## A short course on empirical processes

## Outline

In this short course (6h), we will focus a particular problem: obtaining the best possible probability bounds for the supremum of an empirical process indexed by functions (or sets).

This problem arises in many differents situations: asymptotic theory for nonparametric statistics, but also nonasymptotic theory such as model selection or density estimation by minimizing the total variation distance.

Recent results in concentration of measure in product spaces reduce our problem to obtaining sharp bounds for the *expectation* of the supremum of an emprical process indexed by functions. In the second session, we will expose the main techniques that are used to control this first moment.

- 1. Symetrization
- 2. Chaining
- 3. Uniform entropy numbers

The last session will be devoted to classes of functions (or sets) that have the Vapnik-Chervonenkis property: definition, properties and examples. These classes of functions are encountered in many situations, and we know explicit upper bounds for their uinform entropy numbers. This leads to explicit upper bounds for the suprema of empirical processes.