Sensor Fusion

Programme course

6 credits

Sensorfusion

TSRT14

Valid from: 2017 Spring semester

Determined by
Board of Studies for Electrical Engineering, Physics and Mathematics

Date determined
2017-01-25

Main field of study
Electrical Engineering

Course level
Second cycle

Advancement level
A1X

Course offered for
- Computer Science and Engineering, M Sc in Engineering
- Industrial Engineering and Management - International, M Sc in Engineering
- Electronics Design Engineering, M Sc in Engineering
- Industrial Engineering and Management, M Sc in Engineering
- Applied Physics and Electrical Engineering, M Sc in Engineering
- Information Technology, M Sc in Engineering
- Applied Physics and Electrical Engineering - International, M Sc in Engineering
- Computer Science and Software Engineering, M Sc in Engineering

Entry requirements
Note: Admission requirements for non-programme students usually also include admission requirements for the programme and threshold requirements for progression within the programme, or corresponding.

Prerequisites
Digital Signal Processing, Signals and Systems.

Intended learning outcomes

The student should after the course have the ability to describe the most important methods and algorithms for sensor fusion, and be able to apply these to sensor network, navigation and target tracking applications. More specifically, after the course the student should have the ability to

- Understand the fundamental principles in estimation and detection theory.
- Implement algorithms for parameter estimation in linear and non-linear models.
- Implement algorithms for detection and estimation of the position of a target in a sensor network.
- Apply the Kalman filter to linear state space models with a multitude of sensors.
- Apply non-linear filters (extended Kalman filter, unscented Kalman filter, particle filter) to non-linear or non-Gaussian state space models.
- Implement basic algorithms for simultaneous localization and mapping (SLAM).
- Describe and model the most common sensors used in sensor fusion applications.
- Implement the most common motion models in target tracking and navigation applications.
- Understand the interplay of the above in a few concrete real applications.

Course content

Fusion for linear and non-linear models. Sensor network localization and detection algorithms. Filter theory. The Kalman filter for sensor fusion. Extended and unscented Kalman filters. The particle filter. Simultaneous localization and mapping. Sensors and sensor-near signal processing. Motion models. Estimation and detection theory.

Teaching and working methods

The course is organized in lectures/classes and laboratory work.

Examination

UPG1	Laboratory work	3 credits	U, G
DAT1	Computer examination	3 credits	U, 3, 4, 5

Grades

Four-grade scale, LiU, U, 3, 4, 5

Department

Institutionen för systemteknik

Director of Studies or equivalent
Johan Löfberg

Examiner
Gustaf Hendeby

Course website and other links

Education components
Preliminary scheduled hours: 41 h
Recommended self-study hours: 119 h

Course literature
Teoribok från Studentlitteratur, Statistical Sensor Fusion

Common rules

Regulations (apply to LiU in its entirety)

The university is a government agency whose operations are regulated by legislation and ordinances, which include the Higher Education Act and the Higher Education Ordinance. In addition to legislation and ordinances, operations are subject to several policy documents. The Linköping University rule book collects currently valid decisions of a regulatory nature taken by the university board, the vice-chancellor and faculty/department boards.

LiU's rule book for education at first-cycle and second-cycle levels is available at http://styrdokument.liu.se/Regelsamling/Innehall/Utbildning_pa_grund-_och_avancerad_niva.