Processus
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Antoine Ayache: Stationary increments harmonizable stable fields: upper estimates on path behavior.

Studying sample path behavior of stochastic fields/processes is a classical research topic in probability theory and related areas such as fractal geometry. To this end, many methods have been developped since a long time in Gaussian frames. They often rely on some underlying "nice" Hilbertian structure, and can also require finiteness of moments of high order. Therefore, they can hardly be tansposed to frames of heavy- tailed stable probability distributions. However, in the case of some linear non-anticipative moving average stable fields/processes, such as the linear fractional stable sheet and the linear multifractional stable motion, rather new wavelet strategies have already proved to be successful in order to obtain sharp moduli of continuity and other results on sample path behavior. The main goal of our talk is to show that, despite the difficulties inherent in the frequency domain, such kind of a wavelet methodology can be generalized and improved, so that it also becomes fruitful in a general harmonizable stable setting with stationary increments. Let us point out that there are large differences between this hamonizable setting and the moving average stable one.
Joint work with Geoffrey Boutard.

Jean-Marc Bardet: Asymptotic behavior of the Laplacian quasi-maximum likelihood estimator of affine causal processes.

We prove the consistency and asymptotic normality of the Laplacian Quasi-Maximum Likelihood Estimator (QMLE) for a general class of causal time series including ARMA, AR(∞), GARCH, ARCH(∞), ARMA-GARCH, APARCH, ARMA-APARCH,..., processes. We notably exhibit the advantages (moment order and robustness) of this estimator compared to the classical Gaussian QMLE. Numerical simulations confirms the accuracy of this estimator.

Pierre Bertrand: Verfitting of the Hurst index for a multifractional Brownian motionr.

The multifractional Brownian motion (mBm) can be viewed as a generalisation of the fractional Brownian motion (fBm) where the Hurst index H is replaced by a time-varying function $H(t)$. A time-varying Hurst index is encountered in different kinds of applications: In quantitative finance for instance, it has been shown that the Hurst index estimated on sliding windows is varying with time between 0.45 and 0.65. Theoretical explanations are developed by economists. To sum up, periods with a Hurst index that significantly differs from $H = 1/2$ can be explained by behavioural finance, whereas the case $H = 1/2$ corresponds to Brownian motion and the hypothesis of efficience of financial markets.

For such a time-varying Hurst index, the methods of estimation developed up to now localize the estimation of Hurst index on a small vicinity giving a naive estimator $\widehat{H}(t)$. Actually, we can not know whether fluctuations of $\widehat{H}(t)$ reflect reality or are just artifact of the statistics. We build a test that asymptotically rejects the naive estimator $\widehat{H}(t)$.

Keywords. Fractional Brownian motion, Multifractional Brownian motion, Hurst index, Overfitting, Model selection.

Marianne Clausel: Large scale reduction principle and application to hypothesis testing.

Consider a non-linear function $G(X_t)$ where X_t is a stationary Gaussian sequence with long-range dependence. The usual reduction principle states that the partial sums of $G(X_t)$ behave asymptotically like the partial sums of the first term in the expansion of G in Hermite polynomials. In the context of the wavelet estimation of the long-range dependence parameter, one replaces the partial sums of $G(X_t)$ by the wavelet scalogram, namely the partial sum of squares of the wavelet coefficients. Is there a reduction principle in the wavelet setting, namely is the asymptotic behavior of the scalogram for $G(X_t)$ the same as that for the first term in the expansion of G in Hermite polynomial? The answer is negative in general. This paper provides a minimal growth condition on the scales of the wavelet coefficients which ensures that the reduction principle also holds for the scalogram. The results are applied to testing the hypothesis that the long-range dependence parameter takes a specific value. Joint work with François Roueff and Murad S. Taqqu

Jérôme Dedecker: Behavior of the Wasserstein distance between the empirical and the marginal distributions of alpha-dependent sequences.

