Conference ECODEP
September 30-October 1, 2024

Program

Monday September 30, Morning

9 :00-9 :30	Welcome café
9 :30-10 :00	Patrice Bertail (Nanterre, Paris)
10 :30-11 :00	Aldo Medina Garay (Permambuco Univ., Recife)
11 :00-11 :30	Francyelle de Lima Medina (Permambuco Univ., Recife)
11 :30-12 :00	Thomas Deschatre (EDF, Saclay)
12 :00-12 :30	Didier Girard (CNRS, Laboratoire LJK, Grenoble)

Monday September 30, Afternoon

14 :30-15 :00	Natalia Bahamonde (PUCV, Valparaiso)
15 :00-15 :30	Pierre Patie (Cornell University, Ithaca)
15 :30-16 :00	Christian Francq (ENSAE, Saclay)
16 :00-16 :30	Jean-Michel Zakoian (ENSAE, Saclay)
16 :30-17 :00	Pause
17 :00-17 :30	Laurence Reboul (AMU, Marseille)
17 :30-18 :00	Guillaume Franchi (ENSAI, Rennes)

Tuesday October 1, Morning

09 :30-10 :00	Welcome café
10 :00-10 :30	Hansjoerg Albrecher (HEC, Lausanne)
11 :00-11 :30	Felix Cheysson (Univ-Eiffel, Champs-sur-Marne)
11 :30-12 :00	Denys Pommeret (AMU, Marseille)
12 :00 -12 :30	Thi Hien Nguyen (CYU, Cergy)

Pauses, lunches and café will be offered in the meeting room, floor 2

For the conference dinner please contact doukhan(at)cyu.fr

Titles and Abstracts

Hansjoerg Albrecher (HEC, Lausanne)

Optimal dividend strategies for a catastrophe insurer

We study the problem of optimally paying out dividends from an insurance portfolio, when the criterion is to maximize the expected discounted dividends over the lifetime of the company and the portfolio contains claims due to natural catastrophes, modelled by a shot-noise Cox claim number process. We solve the resulting two-dimensional stochastic control problem, and uniformly approximate the optimal value function through a discretization of the space of the free surplus of the portfolio and the current claim intensity level. It is shown that the nature of the barrier and band strategies known from the classical models with constant Poisson claim intensity carry over in a certain way to this more general situation, leading to action and non-action regions for the dividend payments as a function of the current surplus and intensity level. We also discuss some interpretations in terms of upward potential for shareholders when including a catastrophe sector in the portfolio.
This is joint work with Pablo Azcue and Nora Muler.

Natalia Bahamonde (PUCV, Valparaiso)

Missing, random and irregular data in time series: an overview.

There is a distinction between missing data and unevenly spaced data in the context of time series. The absence of observations at specific time points is referred to as missing data, whereas irregularly spaced data refers to observations that are not equally or consistently distributed in time. When there are gaps or intervals in the time series when no observations are available, this is referred to as missing data. These gaps can occur for a variety of reasons, including data collection issues, technical concerns, or just a lack of data for a specific time period. Missing data can induce bias and compromise the accuracy of analysis and forecasting models. Dealing with missing data is therefore critical in time series analysis to achieve valid results.
The aim of the talk is to draw attention to various possibilities for new research topics in the context of missing data in time series. Different ways in which missing data arise and an overview of the ways in which these have been considered mainly for parameter estimation will be given. Different real data scenarios in which missing data occur under different structures and modes of dependence will also be presented.

Patrice Bertail (Nanterre, Paris)

Dynamic modelling of food nutrients/contaminant exposure: an overview

The purpose of this talk is to review some recent approaches for assessing contamination/nutrition risks in food essentially from a dynamical perspective. We will present first the classical static approach (used for instance in constructing the nutriscore). The basic dynamic model called KEDM (Kinetic Exposure Dynamic model) is closely related to a reversed Spaare-Andersen model (used in insurance) with a natural barrier at 0 and PDMP models, with exponential elimination of contaminants. The purpose is to try to evaluate the probability to be simultaneously over a safe (low) threshold for basic nutrients and below a high threshold for contaminants or "bad" nutrients (like sugar, salt, fat) in the long term. We will show how taking into account the assimilation process can induce fat tail behaviour in the accumulation process in the body. Several single or multiple compartment models have also been proposed recently to model the long-term behavior of contaminants in the body that we will present shortly.

Felix Cheysson (Univ-Eiffel, Champs-sur-Marne)
Hawkes processes in random environment

Hawkes processes are a family of point processes for which the occurrence of any event increases the probability of further events occurring. Thanks to the cluster process representation of Hawkes & Oakes (1974), they can be seen as a time-continuous version of the well-known Galton-Watson process.
A common extension of the GW process is the branching process with random environment, for which the law of reproduction is allowed to change between generations (Smith 1968). In this talk, we extend the Hawkes process by including a random environment governing the rate of reproduction of the process, and establish the assumptions needed to ensure the existence of such a process. We then propose and study simulation procedures for this process.

Victor de la Pena (Columbia, New-York)
Complete Decoupling

In this talk we discuss an approach to decoupling that is a natural generalization of the decoupling produced by linearity of expectations. Applications of the theory will be discussed.

