MATH-448

Statistical analysis of network data

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Cursus	Sem.	Type
Ing.-math	MA2, MA4	Opt.
Mathématicien	MA2	Opt.

Language of teaching	English
Credits	5
Session	Summer
Semester	Spring
Exam	Written
Workload	150h
Weeks	14
Hours	**4 weekly**
Courses	2 weekly
Exercises	2 weekly
Number of positions	

Summary

A first course in statistical network analysis and applications.

Content

- Basic description of a network and its generalizations (e.g. hypergraphs).
- Network examples from a practical point of view.
- Simple network summaries such as the degree distribution.
- Sparse and dense networks. Edge versus node models.
- Statistical implications of probabilistic properties of large networks.
- Erdos Renyi networks, simple models (configuration and stochastic block models).
- Sampling properties of network summaries.
- Fitting simple network models.
- Exchangeability and probabilistic symmetries.
- Other topics as time permits.

Keywords

- network/graph
- Erdos-Renyi, configuaration and stochastic block models
- network summaries
- sparse networks
- exchangeability

Learning Prerequisites

Required courses

- Probability and Statistics

Recommended courses

• Probability and Statistics for mathematicians.

Important concepts to start the course

• The material from first courses in probability and statistics.

Learning Outcomes

By the end of the course, the student must be able to:

• Recognize when a network model is appropriate
• Compute simple network summaries
• Assess / Evaluate parameters of basic network models from data
• Assess / Evaluate a range of network models and understand their properties
• Assess / Evaluate the implications of model symmetries

Teaching methods

Ex cathedra lectures and exercises

Assessment methods

Written exam

Supervision

Office hours	No
Assistants	No
Forum	Yes

Resources

Virtual desktop infrastructure (VDI)

No

Bibliography

• R. Durrett: Random Graph Dynamics. Cambridge University Press 2007·
• E.D. Kolaczyk: Statistical Analysis of Network Data. Springer, 2009·
• Ibid Topics at the Frontier of Statistics and Network Analysis: (Re)Visiting The Foundations (SemStat Elements)·
• R. van der Hofstad. Random Graphs and Complex Networks Volume One, 2016 ·
• M. Newman: Networks: An Introduction, OUP 2010.

Notes/Handbook

A photocopy of the course notes will be available.