DD2420 Probabilistic Graphical Models 7.5 credits

Probabilistiska grafiska modeller

This is a translation of the Swedish, legally binding, course syllabus.

If the course is discontinued, students may request to be examined during the following two academic years

Establishment

Course syllabus for DD2420 valid from Spring 2019

Grading scale

A, B, C, D, E, FX, F

Education cycle

Second cycle

Main field of study

Computer Science and Engineering

Specific prerequisites

This course cannot be counted in the degree if the student has taken DD2447

Language of instruction

The language of instruction is specified in the course offering information in the course catalogue.

Intended learning outcomes

The student shall upon passing the course be able to explain and reason about:

1.how the various graphs represent both factorization and independance relations;

2. exact inference on graphical models including using message passing algorithms to the extent of being able to perform all the steps of the algorithms;

3. approximate inference such as sampling, loopy belief propagation and variational methods;

4. methods for learning model parameters.

Students earning higher grades will have a deeper and/or broader understanding of the above 4 goals and be able to use some of the methods in 3 and 4 above in real engineering tasks.

Course contents

The main content of the course is:

- Graph Representations: Discriminative vs Generative Models, Bayes Nets (DAG), Undirected Models (MRF/Factor Graphs), Exponential Family (features), D-Separation, Markov Blanket,
- Exact Inference: Message Passing, Variable Elimination, Factor Graphs from DAGs, Sum Product Algorithm, Clique Graphs/Trees, Inference with evidence, Junction Tree Algorithm,
- Approximate Inference: Loopy Belief Propagation, Monte Carlo Principle, Direct Sampling, Importance Sampling, Evidence, Rejection Sampling, MCMC, Gibbs Sampling, Collapsed Importance Sampling, Variational methods (Projections), MAP inference.
- Learning: Parameter Estimation, Max Likelihood Estimation, Sufficient Statistics, Bayesian Parameter Estimation, Conjugate Prior, Gaussian/Beta/Dirichlet Distributions, Partially Observed Data, Gradient Ascent, Expectation Maximization, Gaussian Mixture Learning

Disposition

The course topics wll be covered in a series of lectures which, along with reading, will give the student a basic understanding.

There will be manditory tutorial excercises covering these to help solidify the students understanding.

There is also a written exam.

For obtaining higher grades than E the students will be able to choose between alternatives for going into depth on particular methods such as by doing additional tutorials, assignments or projects. Some of these will require programing skills, such as in python and matlab.

Course literature

Probabilistic Graphical Models Principles and Techniques, Daphne Koller & Nir Friedman, MIT Press

ISBN 978-0-262-01319

Examination

- PRO1 - Tutorials 1, 2.5 credits, grading scale: P, F
- PRO2 - Tutorials 2, 2.5 credits, grading scale: P, F
- TEN1 - Examination, 2.5 credits, grading scale: P, F

Based on recommendation from KTH's coordinator for disabilities, the examiner will decide how to adapt an examination for students with documented disability.

The examiner may apply another examination format when re-examining individual students.

The code of honor, of course, covers this course: https://www.kth.se/en/eecs/utbildning/hederskodex/inledning-1.17237

Other requirements for final grade

Passing the manditory tutorials and written exam.

Ethical approach

- All members of a group are responsible for the group's work.
- In any assessment, every student shall honestly disclose any help received and sources used.
- In an oral assessment, every student shall be able to present and answer questions about the entire assignment and solution.