This course syllabus is discontinued or replaced by a new course syllabus.

ÖREBRO UNIVERSITY

Course Syllabus

School of Science and Technology

Computer Science, Advanced Technologies for Intelligent Systems, Second Cycle, 15 Credits

Course Code:	DT103A	**Subject Area:**	Field of Technology
Main Field of Study:	Computer Science	**Credits:**	15
		Subject Group (SCB):	Computer Science
Education Cycle:	Second Cycle	**Progression:**	A1F
Established:	2018-08-31	**Last Approved:**	2018-09-28
Valid from:	Spring semester 2019	**Approved by:**	Head of School

Aims and Objectives

General aims for second cycle education

Second-cycle courses and study programmes shall involve the acquisition of specialist knowledge, competence and skills in relation to first-cycle courses and study programmes, and in addition to the requirements for first-cycle courses and study programmes shall
- further develop the ability of students to integrate and make autonomous use of their knowledge
- develop the students' ability to deal with complex phenomena, issues and situations, and
- develop the students' potential for professional activities that demand considerable autonomy, or for research and development work.

(Higher Education Act, Chapter 1, Section 9)

Course Objectives

Knowledge and understanding
Completing this course, the student shall be able to explain
- the advanced technologies necessary for the analysis, design and development of data modeling and machine learning,
- state-of-the-art algorithms using statistical estimation techniques for solving tasks that are central to mobile robotics, as well as their mathematical background.

Applied knowledge and skills
Completing this course, the student shall be able to
- apply machine-learning methods to achieve a learning goal within an intelligent system,
- develop software that uses probabilistic techniques for robotics applications,
- read and understand scientific literature within the subject area of the course.

Judgments and approach
Completing this course, the student shall be able to compare the virtues and limitations of probabilistic approaches to solving robotics problems.

Main Content of the Course

The course consists of two compulsory sub-courses.

Part I: Machine Learning, 7,5 credits
- Supervised and unsupervised algorithms for classification, prediction and clustering,
- manual and automatic feature design,

- dimensionality reduction techniques and feature selection,
- practical recommendations for applying machine learning algorithms,
- training and classification of neural networks, and
- Bayesian learning and recommender systems.

Part II: Probabilistic Robotics, 7,5 credits
- Mathematical statistics: Bayes' theorem, probability distributions, generative and discriminative models,
- Kalman filters,
- particle filters and Monte Carlo optimisation,
- robot motion and sensor models,
- SLAM (simultaneous localisation and mapping),
- data association, and
- random fields (Markov random fields and conditional random fields).

Teaching Methods

Part I: Machine Learning
Lectures and seminars.

Part II: Probabilsitic robotics
Lectures and project assignments.

In case of a small number of students, the lectures may be replaced by individual tutoring.

Students who have been admitted to and registered on a course have the right to receive tuition and/or supervision for the duration of the time period specified for the particular course to which they were accepted (see, the university's admission regulations (in Swedish)). After that, the right to receive tuition and/or supervision expires.

Examination Methods

Machine Learning, Practice, 4.5 Credits. (Code: 0100)
Written reports and practical exercises.

Machine Learning, Theory, 3 Credits. (Code: 0200)
Oral presentations at the seminar.

Probabilistic Robotics, Theory, 4 Credits. (Code: 0300)
Written examination. In case of a small number of students, the written examination may be replaced by oral examination.

Probabilistic Robotics, Practice, 3.5 Credits. (Code: 0400)
Presentation of project work.

For further information, see the university's local examination regulations (in Swedish).

Grades

According to the Higher Education Ordinance, Chapter 6, Section 18, a grade is to be awarded on the completion of a course, unless otherwise prescribed by the university. The university may prescribe which grading system shall apply. The grade is to be determined by a teacher specifically appointed by the university (an examiner).

According to regulations on grading systems for first- and second-cycle education (vice-chancellor's decision 2010-10-19, reg. no. CF 12-540/2010), one of the following grades is to be used: fail, pass, or pass with distinction. The vice-chancellor or a person appointed by the vice-chancellor may decide on exceptions from this provision for a specific course, if there are special reasons.

Grades used on course are Fail (U), Pass (G) or Pass with Distinction (VG).

Machine Learning, Practice
Grades used are Fail (U), Pass (G) or Pass with Distinction (VG).

Machine Learning, Theory
Grades used are Fail (U) or Pass (G).

Probabilistic Robotics, Theory

Grades used are Fail (U), Pass (G) or Pass with Distinction (VG).

Probabilistic Robotics, Practice
Grades used are Fail (U), Pass (G) or Pass with Distinction (VG).

To receive the grade VG for the entire course, the student must have VG for at least two of the examination methods.

For further information, see the university's local examination regulations (in Swedish).

Specific entry requirements

At least 15 credits from Computer Engineering, Research methodologies for Intelligent Systems, Second Cycle, 30 Credits.

For further information, see the university's admission regulations (in Swedish).

Transfer of Credits for Previous Studies

Students who have previously completed higher education or other activities are, in accordance with the Higher Education Ordinance, entitled to have these credited towards the current programme, providing that the previous studies or activities meet certain criteria.

For further information, see the university's local credit transfer regulations (in Swedish).

Other Provisions

The course is given in English.

Reading List and Other Teaching Materials

Part 1: Additional Reading

Bishop, Christopher M. (2007)
Pattern Recognition and Machine Learning
Springer, ISBN: 9780387310732, 758 pages

Mitchell, Tom M. (1997)
Machine Learning
McGraw-Hill, ISBN: 9780071154673, 352 pages

Part 2: Required Reading

Thrun, Sebastian, Burgard, Wolfram och Fox, Dieter (2005)
Probabilistic Robotics
MIT Press, 647 pages

Additions and Comments on the Reading List

Ytterligare material kommer att utdelas under kursens gång.
Additional material will be awarded during the course.