We study the Wasserstein distance of order 1 between the empirical distribution and the marginal distribution of stationary alpha-dependent sequences. We prove some moments inequalities of order p for any p>1, and we give some conditions under which the central limit theorem holds. The moment inequalities for the Wasserstein distance are similar to the well known von Bahr-Esseen or Rosenthal bounds for partial sums, and seem to be new even in the case of independent and identically distributed random variables.
Joint work with Florence Merlevede

Holger Dette: Detecting long-range dependence in non-stationary time series.

We consider the way of discriminating between non-stationarity and long-range dependence. Most of the literature considers the problem of testing specific parametric hypotheses of non-stationarity (such as a change in the mean) against long-range dependent stationary alternatives. We suggest a simple approach, which can be used to test the null-hypothesis of a general non-stationary short-memory against the alternative of a non-stationary long-memory process. The test procedure works in the spectral domain and uses a sequence of approximating tvFARIMA models to estimate the time varying long-range dependence parameter. We prove uniform consistency of this estimate and asymptotic normality of an averaged version. These results yield a simple test (based on the quantiles of the standard normal distribution), and it is demonstrated in a simulation study that - despite of its semi-parametric nature - the new test outperforms the currently available methods, which are constructed to discriminate between specific parametric hypotheses of non-stationarity short- and stationarity long-range dependence.

Michael Eichler: Semi-parametric dynamic factor models for non-stationary time series.

Current approaches for fitting dynamic factor models to non-stationary time series are based on dynamic principal components analysis in the frequency domain. These approaches are fully non-parametric and depend strongly on the chosen bandwidths for smoothing over frequency and time. As an alternative, we propose a semi-parametric approach in which only part of the model parameters are allowed to be time-varying. More precisely, we consider models where the latent factors admit a dynamic representation with time-varying autoregressive coefficients while the loadings are constant over time.

For estimation of the model parameters, we consider two situations. First, if the cross-sectional dimension N is large the factors can be recovered by ordinary principal component analysis. In a second step we then use local polynomial fitting to estimate the time-varying parameters of the factor process. Second, if the cross-sectional dimension N is moderate, estimation of the model parameters can be accomplished by application of the EM algorithm and the Kalman filter. Simulation results show that compared to estimation of the factors by principal components this approach produces superior results. We illustrate our approach also applications to real data.

Konstantinos Fokianos: Mallows' Quasi-Likelihood Estimation for Log-linear Poisson Autoregressions.

We consider the problems of robust estimation and testing for a log-linear model with feedback for the analysis of count time series. We study inference for contaminated data with transient shifts, level shifts and additive outliers. It turns out that the case of additive outliers deserves special attention. We propose a robust method for estimating the regression coefficients in the presence of interventions. The resulting robust estimators are asymptotically normally distributed under some regularity conditions. A robust score type test statistic is also examined. The methodology is applied to real and simulated data.
Joint work with Stella Kitromilidou.

Ieva Grublytė: Quasi-MLE for quadratic ARCH model with long memory

We discuss parametric quasi-maximum likelihood estimation for quadratic ARCH process with long memory introduced in [**?**] and [**?**] with conditional variance given by a strictly positive quadratic form of observable stationary sequence. We prove consistency and asymptotic normality of the corresponding QMLE estimates, including the estimate of long memory parameter $0 < d < 1/2$. A simulation study of empirical MSE is included.
Joint work with Donatas Surgailis and Andrius Skarnulis

Marc Hoffmann: Statistical inference for bifurcating Markov chains.

We will review and extend several results in nonparametric inference for a class of Markov chains indexed by trees, the BMC model, that serves as toy models for some piecewise deterministic Markov processes. In particular, we will try to provide qualitative ideas in order to understand precisely why classical geometric ergodicity does not yield all the desired properties when a chain is indexed by the full tree. If times permits, we will use the discrete model as a guideline for exploring further some inference results in continuous time.

Adam Jakubowski: Phantom distribution functions for dependent random vectors.

