EQ2341 Pattern Recognition and Machine Learning 7.5 credits

Mönsterigenkänning och maskininlärning

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 EQ2341 valid from Autumn 2017

Grading scale

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

Education cycle

Second cycle

Main field of study

Electrical Engineering

Specific prerequisites

For single course students: 120 credits and documented proficiency in English B or equivalent.

Language of instruction

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

Intended learning outcomes

After passing the course, students should be able to:

(1) Describe models for Pattern Recognition system and formulate the optimal cost functions in a probabilistic framework. Then analytically and experimentally estimate recognizer performances.

(2) Describe a pattern recognition problem for a sequence of observed signals and address the problem using hidden Markov models (HMM).

(3) Design systems and algorithms for pattern recognition. Critically compare the algorithms in a trade-off between complexity and performance. Present and report the results.

(4) Implement and analyze machine learning based methods for automatic training of pattern recognition systems.

Course contents

The course considers foundational and advanced pattern recognition methods for classification tasks in signals and data. We take a Bayesian approach in this course. Simple example applications can be a digit recognition task, or automatic word recognition task. A complex application can be in medical field, such as recognition of disease from patient data. The course covers following.

(1) Pattern recognition problems in Bayesian framework. Forming optimal cost functions, and then establishing maximum-likelihood (ML) and maximum-a-posteriori (MAP) rules for classification.

(2) Discriminant functions.

(3) Hidden Markov models (HMM) for classification of sequence of feature vectors

(4) Machine learning based HMM training - using expectation-maximization (EM)

(5) Approximate machine learning, such as variational Bayes.

Disposition

Preliminary course structure: 14 lectures + 10 tutorials

Course literature

Will be announced on the course homepage before the course starts. Preliminary literature:

(1) Compendium on Pattern Recognition, by Arne Leijon and Gustav Henter

(2) Pattern recognition and machine learning, by C.M. Bishop

Examination

- PRO1 - Project assignments, 2.5 credits, grading scale: A, B, C, D, E, FX, F
- TEN1 - Exam, 5.0 credits, grading scale: A, B, C, D, E, FX, 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.

Other requirements for final grade

There are three assessment components for the course.

(1) Master tests: There will be two master tests in the span of teaching 14 classes. Each test is of 20-30 minutes. The master tests are intended to check concepts. The tests require sustained (or regular) study at home as the teachers cover topics in class. The tests will use short conceptual questions, and no lengthy problem. Grades for master tests: A-F.

(2) Projects: There are practical projects. Projects are examined via presentations. Projects can be performed in groups of two persons. However, the grades are on the basis of individual performance. Grades for projects: A-F.

(3) Final exam: There is a final written exam. Grades for the final exam: A-F.

The overall grade of the course is based on collective performance. The teacher will provide weights to all tests for the overall grade.

To pass the course, master tests are not mandatory. But the projects and final test are mandatory. To achieve a good course grade, a student is expected to perform well in all the three assessment components. The projects are reported as PRO1, 2.5cr., the master tests and final test are jointly reported as TEN1, 5cr.

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.