EE-612

Fundamentals in statistical pattern recognition

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Cursus	Sem.	Type
Electrical Engineering		Opt.

Language of teaching	English
Credits	4
Session	
Exam	Multiple
Workload	120h
Hours	**56**
Courses	36
TP	20
Number of positions	**24**

Frequency

Every 2 years

Remark

Registration closed

Summary

This course provides in-depth understanding of the most fundamental algorithms in statistical pattern recognition or machine learning (including Deep Learning) as well as concrete tools (as Python source code) to PhD students for their work.

Content

This course will cover the broad regression, classification and probability distribution modeling methods and more particularly: Linear regression, Logistic regression, k-NN, Decision Trees, Boosting, Dimensionality reduction (PCA, LDA, t-SNE), k-Means, GMMs, MLPs, CNNs, SVMs.

A - Introduction

- Data representation,
- Pattern Recognition and Machine Learning,
- Lab preparation (**JupyterHub**, Python and **pyTorch**).

B - Regression and Classification

- Linear Regression,
- Logistic Regression and Regularization, Overfitting and Capacity,
- k-NN, **Decision Trees**,
- Artificial Neural Networks: Multi-Layer Perceptron (MLP) and Back-Propagation
- Deep Learning : **Convolutional Neural Networks (CNN)** and Optimization
- Support Vector Machines

C - Dimensionality reduction and Clustering

- Principal Component Analysis (PCA),
- Linear Discriminant Analysis (LDA),
- k-Means, **Single Linkage**,
- **t-SNE**.

D - Probability distribution modelling

- Gaussian Mixture Models (GMM) and the Expectation-Maximization (EM).

Keywords

Pattern Recognition, Machine Learning, Linear models, PCA, LDA, MLP, SVM, GMM, HMM.

Learning Prerequisites

Recommended courses

Linear algebra, Probabilities and Statistics, Signal Processing, Python (for the Labs).

Assessment methods

Laboratory and oral exam.

Resources

Websites

- http://www.idiap.ch/~marcel/professional/Lectures_and_Labs.html