Data Analytics for Smart Cities

Programme course

6 credits

Dataanalys för smarta städer

TNK117

Valid from: 2019 Spring semester

Determined by
Board of Studies for Industrial Engineering and Logistics

Date determined
2018-08-31

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
- Communication and Transportation Engineering, M Sc in Engineering
- Master's Programme in Intelligent Transport Systems and Logistics

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
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 weighted by the distribution of credits of the partial examinations.

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

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.