English course title
Kursnamn på engelska
Network Science

Swedish course title
Kursnamn på svenska
Network Science

Extent (credits)
Omfattning (högskolepoäng)
3 hp

Language of instruction
Undervisningsspråk
English

Recommended prerequisites
Rekommenderade förkunskaper
The course is targeted to PhD students willing to apply network science in their own discipline, but also experienced researchers with a consolidated research background in different areas. Being an interdisciplinary course intended for a broad audience, the topics will be presented in a self-contained way, giving to the students the chance to focus on topics of their interest during the last part of the course. However, the presentation will be at an advanced level (in terms of speed of presentation and content density). The recommended prerequisites are:
- R or basic programming
- Basic probability and statistics

General course objective/s and learning outcomes (Also specify which PhD examination goals that are addressed/covered. Describe how.)
Kursens syfte och mål (Beskriv vilka mål för examen på forskarnivå som beaktas och på vilket sätt.)
The course covers the basics of network science, including centrality measures, network properties, network models, propagation, and the main network mining tasks.
Learning outcomes:
Recall basic concepts in network science. Decide which measure should be used to analyse a specific aspect of a network. Understand the characteristics of the network models and their impact on the network analysis. Interpret the numerical values of the measures.
A. Knowledge and understanding:
the course introduces models, measures and tools that contribute to broaden knowledge, understanding and research methodology in general - but we hope that the students also can use them to approach their disciplinary work from a different perspective.
B. Competence and Skills / C. Judgement and approach
The students will have to present, review and discuss (argue) research in the area of network science in speech and writing and in dialogue with peers from different disciplines.
Course contents

Network Science is a very active and interdisciplinary field aimed at studying physical, social and biological systems that can be modeled as sets of interconnected entities. The course covers the basics of network science, including social network analysis centrality measures (degree, betweenness, ...), network properties (degree distribution, average path length, ...), network models (Erdős-Rényi, small-world, preferential attachment), propagation (SI/SIR/SIS models, ...), and the main network mining tasks (position/role detection, link prediction, community detection). All topics will be introduced in theory and practice, using the R system and different network analysis packages as hands-on exercises during the lectures.

Then, students choose and review a set of important papers from different areas, selected by the teachers based on their importance in the field, to learn about advanced applications and developments.

Instruction (course structure)

The tentative schedule for the course is the following:

**PART I: Networks: an introduction (lectures + practical activities)**

Day 1: Introduction to the course
Day 1: Network models and measures (part I + II)
Day 2: Network mining (part I + II)
Day 2: Invited disciplinary network science talk (TBD)
Day 3: Propagation
Day 3: Multiplex networks
Day 4: Reserve time - Invited disciplinary network science talk (TBD)

**PART II: Literature study**

Students will bid and be assigned to relevant research papers covering various advanced topics, from a list selected by the teachers. The students have to submit their reviews. The papers will be then discussed in groups.

Day 5: Program committee meeting (and course conclusion)

Assessment (form of examination)

Students must actively participate in all the course activities, alternatively submit a complementing exercise.

Course examiner (name, e-mail)
Examinator (namn, e-post)
Matteo Magnani, matteo.magnani@it.uu.se

Department with main responsibility
Huvudansvarig institution
Department of Information Technology

Contact person/s (course responsible teacher) (name, e-mail)
Kontaktperson/er (kursansvarig lärare) (namn, e-post)
Matteo Magnani, matteo.magnani@it.uu.se
Christian Rohner, christian.rohner@it.uu.se
Course dates/period
Kurs datum/period
April-June 2020

Maximum number of participants
Antal platser
25 participants

Submit the application for admission to
Skicka anmälan till kursen till
Matteo Magnani, matteo.magnani@it.uu.se

Submit the application not later than
Skicka anmälan senast
March 15, 2020