



1SC2791 – Epidemic: model, predict, communicate

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Department: DOMINANTE - MATHÉMATIQUES, DATA SCIENCES
Language of instruction: ANGLAIS, FRANCAIS
Campus: CAMPUS DE PARIS - SACLAY
Workload (HEE): 40
On-site hours (HPE): 27,00

Description

The importance of modeling in epidemiology is no longer in question: everyone has been able to feel the stakes and the consequences on daily life, whether in terms of model use for prediction, choice of interventions or communication.

This week course on modeling in epidemiology puts students in the role of a committee of modeling experts in an organization such as the WHO or the Pasteur Institute, faced with an epidemic situation to be analyzed and controlled.

The objective is to have students put into practice the modeling approach in life sciences and the mathematical methods associated with it, particularly in terms of analysis and evaluation of models.

Quarter number

ST2

Prerequisites (in terms of CS courses)

None except courses from the ST2 viral propagation

Syllabus

During this course, the students will dwelve into the domain of epidemiology, by working as a team of modelling experts in the context of an international health service such as the WHO or Pasteur Institute.

During the first part of the week, they will learn about epidemic models and constitute their expertise for a given set of infectious diseases, mainly by the means of bibliographic research and conference by an epidemiologist. They will also implement different mathematical methods for model development, parametric estimation and evaluation. The second part of the week consists in a "WHO challenge » : the teams compete to deal with the situation of an epidemic crisis about wich they periodically receive some datasets. Adapting their models prealably developed to the given situation, they have to make prediction of the future trends of the



epidemy, to simulate possible public interventions in order make recommendations to the government, and to communicate using different types of media (press release, scientific report, etc). Epidemiology is an interesting playground for this kind of course since experimentation is impossible at the population scale, thus emphasising the importance of mathematical modelling.

Class components (lecture, labs, etc.)

Work in teams of 4, each team building an expert on a given disease and then sharing during the challenge. Warm-up exercise on data from an epidemic in class. Flash" course on small reminders of modeling tools. Interventions by various experts (crisis communication, epidemiologist, etc.).

Grading

- press release - dossier for public health decision-makers - report for scientists - Oral presentation - challenge score (prediction and effectiveness of recommended interventions) - quizz (bonus)

Course support, bibliography

A nice introductive paper: "Covid-19 : ces modélisateurs qui anticipent la pandémie - By David Larousserie. "Le Monde", Published January 5th 2021, 04h04".

Resources

Teacher : Véronique Letort - Le Chevalier and Sarah Lemler + others

Learning outcomes covered on the course

Understand epidemiology basics

Understand dynamic epidemic propagation models based on ordinary differential equations (SIR, SIS, etc.) or multi-agent models. Critical thinking regarding the model best adapted to a given situation, and above all, implementation of the iterative approach of building a model based on information, often fragmentary, on a real system and its evolution. Implementation of the methodological chain for model analysis, parameter estimation and selection.

Application of models for prediction and decision support (recommendation of interventions).

Understand basics of communication for different audiences (general public, public health decision-makers, scientific community)

Description of the skills acquired at the end of the course

C1.1 Analyze: study a system as a whole, the situation as a whole. Identify, formulate and analyze a system within the framework of a transdisciplinary



approach with its scientific, economic, human dimensions, etc.

C1.2 Model : use and develop appropriate models, choose the right scale of modeling and relevant simplifying assumptions

C7.4 On communication techniques : master spoken, written and body language, and master basic communication techniques

And C4, C8.