Linnæus University

Dnr: 2020/1242-3.1.2.2

Course syllabus

Faculty of Technology

Department of Computer Science and Media Technology

4DV809 Datalogisk och Visuell Nätverksanalys, 5 högskolepoäng
4DV809 Computational and Visual Network Analysis, 5 credits

Main field of study
Computer Science

Subject Group
Informatics/Computer and Systems Sciences

Level of classification
Second Level

Progression
A1N

Date of Ratification
Approved by Faculty of Technology 2020-03-30
The course syllabus is valid from spring semester 2021

Prerequisites

- 90 credits in Computer Science (including a degree project at Bachelor level).
- English B/English 6 or the equivalent.

Objectives

After completing the course the student shall be able to:

Knowledge and understanding

- A.1 Define and explain the main characteristics of relational data (graphs and networks) and the corresponding computational analyses,
- A.2 describe the main classes of existing graph drawing approaches, and
- A.3 establish the relation between computational and visual methods for network data analysis.

Skills and abilities

- B.1 Select and use suitable tools for data processing and visualization for network data, and
- B.2 design and develop custom solutions for visual network analysis.

Judgement and approach

- C.1 Compare and criticize the discussed computational and visual analysis approaches in the light of current theories and research, and
- C.2 make well-grounded design choices in the context of various tasks and data constraints.

Content

This course provides an introduction to the variety of analytical methods for relational data, i.e., graphs and networks. Such data types are applied for numerous tasks within computer science, software engineering, and other domains such as social sciences, bioinformatics, security, etc. This course addresses three perspectives: 1) computational network analysis, e.g., automatic identification of the most influential nodes; 2) graph drawing for automatic layout of nodes and edges; and 3) information visualization for interactive representation and exploration of networks and associated data.

The following topics are covered:

- Definitions and standard representations for graph and network data
- Graph measures and centralities
- Network analysis tasks and algorithms (link analysis, community detection)
- Overview of graph drawing approaches (physical analogy-based, layered, orthogonal drawings)
- Force-based layout methods for node-link diagrams
- Information visualization perspective on visual network analysis
- Alternative and novel visual representations for graphs and networks
- Domain applications of visual network analysis
- Open challenges in visual network analysis
- Overview of software tools and libraries for computational and visual network analysis

Type of Instruction

The instruction consists of lectures, seminars, and teacher-supervised laboratory sessions.

Examination

The examination of the course is divided as follows:

Code	Designation	Grade	Credits
2101	Programming project	AF	2,00
2102	Oral presentation	AF	1,00
2103	Oral exam	AF	2,00

The course is assessed with the grades A, B, C, D, E, Fx or F.

The grade A constitutes the highest grade on the scale and the remaining grades follow in descending order where the grade E is the lowest grade on the scale that will result in a pass. The grade F means that the student’s performance is assessed as fail (i.e. received the grade F).

Assessment of student performance is made through a programming project, an oral

presentation, and an oral exam. Repeat examination is offered in accordance with Local regulations for courses and examination at the first- and second-cycle level at Linnaeus University.

To pass the course, grade E or higher is required for all parts. The final grade is decided from: Programming project (40%) and Oral presentation (20%), and Oral exam (40%).

If the university has decided that a student is entitled to special pedagogical support due to a disability, the examiner has the right to give a customized exam or to have the student conduct the exam in an alternative way.

Objectives achievement

The examination elements are linked to the course objectives in the following ways:

Goal	2101	2102	2103
A.1		☑	☑
A.2			☑
A.3	☑		☑
B.1	☑		
B.2	☑		
C.1	☑	☑	☑
C.2	☑		☑

Course Evaluation

During the implementation of the course or in close conjunction with the course, a course evaluation is to be carried out. Results and analysis of the course evaluation are to be promptly presented as feedback to the students who have completed the course. Students who participate during the next course instance receive feedback at the start of the course. The course evaluation is to be carried out anonymously.

Other

Grade criteria for the A–F scale are communicated to the student through a special document. The student is to be informed about the grade criteria for the course by the start of the course at the latest.

The course is conducted in such a way that the course participants' experiences and knowledge are made visible and developed. This means, for example, that we have an inclusive approach and strive for no one to feel excluded. This can be expressed in different ways in a course, for example by using the gender neutral example.

Required Reading and Additional Study Material

Newman, Mark, Networks, Oxford University Press, latest edition. Pages: 200 of 800.

Kerren, Andreas, Purchase, Helen, and Ward, Matthew O., Multivariate Network Visualization. LNCS 8380, Springer, 2014, ISBN 978-3-319-06792-6. Pages: 100 of 237.

Kaufmann, Michael, and Wagner, Dorothea, Drawing Graphs. LNCS 2025, Springer, 2001, ISBN 978-3-540-42062-0. Pages: 100 of 318.