FEO3310 Sparse Signal Processing 8.0 credits

Gles Signalbehandling

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

Establishment

Course syllabus for FEO3310 valid from Autumn 2011

Grading scale

G

Education cycle

Third cycle

Specific prerequisites

Language of instruction

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

Intended learning outcomes

After the course, the students should be able to :
(1) Understand the key concept of sparsity in nature that relates to the fact that most of the signals
and systems have low degrees of freedom and then identify relevant research problems.

(2) Formulate and use a linear model setup for describing a sparse signal and system setup.
(3) Apply algorithmic tools to solve for a sparse solution such that overall system efficiency increased.
(4) Design and compare several algorithms applied to a particular signal and system setup, using
appropriate simulation platform and analytical tools.
(5) Contribute to the frontier research in the area.

Course contents

The course is focused on solving a sparse solution of a linear under-determined system with the trade-off
between complexity and performance. A brief outline of the course contents is as follows.
(1) The key problem of solving a linear under-determined system and sparsity
(2) Pursuit algorithms – Design and their theoretical performance guarantees
(3) From exact to approximate solutions
(4) Iterative-shrinkage algorithms
(5) Towards average performance analysis
(6) The Dantzig-Selector algorithm
(7) MAP versus MMSE estimation

Disposition

Lectures, group and individual discussion of research papers, project assignment and a final examination of five
hours.

Course literature

Michael Elad, “Sparse and Redundant Representations: From Theory to Applications in Signal and Image
Precessing” 2010, Springer

Examination

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.

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

Other requirements for final grade

The evaluation criteria are the presentation of research papers and project assignments. Each paper presentation
will be graded according to (approximate thresholds):
-1 : less that 20% of the paper is understood correctly
0 : between 20 % to 40% of the paper is understood correctly
1 : between 40% to 70% of the paper is understood correctly
2 : more than 70% of the paper is understood correctly
There are three paper presentations (two in a group as a technical note preparation and one individually as a
paper presentation) and the threshold for receiving a pass-grade is four points.
In addition, the student has to successfully complete two project assignments. The project assignments will
mainly focus on implementing algorithms and their use in practice. Each project assignment will be graded
according to (approximate thresholds):
-1 : less that 20% of the project executed
0 : between 20 % to 40% of the project executed
1 : between 40% to 70% of the project executed
2 : more than 70% of the project executed
The threshold for receiving a pass-grade is three points.
Overall, for achieving a pass-grade, the threshold is seven points out of ten points. If required, a final
examination of five hours may be arranged.

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.