Thomas Deschatre (EDF, Saclay)
Disentangling endogenous and exogenous correlations of low frequency data using high frequency information

Given empirical data of two times series, we address the problem of extracting the part of endogenous and exogenous dynamics that altogether form the empirical correlation of the time series. In this formulation, our question is ill-posed and our purpose hopeless without an additional structure. We assume 1) the simplest model, namely discretely observed correlated Brownian motions, that may serve as a representative model for low frequency prices of correlated financial assets, up to an absolutely continuous change of measure. 2) Moreover, we have access to some additional microscopic information, namely the fluctuation of the prices at high frequencies, via marked point processes models that diffuse to the original time series at a macroscopic scale. We introduce the effect of endogeneous and exogenous agents via multidimensional delayed Hawkes processes (we will explain what we mean by delayed) with latent components, simple exponential kernels and shot noises. We show that this approach can incorporate endogenous and exogeneous effects despite the relatively constrained structure of point processes models. The difficulty comes from the fact that we observe the fluctuations of prices but not the nature of the agents that cause them. Moreover, we face microstructure noise at these scales. First and second order characteristics are not sufficient to recover the parameters of the model, but adding third order characteristics does the job, at least mathematically. This enables us to overcome the latent structure of our model and quantify the part of endogenous versus exogenous effects that have an explicit trace on the macroscopic correlation (our initial low frequency observable).
A joint ongoing work with E. Bacry, M. Hoffmann, J.F. Muzy and R. Ruan

Guillaume Franchi (ENSAI, Rennes)
Modeling abundance time series through a HMM framework

Abundance time series that are collected on the ground are often derived from counts and observations over time. However, the exact relative abundance remains unknown, which leads us to model it through a HMM framework. We will thus suppose that the observed process of counts follow a multinomial distribution, whose probabilities are given by the hidden relative abundance process. The unobserved process of relative abundance will, for its part, follow an autoregressive Dirichlet model, with a strong GLM flavor.
The estimation of the model's parameters is quite challenging, and though the use of the EM algorithm is quite classical, the computation of the conditional expectation requires the use of sequential

importance sampling. An application to a population of insects in a sugar-cane field is provided as an illustration.
Joint work with Lionel Truquet

Christian Francq (ENSAE Saclay)
Asymptotics for penalized QMLEs of time series regressions

We examine a linear regression model applied to the components of a time series, aiming to identify time-varying, constant as well as zero conditional beta coefficients. To address the non-identifiability of parameters when a conditional beta is constant, we employ a lasso-type estimator. This penalized estimator simplifies the model by shrinking the estimates when the beta is constant. Given that the model accommodates conditional heteroskedasticity and the relevant regressors are unknown, the total number of parameters to estimate can be quite large. To manage this complexity, we propose a multistep estimator that first captures the dynamics of the regressors before estimating the dynamics of the betas. This strategy breaks down a high-dimensional optimization problem into several lower-dimensional ones. Since we avoid making strict parametric assumptions about the innovation distributions, we use Quasi-Maximum Likelihood (QML) estimators. The non-Markovian nature of the global model means that standard convex optimization results cannot be applied. Nevertheless, we analyze the asymptotic distribution of the multistep lasso estimator and its adaptive version, deriving bounds on the maximum value of the penalty term. We also propose a nonlinear coordinate-wise descent algorithm, which is demonstrated to find stationary points of the objective function. The finite-sample properties of these estimators are further explored through a Monte Carlo simulation and illustrated with an application to financial data.
Joint work with Sébastien Laurent (Marseille), Julie Schnaitmann (Tübingen)

Didier Girard (CNRS, Laboratoire LJK, Grenoble)
Matérn type Gaussian processes

Matérn autocovariances have become popular over the last twenty years. In this talk, one mainly studies the case of stationary isotropic zero-mean Gaussian fields which are often used in geostatistics. The simpler “quasi-Matérn” variant (for 1D, 2D or 3D gridded data) is also considered. The probability law of such a field is determined by 3 parameters: the variance denoted b, the roughness index ν and the range-parameter θ.
Some monotonicity and unimodality properties w.r.t. θ concerning the (ratio of) spectral densities of such processes, when observed on a regular grid, will be established or conjectured. These properties give an insight on the influence of θ on the prediction (for an unobserved site) capability of such processes; the assumption that the data sites are equispaced can be alleviated at least in the exponential case $\nu = 1/2$.
They also permit to establish theoretical efficiency properties of the “energy-variance matching” method, which has been recently proposed as an alternative to the maximum-likelihood method for the estimation of b and θ.

Claude Lefevre (ULB, Bruxels)
Abel-Gontcharoff pseudopolynomials and applications to some first crossing problems.

We start with the A-G polynomials and highlight their use to determine the first crossing level distribution of some classical point processes with a lower boundary. To address more general point processes, we introduce an extension of these A-G polynomials, called A-G pseudopolynomials

(functions). Their theory is first presented and then some applications are discussed, notably in epidemic modeling.
This is a joint work with Philippe Picard, Université de Lyon.

