

Mat-1.C Statistical learning (5 cr)

Jüri Lember from the University of Tartu visits Department of Mathematics and systems analysis in March–June 2012. He will give lectures on *Statistical learning*: The contents of the lectures are

1. Pattern recognition: the problem, Bayes classifier, learning from data: supervised learning, consistency.
2. Introduction to Vapnik-Chervonenkis theory: empirical risk minimization, Glivenko-Cantelli theorem, concentration inequalities, VC-dimension, regularization.
3. Linear classifiers: the risk bounds via covariation matrices, linear regression, logistic regression, LDA (linear discriminant analysis), SVM (support vector machine).
4. Kernel methods: non-linear SVM's, kernels, examples, representation theorem, KPCA (kernel principal component analysis), ridge and lasso regression with kernels.
5. Boosting: risk and psi-risk, AdaBoost, gradient-Boost, boosting and regression.

6. Overview of other methods: plug-in methods, nearest neighbor methods, trees (especially CART -trees).
7. Unsupervised learning: the model versus data, mixture model, Markov chain and hidden Markov model (HMM): examples, some properties of HMM's.
8. Inferences with hidden Markov models: Rabiner's three problems, forward-backward variables, Viterbi algorithm, Viterbi training, EM algorithm, segmentation with hidden Markov models: the risk based approach.

The lecture and exercise times are

- Mo 12 - 14 **U322**, Tu 14 -16 **U344** and We 14-16 **U356**.

First lecture is on **Mo 12.3. 2012**. More information: jyril@ut.ee or esko.valkeila@aalto.fi