Module title				Abbreviation
Machine Learning for Networks 2				10-I=MLN2-232-m01
Module coordinator			**Module offered by**	
holder of the Chair of Computer Science XV			Institute of Computer Science	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**		
5	numerical grade	--		
Duration	**Module level**	**Other prerequisites**		
1 semester	graduate	--		

Contents

Graph representations of relational data have become an important foundation to address data science and machine learning tasks across the sciences. Graph mining and learning techniques help us to detect functional modules in biological networks and communities in social networks, to find missing links in social networks, or to address node-, link-, or graph-level classification tasks. But how can we apply frequentist and Bayesian statistical learning techniques to data on complex networks? And how we can use the topology of relationships to infer similarity scores between objects that can, e.g., be used for the design of recommender systems? How can we use matrix factorization techniques to generate low-dimensional vector-space representations of nodes that retain a maximum amount of information about the topology of links? And how can we apply the latest deep learning techniques to address node-, link-, or graph-level learning tasks in data with relation structures?

Addressing these questions, this course combines a series of lectures - which introduce theoretical concepts in statistical learning, representation learning, and graph neural networks -- with practice sessions that show how we can apply them in practical graph learning tasks. The course material consists of annotated slides for lectures and a series of accompanying jupyter notebooks.

Intended learning outcomes

The course will equip students with techniques to address supervised and unsupervised learning tasks in data on complex networks. Students will learn how statistical learning and data compression techniques can be used to infer cluster pattern and how topological similarity scores can be used to address unsupervised link prediction and graph reconstruction. Participants will further study both algebraic and deep learning based methods to learn low-dimensional vector-space representations of graph-structured data, and learn how graph neural networks help us to apply deep learning to node- and graph-level learning tasks in large complex networks. Students can apply and deepen their knowledge through weekly exercise sheets. The successful completion of the course requires to pass a final written exam.

Courses (type, number of weekly contact hours, language — if other than German)

V (2) + Ü (2)
Module taught in: English

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (approx. 60 to 120 minutes)
If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate).
Language of assessment: English
creditable for bonus

Allocation of places

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Additional information

Focuses available for students of the Master's programme Informatik (Computer Science, 120 ECTS credits): AT,IT,SE,KI,HCI,IN

Workload
150 h
Teaching cycle
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Referred to in LPO I (examination regulations for teaching-degree programmes)
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Module appears in
Master's degree (1 major) Computer Science (2023) Master's degree (1 major) Artificial Intelligence & Extended Reality (2024) Master's degree (1 major) Artificial Intelligence (2024) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Mathematics (2024)