Francyelle de Lima Medina (University Permambuco, Recife)
Bayesian analysis of linear regression models with autoregressive symmetrical errors and incomplete data

In this research, we propose Bayesian analysis of linear regression models with autoregressive symmetrical errors. The model considers the symmetric class of scale mixture of normal distributions which include the normal, slash, contaminated normal and Student-t distributions as special cases. A Markov chain Monte Carlo (MCMC) algorithm is tailored to obtain Bayesian posterior distributions of the unknown quantities of interest. The likelihood function is utilized to compute some Bayesian model selection measures. We evaluate the proposed model under different settings of censored and/or missing levels using simulated data. Finally, we illustrate the usage of our proposal through the analysis of a real dataset.

Aldo Medina Garay (University Permambuco, Recife)
A maximum likelihood and regenerative bootstrap approach for estimation and forecasting of INAR(p)-processes with zero-inflated innovations

In this work, we study a class of p-order non-negative integer-valued autoregressive (INAR(p)) processes, with innovations following zero inflated (ZI) distributions called ZI-INAR(p) processes. Based on the EM algorithm, we present an estimation procedure of parameters model. We also develop a regenerative bootstrap method to construct confidence intervals for the parameters as well as to estimate the forecasting distributions for future values. The performance of the proposed methods is evaluated considering the analysis of two simulation studies and a real dataset.

Thi Hien Nguyen (CY University, Cergy)
Construction, consistency, asymptotic normality of viscosity estimation for 2D Navier-Stokes

We examine the motion of incompressible viscous fluid in a rectangle, imposing the periodicity condition in one direction and the no-slip boundary condition in the other. Assuming that the flow is subject to an external random force, white in time and regular in space, we construct an estimator ν_t for the viscosity ν using only observations of the L^2 norm of the vorticity on the time interval [0,t]. We prove that the estimator~ν_t is strongly consistent and asymptotically normal. The proof of consistency is based on the explicit formula for the estimator and some bounds for trajectories, while that of asymptotic normality uses in addition mixing properties of the Navier--Stokes flow.
Joint work with Armen Shirikyan

Pierre Patie (Cornell University, Ithaca)
On some intriguing properties of the absorption time of a class of self-similar processes

We start by introducing a class of non-Markovian self-similar stochastic processes with two-sided jumps as a stochastic time-change of Markovian self-similar processes. We proceed by providing an explicit characterization and analytical properties, including the persistence phenomena, of the distribution of

the absorption time T (time of ruin). For a suitably chosen time-changed, we observe, for classes with two-sided jumps, the following surprising facts:
1) All the T's within a class have the same law which we identify in a simple form for all classes and reduces, in the spectrally positive case, to the Fréchet distribution.
2) Each of these distributions corresponds to the law of an absorption time of a single Markov process without positive jumps, leaving the interpretation that the time-change has annihilated the effect of positive jumps.
This is based on joint works with R. Loeffen and M. Savov, and with A. Srapionyan

Denys Pommeret (AMU, Marseille)

Estimating the Probability of Missing Data

In actuarial science, and in other fields, collected data often contain missing values. The mechanism behind missing data may be related to the missing value itself and/or other observed variables. This is referred to as Missing At Random (MAR) and/or Missing Not At Random (MNAR). However, there are cases where information about the incomplete variable is available. For example, we may know the age distribution in my population, but my dataset has missing age values. Alternatively, we may have observed a complete dataset and are now dealing with a dataset that contains missing values. In such cases (when the missing variable has been observed elsewhere), we propose an estimator for its probability of being MAR or MNAR.

Laurence Reboul (AMU, Marseille)

Set estimation under dependence

In this paper, we extend estimation results on the R-convex hull of the points of a random sample from independence to some dependent cases. Explicit convergence rates are obtained in that case; we deal with R-convex hulls and its natural plug-in to estimate the supports or level-sets together with their volume and perimeter of the marginal density f on R^d, of a strictly stationary process. For this we assume some weak dependence conditions and different distributional assumption depending on the estimation purpose (support or level sets estimation).The loss with regard to the classical independent case depends on the current dependence structure .
Joint work with Catherine Aaron and Paul Doukhan

Jean-Michel Zakoian (ENSAE, Saclay)

Testing for breaks in the conditional mean based on the estimating function approach.

The estimating function approach [Godambe (1960) and Durbin (1960)] is particularly attractive for time series models where the dynamics is not fully specified, but the conditional mean is assumed to be a given parametric function of past observations. In many financial applications, however, the conditional mean may undergo a structural change. We propose a class of cumulative sum, CUSUM, statistics to detect breaks in the conditional mean under weak assumptions. This procedure depends on the choice of a sequence of weights, leading to a potentially infinite number of consistent tests, and we show that the best test is related to Godambe's optimal estimator, also discussing data-driven procedures for this optimal choice of weights. We study inference in the presence of a changepoint, and we also study the case where the conditional mean is misspecified. Our results are illustrated using Monte Carlo experiments and real financial data.
Joint work with Christian Francq (ENSAE), Lorenzo Trapani (Nottingham)