EPFL

COM-512

Networks out of control

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Cursus	Sem.	Type
Computer science	MA2, MA4	Opt.
Cybersecurity	MA2, MA4	Opt.
Data Science	MA2, MA4	Opt.
Data science minor	E	Opt.
Electrical Engineering		Opt.
SC master EPFL	MA2, MA4	Opt.
Systems Engineering minor	E	Opt.

Language of teaching	English
Credits	6
Session	Summer
Semester	Spring
Exam	Written
Workload	180h
Weeks	14
Hours	**3 weekly**
Lecture	2 weekly
Exercises	1 weekly
Number of positions	

Remark

Cours biennal

Summary

The goal of this class is to acquire mathematical tools and engineering insight about networks whose structure is random, as well as learning and control techniques applicable to such network data.

Content

- Random graph models: Erdös-Renyi, random regular, geometric, percolation, small worlds, stochastic block model
- Learning graphs from data: centrality metrics, embeddings, Hawkes processes, network alignment
- Control of processes on graphs: epidemics, navigation

Keywords

Random graphs, network data, machine learning, graph processes.

Learning Prerequisites

Required courses

Stochastic models in communication (COM-300), or equivalent.

Important concepts to start the course

Basic probability and stastistics; Markov chains; basic combinatorics.

Teaching methods

Ex cathedra lectures, exercises, mini-project

Expected student activities

Attending lectures, bi-weekly homeworks, mini-project incl. student presentation at the end of semester, final exam.

Assessment methods

1. Homeworks 10%
2. Mini-project 40%

3. Final exam 50%.

Supervision

Office hours	Yes
Assistants	Yes
Forum	No

Resources

Bibliography

• A. D. Barbour, L. Holst and S. Janson, Poisson Approximation, Oxford Science Publications, 1992.

• B. Bollobas, Random Graphs (2nd edition), Cambridge University Press, 2001.

• R. Durrett, Random Graph Dynamics, Cambridge University Press, 2006 (electronic version).

• D. Easley, J. Kleinberg. Networks, Crowds, and Markets: Reasoning About a Highly Connected World, Cambridge University Press, 2010 (electronic version).

• G. Grimmett, Percolation (2nd edition), Springer, 1999.

• S. Janson, T. Luczak, A. Rucinski, Random Graphs, Wiley, 2000.

• R. Meester and R. Roy, Continuum Percolation, Cambridge University Press, 1996.

Ressources en bibliothèque

• Random Graphs / Bollobas
• Random Graphs / Janson
• Continuum Percolation / Meester
• Random Graph Dynamics / Durrett
• Networks, Crowds and Markets / Easley
• Poisson Approximation / Barbour
• Percolation / Grimmett

Notes/Handbook

Class notes will be available on the course website.

Moodle Link

• https://go.epfl.ch/COM-512