

Department of Systems Engineering and Engineering Management

Seminar Series

Multi-state models and some applications in Seismology and Epidemiology

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Date	8 December 2016 (Thursday)
Time	10:30am - 11:30am
Venue	B5-309, 5/F, AC1

Abstract

Nowadays, multi-state models have become increasingly important in probability and statistical modeling. Applications concern reliability and maintenance, risk processes, earthquake modeling, survival analysis etc. Here we focus on two classes of multi-state models: the semi-Markov and the state space models. Semi-Markov models are state-of-the-art models that enable a flexible description of complex systems. We focus on semi-Markov models in finite state-space and discrete time to describe the earthquake generation process. We introduce statistical estimators of occurrence rates which are based on counting processes. These estimators are proven to have appealing asymptotic properties including consistency and asymptotic normality. We further provide numerical examples based on simulated and real data. It is shown that these results can lead to a better understanding of the earthquake generation and therefore contribute to the seismic hazard assessment in the region of interest.

We further present a sequential filtering methodology to estimate instantaneous reproduction numbers with special emphasis on epidemics with imported cases. A new formalization of the estimation of time-varying instantaneous reproduction numbers is presented and its potential benefits are discussed. The infection process is modelled as a stochastic process that incorporates observed and latent information. It is shown that the proposed

approach is able to capture the variability in instantaneous reproduction numbers due to imported cases which is the case for epidemics like dengue fever. The method is further validated by numerical simulations and estimates are obtained for would-be emerging epidemics of these viruses.

About the Speaker

Irene Votsi is an Assistant Professor in the Laboratory of Mathematics in Le Mans (LMM, France). Her primary interests include the modeling of real world phenomena subjected to risks by means of stochastic processes. Irene is an investigator on a study to understand the dynamics of earthquake occurrences, the wind production as well as the spread of infectious diseases. She joined the LMM team in 2016 and completed a PhD in statistics in 2013. During 2013-2015 she worked as a researcher in Ecole CentraleSupélec and in Institut Pasteur (Paris).

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All are Welcome!