EQ2845 Information Theory and Source Coding 7.5 credits

Informationsteori och källkodning

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 EQ2845 valid from Spring 2019

Grading scale

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

Education cycle

Second cycle

Main field of study

Electrical Engineering

Language of instruction

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

Intended learning outcomes

After passing this course, participants should be able to

- describe and use the principles of information theory, like entropy, mutual information, asymptotic equipartition, data processing, prefix codes, Kraft inequality, noiseless source coding, maximum entropy, rate distortion, noisy source coding, Shannon lower bound, backward channel, reverse waterfilling, energy concentration, etc. to develop source coding algorithms,

- develop source coding schemes for lossless coding, like Huffman coding, arithmetic coding, Lempel-Ziv coding, universal source coding,

- develop source coding schemes for lossy coding, like scalar and vector quantization, Lloyd-Max quantization, entropy-constrained quantization, high-rate quantization, transform coding, predictive coding,

- implement (for example with MatLab) and assess the developed source coding schemes / algorithms,

- explain coding design choices using the principles of information theory,

- develop source coding schemes for a given source coding problem,

- model and assess source coding schemes using the principles of information theory,

- analyze given source coding problems, identify and explain the challenges, propose possible solutions, and explain the chosen design.

To achive higher grades, participants should also be able to

- solve more advanced problems in all areas mentioned above.

Course contents

This course introduces the principles of information theory and source coding, discusses fundamental source coding concepts, and provides hands-on experience for selected popular source coding algorithms. The course includes topics on information and entropy, lossless coding, Shannon's noiseless source coding theorem, lossy coding, rate distortion, Shannon's noisy source coding theorem, scalar and vector quantization, transform and predictive coding.

Specific prerequisites

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

Recommended: EQ1220 Signal Theory or equivalent

Course literature

T.M. Cover and J.A. Thomas, “Elements of Information Theory,” John Wiley & Sons, Inc., New York.

Examination

- INL1 - Assignment, 1.5 credits, grading scale: P, F
- TEN1 - Exam, 6.0 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.

Homework assignments 1.5 ECTS (P/F). Written exam 6 ECTS (A-F).

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.