Data Analytics for Smart Cities

Programme course

6 credits

Dataanalys för smarta städer

TNK117

Valid from: 2021 Spring semester

Determined by
Board of Studies for Industrial Engineering and Logistics

Date determined
2020-09-29

Offered for the last time
Autumn semester 2022

Replaced by
TNK130

Main field of study
Electrical Engineering, Transportation Systems Engineering

Course level
Second cycle

Advancement level
A1X

Course offered for
- Master's Programme in Intelligent Transport Systems and Logistics
- Communications, Transport and Infrastructure, M Sc in Engineering

Prerequisites
Basic knowledge in linear algebra, calculus, statistics and probability theory as well as computer programming.

Intended learning outcomes
In this course, you will learn how to utilize and learn from data in order to gain insights for decisions, especially in the area of smart cities. We will examine real world examples from for example traffic management, logistics, telecommunications and crowd sensing. After completing the course, the student should be able to:

- Identify the most common statistical methods used in data analytics
- Explain the differences in characteristics between different type of data analytics methods and give examples of when they should be applied
- Understand, explain and apply relevant concepts and methods in data analytics to solve practical problems
- Use selected statistical methods for prediction, classification and decision making
- Evaluate and choose among different methods for a specific problem instance
- Use existing data sets to train and evaluate selected methods for real-world applications
- Implement methods and algorithms for data analytics in a programming language

We will mainly use the statistical software Matlab to build models and work with data.

Course content

The course aims to provide knowledge in data analytics, especially for applications related to smart cities. The course will cover both supervised and unsupervised learning. The focus will be on classification and prediction, but also include clustering, anomaly detection and dimensionality reduction. Example content includes statistical inference, correlation, linear regression, logistic regression, K-nearest neighbour, support vector machines, hidden Markov models, neural networks, k-means clustering and principal component analysis.

Teaching and working methods

Lectures, tutorials and labs.

Examination

LAB1	Laboratory Work	2 credits	U, G
UPG1	Assignments	2 credits	U, 3, 4, 5
KTR1	Written Test	2 credits	U, 3, 4, 5

The final grade is the average of the grades received from UPG1 and KTR1.

Grades

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

Other information

About teaching and examination language

The teaching language is presented in the Overview tab for each course. The examination language relates to the teaching language as follows:

- If teaching language is Swedish, the course as a whole or in large parts, is taught in Swedish. Please note that although teaching language is Swedish, parts of the course could be given in English. Examination language is Swedish.
- If teaching language is Swedish/English, the course as a whole will be taught in English if students without prior knowledge of the Swedish language participate. Examination language is Swedish or English (depending on teaching language).
- If teaching language is English, the course as a whole is taught in English. Examination language is English.

Other

The course is conducted in a manner where both men's and women's experience and knowledge are made visible and developed.

The planning and implementation of a course should correspond to the course syllabus. The course evaluation should therefore be conducted with the course syllabus as a starting point.

Department

Institutionen för teknik och naturvetenskap

Director of Studies or equivalent

Erik Bergfeldt

Examiner

Nikolaos Pappas

Education components

Preliminary scheduled hours: 48 h
Recommended self-study hours: 112 h

Course literature

Other

◦ Piegorsch, W. W. (2015). Statistical data analytics: foundations for data mining, informatics, and knowledge discovery. John Wiley & Sons.
◦ Christopher M. Bishop (2006). Pattern Recognition and Machine Learning, Springer.
◦ Hastie, Tibshirani and Friedman (2013). An Introduction to Statistical Learning, Springer.

Additional Material:

◦ Gallager, R. G. (2013). Stochastic processes: theory for applications. Cambridge University Press.