The notion of a phantom distribution (phdf) function was introduced by O'Brien in [2]. Let $\{X_j\}$ be a stationary sequence with partial maxima

$$M_n = \max_{1 \leqslant j \leqslant n} X_j$$

and the marginal distribution function $F(x) = P(X_1 \leqslant x)$. A stationary sequence $\{X_n\}$ of *real* random variables is said to admit a phantom distribution function G if

$$\sup_{u \in R} \left| P(M_n \leqslant u) - G^n(u) \right| \to 0, \text{ as } n \to \infty.$$

For Markov chains with a regenerative structure Rootzén [4] gives an interpretation of G in terms of maxima over the regeneration cycle.

In general it is known [1] that the existence of a phdf is a quite common phenomenon for stationary weakly dependent sequences. In particular, it is shown in [1] that any α-mixing stationary sequence with continuous marginals admits a continuous phdf.

In the paper we discuss the corresponding notion of a phantom distribution function for random vectors and provide some sufficient conditions for its existence. The machinery is much in the spirit of Perfekt [3].

This a joint work with Natalia Soja-Kukieła.

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William Kengne: Testing for parameter change in a general class of time series of counts.

We consider the structural change in a class of discrete valued time series that the conditional distribution follows a one-parameter exponential family. We propose a change-point test based on the maximum likelihood estimator of the parameter. Under the null hypothesis (of no change) the test statistics converges to a well known distribution and diverges to infinity under the alternative. Some simulation results and real data application are reported.

Emilie Lebarbier: Segmentation of time-series with various types of dependency.

The objective of segmentation methods is to detect abrupt changes, called breakpoints, in the distribution of a signal. Such segmentation problems arise in many areas, as in biology, in climatology, in geodesy, ... The inference of segmentation models requires to search over the space of all possible segmentations, which is prohibitive in terms of computational time, when performed in a naive way. The Dynamic Programming (DP) strategy is the only one that gives the exact solution in a fast way but only applies when the contrast (e.g. the log-likelihood) to be optimized is additive with respect to the segments. However, this is not the case in presence of some dependencies. We consider two cases:

(i) When dealing with multiple series, it is likely that some dependencies between series exist (probe effect in the genomic context or spatial correlation in climatology and geodesy context).

(ii) When dealing with time-series, it is likely that time-dependency exists. We need to take into account for the dependency in order to avoid false breakpoint detection. Our goal is to propose an efficient maximum likelihood inference procedure and our strategy consists in removing the dependency so that DP can be applied.

For the case (i), we propose to encode the dependency between-series into a factor model and use an EM algorithm to estimate the parameters. With this representation of the dependency, we will see that, at the M-step the contrast to be optimized turns out to be additive so DP applies. The last issue concerns the choice of the number of factors and the number of segments. To this end, we propose a heuristic combining two BIC criteria.

For the case (ii), we model the time-series dependency with an AR(1). For the inference, we propose a two-step procedure: first, we propose a robust estimator of the auto-correlation parameter, which is consistent. Then, we apply the classical inference approach on the decorrelated series. We show asymptotic properties of the obtained estimators.

Jacques Levy Vehel: Processes with varying local regularities

This talk will concentrate on two measures of local regularity, namely the pointwise Hölder exponent and the intensity of jumps. I will introduce various kinds of self-regulating and self-stabilizing processes, along with relevant statistical estimation procedures as well as applications in selected fields.

Florence Merlevede: Strong approximation for additive functionals of geometrically ergodic Markov chains.

The talk will focus on a Komlos-Major-Tusnady type strong approximation for additive functionals of Markov chains. We will show that if we consider bounded functionals of a stationary Harris recurrent geometrically ergodic Markov chain on a countably generated state space, then we obtain the almost sure strong approximation of their associated sums by the partial sums of a sequence of independent and identically distributed Gaussian random variables with the optimal rate O (log n).
The talk is based on a joint work with E. Rio.

Guy Nason: A test for local white noise (and the absence of aliasing) in locally stationary wavelet time series.

This talk develops a new test for local white noise which also doubles as a test for the lack of aliasing in a locally stationary wavelet process. We compare and contrast our new test with the aliasing test for stationary time series due to Hinich and co-authors. We show that the test is robust to mismatch of analysis and synthesis wavelet. We demonstrate the effectiveness of the test on some simulated examples and on an example from wind energy.

