positions	

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**

Matlab programming (tutorial provided at the beginning of the course)

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: 2/3 Exam, 1/3 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

- <http://moodle.epfl.ch/course/view.php?id=8851>