Résultats d'apprentissage:

Real-world engineering applications must cope with a large dataset of dynamic variables, which cannot be well approximated by classical or deterministic models. This course will give an overview of a number of alternative methods from Machine Learning that have been proven successful for the analysis of non-linear, highly noisy and correlated data. Students will familiarize themselves with each method through short hands-on practical.

Objectifs d'apprentissage:

Controlling complex systems (e.g. controlling high-degrees of freedom autonomous robots, analyzing multimodal signals) requires methods to deal with a large dataset of dynamic variables, which cannot be well approximated by classical or deterministic models. This course will give an overview of a number of alternative methods from Machine Learning that have been proven successful for the analysis of non-linear, highly noisy and correlated data. Students will familiarize themselves with each method through short hands-on practical. The course will be evaluated through a final exam (50% grade) and through the reports following each practical (50% grade).

Contenu:

- Discrete, Hierarchical and Bayesian Classifiers: K-means, soft K-means, Mixture of Gaussians, EM-
- Statistical Decomposition of Signals: PCA, ICA
- Non-linear Regression: Support Vector Regression, Gaussian Mixture Regression
- Artificial Neural Networks and Genetic Algorithms
- Markov-Based Techniques for Time Series Analysis: Hidden Markov Models, Reinforcement Learning

Prérequis:

Programming in C/C++, Linear Algebra, Probability and Statistics

Forme d'enseignement:

Ex-cathedra, practicals

Forme du contrôle:

Written exam (50% grade), practicals (50% grade).

Bibliographie et matériel:

The course is accompanied by lecture notes entitled "Machine Learning Techniques" by Aude Billard. These are available at the libraire polytechnique and students should purchase these before the start of the class.

Other recommended textbooks:

- Cluster Analysis, Copyright StatSoft, Inc., 1984-2004
- Pattern Classification Richard O. Duda, Peter E. Hart, David G. Stork,

En bibliothèque / in libraries :

(cliquez sur le lien pour consulter les informations du réseau de bibliothèque suisse / click on the link to consult information of the Swiss network of libraries)

- Independent component analysis / Aapo Hyvärinen, Juha Karhunen, Erkki Oja, 2001
- Information theory, inference and learning algorithms / David J.C. MacKay, 2001
- Pattern classification / Richard O. Duda, Peter E. Hart, David G. Stork, 2001

Matière examinée / subjects examined

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<tr>
<td>Applied machine learning</td>
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Self-organizing maps / Teuvo Kohonen, 2001
(http://opac.nebis.ch/F?local_base=nebis&con_lng=FRE&func=find-b&find_code=020&request=3-540-67921-9)