LINKÖPING UNIVERSITY: BIP in APPLIED TOPOLOGY

When: 2 September – 13 September (Campus Valla) | 14 September – 30 November (distance)
Where: Linköping University (LiU), Linköping, Sweden
Credits: 6 ECTS
Course code: ETEX01

ETEX01 is a blended intensive program of lectures and seminars organised by Linköping University at the beginning of September, open to LiU's students and visiting students with a Bachelor's degree in mathematics or equivalent.

Aside from lectures and seminars there will be a few evening activities – like our very own outdoor arrival festival – KALAS! Outside of these activities, Linköping has a lot to offer and has been voted "Best student city" in Sweden for 2024 and several times over the last decade, so be sure to soak in the city and region while you're here!

ETEX01 is free of charge to a selection of visiting students, however, travel, accommodation and other expenses costs will be borne by the participants.

The full list of nominated students need to be sent to Linköping University by 3 June 2024. After that we will send an easy application form to all nominated students to fill out and submit.

Please find some further information about studying at Linköping University through the link below.
Essential information - Linköping University (liu.se)

Linköping University
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Course Description

Topological Data Analysis has become an important tool in machine learning and artificial intelligence. The course will provide the needed concepts, methods and tools in homology (persistent homology and persistent diagrams) to have efficient methods to study data clouds and other objects in data analysis.

After the course the student should be acquainted with the basic concepts in topological complexes, homology and persistent homology, and its use in data analysis and other subjects. Specifically, they should be able to:

- approximate data clouds and other geometrical objects by topological complexes and filtrations and, calculate the persistent homology of these mathematical objects and the persistent diagrams.
- give reliable interpretations of the topological invariants in applications in technology and humanities.
- use software packages to calculate homology of complexes and persistent diagrams, and to carry out analysis data with these methods.

Contents

1. Homology: CW-complexes and simplicial complexes. Construction of complexes from data: Čech and Rips complexes. Filtrations and Discrete Morse Theory. Complex homology. Methods to calculate homology.
2. Persistent Homology: Definition of persistent homology, persistent diagrams. Calculations of persistent diagrams. Stability Theorem.
3. TDA and Other Applications: What is TDA, examples and applications. Applications to discrete optimization. Construction of complexes from data. Digital topology. Spaces of configurations.

Teaching and working methods

Lectures on site with hybrid teaching, as well as online meetings, laboratories in virtual classrooms. Digital study material. Hand-in assignments.

More information can be found at https://studieinfo.liu.se/en/kurs/ETEX01/ht-2024#syllabus