Mat-1.C Information theory and statistics (4cr)

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Lectures (weeks 11 – 13, 15 – 18):

Monday: 12 – 14   (U344)
Tuesday: 8 – 10   (U344)

Exercises (weeks 11 – 13, 15 – 17):

Wednesday: 8 – 10   (U344).

The course covers the basic concepts of information theory, emphasizing the connections with mathematical statistics. The main topics are:

1. Basic concepts: (Shannon) entropy, Kullback-Leibler divergence, mutual information; the entropy rate of a stochastic process.

2. Markov chains, data processing inequality, sufficient statistics.

3. Introduction to coding: examples of codes, Kraft's inequality, optimal (Huffman) codes.

4. Almost equipartition property (AEP), Shannon's source coding theorem.

5. Channels, capacity, Shannon's channel coding theorem.

6. Method of types (Csiszar-Krner theory), universal coding, large deviation inequalities, Sanov theorem, hypotheses testing.

7. Differential entropy, MaxEnt principle.

Depending on the time and/or the interest of the audience some additional topics like the introduction to the ergodic theory, rate-distortion theory or some elements of algorithmic information theory might be briefly covered.

The course should be accessible to all (post- and undergraduate) students familiar with the basic probability concepts.

The course ends with a test consisting mainly on exercises or short problems. Registration in WebOodi before March 18, 2013.