1SC2710 – Viral propagation

Instructors: Véronique Le Chevalier, John Cagnol, Sarah Lemler
Department: DÉPARTEMENT MATHÉMATIQUES
Language of instruction: ANGLAIS, FRANCAIS
Campus: CAMPUS DE PARIS - SACLAY
Workload (HEE): 40
On-site hours (HPE): 22,50

Description

Who should we immunize, to prevent an epidemic? Who should we target in order to run an effective promotional campaign for our product? How do opinions or rumors form and spread in social media ?

Modeling propagation in various contexts (populations, computer networks, social networks) has made great progress over the past decades. The objective of this class is to familiarize students with the now classic techniques that will allow them to model, predict and optimize its effects in concrete situations.

Two types of models can be used: continuous (based on differential equations) and discrete (generally based on graphs). Students will be introduced to these models and invited to work on the modeling approach.

Quarter number
ST2

Prerequisites (in terms of CS courses)

- CIP
- PDE
- SIP
- Modeling
- Algorithms and Complexity

Students must be able to follow courses in French **and** English and to communicate and present in both languages.

Syllabus
Concepts of descriptive and analytical epidemiology (incidence, prevalence, types of epidemiological surveys and associated risk measures, odds ratios, etc.)

- Compartmental models and their analysis
- Propagation modeling on graphs and their properties
- Some notions on graph inference

Class components (lecture, labs, etc.)

1. Lectures and labs

Grading
Continuous assessment : 50%
Final exam : 50%

Course support, bibliography

Resources

- Theoretical lectures, exercises, programming

Learning outcomes covered on the course

- We expect that by the end of the course, the students will :
- Understand various data analysis tasks related to graphs and information spreading.
- Formulate and solve problems that involve propagation phenomena on homogeneous domains or on networks.

Description of the skills acquired at the end of the course
By the end of the course, we expect that students will have acquired skills on :

- Compartmental models (e.g., SIR, SIR).
- Graph theory and network analysis.
- Information and influence spreading on graphs.
- Implementation of graph algorithms for information propagation on networks in Python.