EL2320 Applied Estimation 7.5 credits

Tillämpad estimering

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

Establishment

Course syllabus for EL2320 valid from Spring 2019

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

The overall goal of the course is to give the participants theoretical as well as practical skills and experience in estimation. The course will start from a number of concrete examples to motivate the need for various filtering techniques such as Kalman filters and particle filters. After completing the course the student should:

- be able to describe the parts of a Bayesian recursive filter in terms of the underlying probabilities, compare and contrast different estimation techniques, and select and apply appropriate techniques to problems.
- have reflected on the relationship between measurement uncertainty, probability theory and estimation methods.
- have gained experience in finding information from current scientific literature including recently published journal articles. As well as presentation of results in well structured scientific reports.

Course contents

The course focuses on giving the participants practical experience in using different estimation techniques on real problems. Examples used in the course are, for example, from navigation with mobile robots.

The following will be covered in the course: Observability, the Markov assumption, data association, estimation techniques such as Kalman filter, extended Kalman filter, particle filter, Rao-Blackwellized particle filter, Unscented Kalman Filter

Disposition

There are 12 lectures. Both theory and practice of estimation will be covered. Getting practical skills in anything requires you to get hands-on experience and as such the work between the lectures will be very important.

Two labs solved individually cover the Kalman filter and the particle filter.

For the final project, the student should work in pairs and implement an estimation method. Each student needs to write an individual report including a literature study. It is also possible for a single student to write an individual report in the form of only a literature study (i.e. without an implementation) to pass the minimum requirement for the final project assignment. See the examination comment below on the difference in grading between these two options.

Course literature

The official course book is "Probabilistic robotics" by Thrun, Burgard and Fox, The MIT Press, ISBN 0-262-20162-3 covers most of the material in the course from a robotics points of view. Letcures notes will also be made available. This course is at advanced level so some

of the material will be in the form of research publications. The students are assumed able to research for additional material to solve the project assignment.

Equipment

No special equipment needed, you only need access to a computer

Examination

- PRO2 - Project, 2.0 credits, grading scale: P, F
- PRO1 - Project, 2.0 credits, grading scale: P, F
- TEN1 - Examination, 3.5 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.

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

The basic part of the examination in the course consists of two lab assignments (PRO1), a project (PRO2) and an exam (TEN1). These are credited as,

PRO1: 2.0hp
PRO2: 2.0hp
TEN1: 3.5hp

Each of these will be reported to the system with a P/F grade and passing them means that the student has passed the course. The final grade is then an assessment based on the level above passing on these moments as described below.

The final grade for the course will be an average of the grade on the exam and the implementation project. This project assignment can be completed in groups of two students but each needs to write a separate report and will be assessed separately.

Not opting to do an implementation project (ie. only doing a literature study) thus gives a final grade of half the exam grade.

Other requirements for final grade

To get a passing grade in the course the students need to pass the labs, the mandatory part of the project assignments and the 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.