

76^e Journée de séminaires actuariels

Tuesday, January 30, 2024

Amphi G1, ISFA

- ≡ 9 h 30 WELCOMING OF THE PARTICIPANTS (3103)
- ≡ 10 h 00 Phd talk #1: **Eman Elmeaddawy** (UNIL)
Spatio-temporal Association among Causes of Mortality in Europe
- ≡ 10 h 20 Q&A's by ISFA PhD students
- ≡ 10 h 30 **Christophe Dutang** (ENSIMAG, Grenoble)
One-step closed-form estimator for generalized linear model with categorical explanatory variables
- ≡ 11 h 15 Discussion by Rayane Vigneron (ISFA)
- ≡ 11 h 30 Networking Session
- ≡ 12 h 00 LUNCH BREAK (3103)
- ≡ 13 h 30 **Matthieu Simon** (Université de Mons)
Stochastic epidemic models and insurance
- ≡ 14 h 15 Discussion by José Miguel Flores Contro (UNIL)
- ≡ 14 h 30 Phd talk #2: **Etienne Raynal** (ISFA)
Risk-averse Reinforcement Learning in long-term asset allocation with Hidden Markov Models
- ≡ 14 h 50 Q&A's by UNIL PhD students
- ≡ 15 h 00 Phd talk #3: **Alaric Mueller** (UNIL)
Flood occurrence in the European Alps: A study over 1000 years based on sediment data
- ≡ 15 h 20 Q&A's by ISFA PhD students
- ≡ 15 h 30 Phd talk #4: **Amal Ben Hamida** (ISFA)
Does departure from Benford's law improve intraday stock returns prediction?
- ≡ 15 h 50 Q&A's by UNIL PhD students
- ≡ 16 h 00 CLOSING AND APERO (3103)

ABSTRACTS

Christophe Dutang: *One-step closed-form estimator for generalized linear model with categorical explanatory variables*

Abstract: The parameters of generalized linear models are generally estimated by the maximum likelihood estimator (MLE), computed using a Newton-Raphson type algorithm that can be time-consuming for a large number of variables or modalities, or a large sample size. Explicit estimators exist for these models but they are not always asymptotically efficient, especially for simple effects models, although they are fast to calculate compared to the MLE. The article proposes a fast and asymptotically efficient estimation of the parameters of generalized linear models with categorical explanatory variables. It is based on a one-step procedure where a single step of the gradient descent is performed on the log-likelihood function initialized from the explicit estimators. This work presents the theoretical results obtained, the simulations carried out and an application to car insurance pricing.

Matthieu Simon: *Stochastic epidemic models and insurance*

Abstract: SIS (Susceptible-Infected-Susceptible) models describe the spread of an infectious disease in a closed population which is partitioned into two groups: the class of susceptibles contains the individuals free of the disease and the class of infectives contains those who carry the infectious agent. The dynamics is as follows: when a susceptible gets infected, he becomes contagious for a random duration and can transmit the disease to the susceptibles. Then he recovers and becomes exposed to the disease (i.e., susceptible) again. The epidemic terminates as soon as there are no more infected individuals in the population.

In this talk, we consider an insurance company that provides a coverage against the risk of disease to a population subject to an epidemic represented by a stochastic SIS model. We assume that the company collects premiums from the susceptibles at a continuous rate, while the care costs are reimbursed to the infected individuals via an annuity or via a lump-sum benefit. We first determine the joint distribution of several variables that influence the cost of such insurance coverage: the duration of the epidemic, the total number of contaminations and the total cost of the epidemic from the insurer's point of view. Next, we analyse the reserve process of the insurance company. We mainly focus on the risk that ruin occurs before the epidemic is over: we use matrix-analytic methods to determine the joint distribution of the time of ruin, the total number of contaminations and the population state at the time of ruin.

Finally, we consider a variant of the model where we follow the risk process over a large time scale, so that normal periods (without disease) and epidemic episodes alternate. This leads to introducing a regenerative extension of the model, using a Brownian reserve process.

Phd talks

Eman Elmeaddawy: *Spatio-temporal Association among Causes of Mortality in Europe*

Abstract: In this study, we investigate space-time association among causes of mortality in Europe. In the first part of this research, we study mortality differences by causes of death between Eastern and Western Europe using exploratory spatial data analysis. The most common causes of mortality namely, Circulatory Diseases, Cancers, Respiratory Diseases, External Causes, and Mental Disorders & Nervous System Diseases are being studied for 30

European countries in the period from 1995-2015 for the age groups (40-65) and (65+) for both males and females. In this presentation, we share the preliminary results of the spatial association features that the underlying Standardized Mortality Ratios exhibit.

Etienne Raynal: *Risk-averse Reinforcement Learning in long-term asset allocation with Hidden Markov Models*

Abstract: We aim to address the challenge of identifying an ideal long-term arbitrage strategy that can adapt to an individual's market perspective. In this research, we expand upon the existing body of knowledge regarding optimal asset allocation by employing a reinforcement learning algorithm rooted in a Markov Decision Process. The state space of this process is defined by estimating a Hidden Markov Chain, which serves to characterize the market dynamics. Our agent acquires knowledge about the market at each time step through this characterization, employing the MAP algorithm to determine an optimal strategy. Additionally, we investigate the impact of the MAP algorithm on asset allocation in relation to hidden state estimation. We train and test the agent on both synthetic and real-world datasets.

Alaric Mueller: *Flood occurrence in the European Alps: A study over 1000 years based on sediment data*

Abstract: Floods are responsible for a large part of insurance losses due to natural hazards and the modelling of corresponding losses suffers from intricate spatial dependence patterns. In addition, they typically exhibit non-stationary behaviour over time, which can be at least partly attributed to climate change. In this paper, we study this non-stationary component by investigating the spatial and temporal dependence structure of flood occurrences under minimal assumptions. Using detailed flood occurrence records from 27 lakes in the European Alpine region over the last 1000 years, we adapt and employ functional data analysis techniques to study the empirical dependence structure of flood risk over time and space. We then use the results to extrapolate an implied spatial and temporal flood occurrence model in that region.

Amal Ben Hamida: *Does departure from Benford's law improve intraday stock returns prediction?*

Abstract: Benford's law is commonly used as a tool for identifying potential frauds, data irregularities, and anomalies in several fields. This conceptual paper investigates how to conduct digital analysis using Benford's law and suggests potential benefits from its use in forecasting intraday stock returns. The analysis examines the first digits of intraday stock returns, trading volumes, and durations of five companies listed on the Euronext Paris stock market, all of which possess a sufficiently substantial dataset. Departures from Benford's distribution are quantified using chi-square test statistics. Initial findings reveal a significant noncompliance of the examined dataset with Benford's Law, indicating potential data manipulation. Subsequently, we explore the impact of these deviations on stock returns by predicting intraday stock returns using the linear model and smooth-transition autoregressive model, which accounts for regime-switching behavior alongside time varying parameters. Our results are in alignment with the idea that due to intraday data manipulation, Benford's variables exert a more pronounced influence on stock returns in a bear market regime than in a typical regime. Furthermore, our research yields robust statistical evidence supporting the good performances of smooth transition autoregressive models.