Young Researchers' Day

20 September, 2013

9^{00}	**Majda Talamakrouni**	Parametrically guided nonparametric density and hazard functions estimation with censored data
9^{30}	**Daniel Koch**	An extension of the locally stationary wavelet processes
10^{00}	**Anna Kiriliouk**	An M-estimator for tail dependence in spatial extremes

Coffee Break

11^{00}	**Jennifer Alonso Garcia**	Risk and Solvency of a Notional Defined Contribution public pension scheme
11^{30}	**Rudolf Schenk**	Adaptive Bayesian estimation in Gaussian sequence space models
12^{00}	**Michał Warchoł**	Statistics for spectral tail processes of heavy–tailed Markov chains

The seminar is followed by a sandwich lunch in the cafeteria

The Young Researchers' Day is held in room c.115 of the Institut de statistique, biostatistique et sciences actuarielles, Voie du Roman Pays 20, Louvain-la-Neuve.

Parametrically guided nonparametric density and hazard functions estimation with censored data

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The method of parametrically guided nonparametric estimation is an appealing method that can reduce the bias of kernel density and hazard function estimators without increasing the variance. In this paper we generalize this method to the censored data case. The asymptotic properties of the proposed estimators are established and their performance is evaluated via finite sample simulations.

References

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An extension of the locally stationary wavelet processes

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Nonstationary time series analysis has developed dramatically over the last decades to have a profound effect on econometric analysis in general. A class of nonstationary time series with particular interest in economics and finance are processes with time-varying second-order structure. Locally stationary wavelet (LSW) processes provide a representation of nonstationary time series with smoothly changing autocovariance functions based on discrete non-decimated wavelets and an orthogonal Gaussian increment process.

In this talk we present a new LSW model framework which allows for correlated increments. We propose several versions of the extended LSW model based on different correlation structures of the increment processes. We show that the presence of correlated increments expands the family of autocorrelation wavelets leading to a wider range of the local autocovariance function and hence enlarges the class of stochastic processes that can be represented by the LSW model. We show that the extended family of autocorrelation wavelets remains linearly independent and that the autocovariance representations of the new LSW models are unique.

A consistent estimator of the evolutionary wavelet spectrum of the extened model framework is presented. We close the talk with an application based on time series data of the IBM absolute stock returns.

References

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An M-estimator for tail dependence in spatial extremes

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Suppose we have n independent random vectors in $\mathbb{R}^d$, $X_i = (X_{i1}, \ldots, X_{id})$ for $i = 1, \ldots, n$, with continuous distribution function F and with marginal distribution functions $F_1, \ldots, F_d$. We say that F is in the *max-domain of attraction* of the extreme-value distribution G if there exist $a_{nj} > 0$, $b_{nj} \in \mathbb{R}$ for $j = 1, \ldots, d$, such that

$$\lim_{n \to \infty} F^n(a_{n1}x_1 + b_{n1}, \ldots, a_{nd}x_d + b_{nd}) = G(x),$$

for all $x \in \mathbb{R}^d$. For certain normalizing constants we have $G(x) = \exp\{-\ell(1/x_1, \ldots, 1/x_d)\}$, where $\ell : [0, \infty)^d \to [0, \infty)$ is called the *stable tail dependence function*; it can be expressed as

$$\ell(x_1, \ldots, x_d) = \lim_{t \downarrow 0} \frac{\mathbb{P}[1 - F_1(X_{11}) \leq x_1 t \text{ or } \ldots \text{ or } 1 - F_d(X_{1d}) \leq x_d t]}{t}.$$

We are interested in estimating the parameters of the function ℓ. Assume that ℓ belongs to some parametric family $\{\ell(\cdot; \theta) \mid \theta \in \Theta\}$, with $\Theta \subset \mathbb{R}^p$. We use a semiparametric model, based on minimizing the distance between ℓ and its nonparametric counterpart. Most methods for estimation of θ are likelihood-based, and thus are not valid for non-differentiable models. [1] propose an estimator, not relying on differentiability of ℓ, which is valid in arbitrary dimensions d. However, since this estimator involves d-dimensional numerical integration, it becomes computationally infeasible as d grows. Hence we propose a modified estimator, based on the sum of at most $d(d-1)/2$ two-dimensional integrals. This modification will enable us for example to estimate spatial models in $\mathbb{R}^2$, where we want to allow for large d as it represents the number of locations.

References

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Risk and Solvency of a Notional Defined Contribution public pension scheme

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The non-financial defined contribution or notional model combines pay-as-you-go financing with a pension formula that depends on the amount contributed and the return on it. The aim of this paper is twofold: to show to what extent the liquidity and solvency indicators are affected by fluctuations in the economic, financial and demographic conditions; and to explore the issue of introducing an optimal automatic balancing mechanism into the notional model to re-establish the financial equilibrium. With this in mind, we present a 4 overlapping generations model with dynamic evolution of the main parameters affecting the pension equilibrium.

Keywords: actuarial analysis, liquidity risk, public pensions, retirement, solvency

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Adaptive Bayesian estimation in Gaussian sequence space models

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We consider the inverse regression problem $Y = Af + \sqrt{\varepsilon}\xi$, where A is a known linear operator between two Hilbert spaces, ξ a Gaussian white noise, and ε a noise level. The objective of this talk is to establish adaptive nonparametric posterior concentration rates of convergence for the regression function f. In a first step, we derive lower and upper bounds for the posterior concentration rates over a family of Gaussian prior distributions indexed by a tuning parameter. These rates are based on tail bounds for noncentral χ^2 distributions established in [1]. By selecting the optimal tuning parameter over the class we derive the fastest bounds within the family. Of course, this optimization procedure depends on the regression function f and leads to an oracle in the frequentist framework. In a second step, we put a prior on the tuning parameter and derive the posterior concentration rate of the constructed hierarchical Gaussian prior distribution. The results of the Bayesian inference are furthermore put into relation with the frequentist problem of estimating the regression function f. Considering typical smoothness classes, we show that a full data-driven Bayes estimate derived from this hierarchical prior distribution can attain minimax optimal rates of convergence and is hence adaptive.

References

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Statistics for spectral tail processes of heavy–tailed Markov chains

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Extremes of stationary time series can exhibit cross–sectional and temporal dependence. Such phenomenons can be fully characterized by the tail process [1]. This probabilistic concept is of high interest as it embeds all known extreme–value asymptotics of multivariate time series. Our contribution is to develop suitable statistical methodologies for tail processes that emerge from heavy–tailed Markov chains. In particular we propose an estimator for the law of the spectral process, a sequence–valued angular component of the tail process, and prove its asymptotic normality. Moreover, we show how to exploit the time–change property of the tail process in order to improve the performance of the estimator.

References

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