# PATTERN RECOGNITION

Description

Introduction to the theory and algorithms of statistical pattern recognition with applications to recognition of sounds (e.g. speech, music), visual objects, audio-visual events, and other spatio-temporal sensory or symbolic data. Bayesian decision and estimation theory (Maximum Likelihood, Maximum-A-Posteriori). Nearest neighbor decision rule. Methods for clustering (e.g. k-means) and unsupervised learning. Decision trees. Methods for feature transformation and selection in pattern space, and dimensionality reduction: principal component analysis (PCA), linear discriminant analysis (LDA), independent  component analysis (ICA). Methods for linear and nonlinear regression. Pattern classification methods with linear discriminant machines: Perceptrons καιSupport Vector Machines. Hidden Markov models (HMMs), Gaussian Mixture models (GMMs), Expectation-Maximization algorithm, Viterbi algorithm.  Dynamic Bayesian nets. Probabilistic graphical models.  Deep learning methods: Deep, Convolutional, Recursive Neural Nets (DNNs CNNs, RNNs). Analytic and laboratory exercises.

Bibliography

* ***[DHS]*** R. O. Duda, P.E. Hart and D.G. Stork,  
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  Wiley, 2001.
* ***[Bishop]*** C. M. Bishop,   
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  Springer, 2006.
* ***[Goodfellow-et-al]***, I. Goodfellow, Y. Bengio and A. Courville, **Deep Learning**, MIT Press, http://www.deeplearningbook.org .
* ***[Theodoridis 2020]*** S. Theodoridis,  "Machine Learning: A Bayesian and optimisation perspective", Academic Press, 2nd Edition, 2020.

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