PROCESSUS DE MARKOV ET PROCESSUS GAUSSIENS POUR LA MODÉLISATION DE

MARKOV AND GAUSSIAN PROCESSES FOR MODELING TEMPORAL AND SPATIAL

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| Lecturers : 18 | TC : 2 | PW : 0.0 | Autonomy : 0.0 | Study : 10 | Project : 0.0 | Language : FR

Objectives

This course is oriented towards the modeling of random phenomena depending on time or space. The first part will be devoted to Markovian processes, processes involved in the modeling of temporal phenomena. Both theoretical modeling tools and numerical aspects will be presented. Their use will be seen through models from ecology, the environment or finance. The second part will be mainly devoted to regression by Gaussian processes. This tool also known as kriging and historically introduced for the
modeling and forecasting of spatial quantities, is now widely used to model complex numerical experiments. We will also present the techniques of uncertainty quantification and Bayesian optimization.

Keywords : Markov process, Kolmogorov equation, Feymann-Kac formula, kriging, regression by Gaussian processes, Bayesian optimization, sensitivity analysis, computer experiments.

Programme

1/ Continuous Time Markov Chain
2/ MArkov processes in continuous time
3/ Kriging model for spatial data
4/ Kriging in the context of approximation of expensive codes: Bayesian optimization and uncertainty quantification.

Learning outcomes

- Modeling and simulation of Markovian processes. Know how to make the link between stochastic processes and partial differential equations.
- Implementation of a kriging forecast from spatial data
- Implementation of a global optimization approach based on a regression model using Gaussian processes.

Independent study

Objectifs : This activity is not concerned with framed autonomy activities outside personal work.

Méhodes : This activity is not concerned with framed autonomy activities outside personal work.

Core texts

TJ Santner, BJ Williams, WI Notz, BJ Williams, *THE DESIGN AND ANALYSIS OF COMPUTER EXPERIMENTS*, Springer, 2003
Noel A. C. Cressie *STATISTICS FOR SPATIAL DATA, REVISED EDITION*, John Wiley & Sons, Inc., 1993
Thomas M. Liggett*CONTINUOUS TIME MARKOV PROCESSES : AN INTRODUCTION*, Providence R.I. : American Mathematical Society, 2010

Assessment

Final mark =60% Knowledge + 40% Know-how
Knowledge= 100% final exam
Know-how= 100% continuous assessment