Valid for year : **2017**

**XXXXYY** **Advanced** **Machine Learning, 6 ECTS credits**

**/ Avancerad maskininlärning/**

For: U, D, DAV, IT, CS.

Prel. Scheduled hours: 48

Rec. self-study hours: 112

*Area of Educations*: Technology

*Main field of studies*: Computer Science, Computer Engineering

Advancement level (G1,G2,A): A

*Huvudområde*: Datateknik, Datavetenskap, Informationsteknologi

Aim:

The course presents the analysis of several large classes of models widely used in advanced machine learning, such as state-space models, gaussian processes, hidden Markov models, Bayesian networks, and Markov random fields. Students will learn about the structure and learning of these models, when they are applicable, how to use them in practical machine learning applications, and how to correctly interpret the results. The models are mainly analyzed from a Bayesian perspective.

After completing the course the student should be able to:

* use the introduced model classes to accurately formulate and solve practical problems.
* learn the parameters and perform predictions in the presented models.
* evaluate and choose among the models within each class.
* implement the models and learning methods in a programming language.

*Prerequisites*: (valid for students admitted to the programmes within which the course is offered)

Probability theory and Statistics; Bayesian Learning; Machine Learning; Mathematical analysis; Linear Algebra; Basic programming.

*Supplementary courses*

Text mining, Detection and Recognition.

*Organisation*:

The course consists of lectures, seminars and computer laboratory work. The lectures introduce concepts and theories that students then use in problem solving at the computer labs. Seminars comprise student presentations and discussion of computer lab reports.

*Course contents*:

Bayesian learning summary, Gaussian processes, State-space models, Kalman filtering and smoothing, Particle methods, Graphical models, Bayesian networks, Markov models, Hidden Markov models, Markov random fields.

Course literature:

* Bishop, C. M., Pattern Recognition and Machine Learning, Springer, 2006.

*Examination*:

DAT1 Computer exam (U,3,4,5) 3 ECTS

UPG1 Computer-based laboratory exercises (U,G) 3 ECTS

DAT1 is an exam in a computer hall that tests students' theoretical knowledge and problem-solving skills in machine learning.

UPG1 consists of computer exercises that tests the students' ability to translate theoretical knowledge into practical problem solving in machine learning.

Course language is English.

Department offering the course: IDA.

Director of Studies: Ann-Charlotte Hallberg

Examiner: Mattias Villani

Link to the course homepage at the department

Board responsible for the course: Data&Medie