Efstathios Paparoditis: Periodogram Based Tests of Stationarity.

We review some recent developments in testing stationarity in time series analysis by means of testing the constancy over time of the spectral density resp. the spectral distribution function. In this context, we discuss different L_2-type and Kolmogorov-Smirnov-type tests of stationarity. Such tests compare estimates of the spectral density calculated over a window of data with a global spectral density estimator based on the entire time series. A framework for the asymptotic analysis of the local power properties of such tests is developed by defining appropriate sequences of locally stationary processes that converge at a controlled rate to a limiting stationary process as the length of the time series increases. Some interesting classes of local alternatives to stationarity are generated and the local power properties of the different tests are compared. Some numerical results illustrate our theoretical findings.

Stefan Richter: Adaptive bandwidth selection with cross validation for locally stationary processes.

Locally stationary processes behave in an approximately stationary way over short periods of time. There exists a subclass of such processes which allows a decomposition into a stationary time series model depending on a parameter, and a deterministic parameter curve which encodes the time dependence. A prominent example of such a process is the tvARMA process.

We assume that the stationary time series model is known, but the parameter curves are not. For estimation of these curves, nonparametric kernel-type maximum likelihood estimates (depending on a smoothing parameter) have been proposed. To the best of our knowledge, the theoretical behavior of a data adaptive bandwidth choice method for such estimates has not been considered in the literature.

We propose an adaptive bandwidth choice via cross validation. We prove that this procedure is asymptotically optimal with respect to a Kullback-Leibler-type distance measure under mild assumptions on the unknown parameter curve.

The performance of the method is also studied in a simulation.

Emmanuel Rio: New deviation inequalities for martingales with bounded increments.

In this paper we give new deviation inequalities for martingales with increments bounded from above. Our results are based on an improvement of the results of Bennett (1968) for random variables bounded from above.

François Roueff: Posterior consistency for partially-observed Markov models.

In this work, we establish the posterior consistency property for a parametrized family of partially observed fully-dominated Markov models. The main assumption is expressed in terms of the Kullback neighborhood associated to one transition of the complete Markov chain, which should be of positive probability with respect to the prior distribution. We show that under some additional mild assumptions, the posterior consistency can be derived in straight line from the consistency of the Approximate Maximum Likelihood estimator. The result is then extended to possibly non-compact parameter sets and to non-stationary observations. We check our assumptions on examples including stochastic volatility models and non-linear switching autoregressions with underlying Markov chains.

Philippe Soulier: Fonctional limit theorems for weakly dependent regularly varying time series.

We consider a stationary regulary varying time series whose marginal distribution is in the domain of attraction of a stable law. For weakly dependent time series, the finite dimensional convergence of the partial sum process is now well understood but it is well known that in many cases convergence does not hold in any of the Skorohod topologies. Builiding upon recent results of Mikosch and Wintenberger on cluster functionals, we will present a new approach to this problem which fully describes the situation when convergence in the skorohod's topologies fail. We also obtain results for records.

Subba Rao Suhasini: Fourier based statistics for irregular spaced spatial data.

In this talk we introduce a class of statistics for spatial data that is observed on an irregular set of locations. Our aim is to obtain a unified framework for inference and the statistics we consider include both parametric and nonparametric estimators of the spatial covariance function, Whittle likelihood estimation, goodness of fit tests and a test for second order spatial stationarity. To ensure that the statistics are computationally feasible they are defined within the Fourier domain, and in most cases can be expressed as a quadratic form of a discrete Fourier-type transform of the spatial data. Evaluation of such statistic is computationally tractable, requiring $O(nb)$ operations, where b are the number Fourier frequencies used in the definition of the statistic (which varies according to the application) and n is the sample size. The asymptotic sampling properties of the statistics are derived using mixed spatial asymptotics, where the number of locations grows at a faster rate than the size of the spatial domain and under the assumption that the spatial random field is stationary and the irregular design of the locations are independent, identically distributed random variables. We show that there are quite intriguing differences in the behaviour of the statistic when the spatial process is Gaussian and non-Gaussian. In particular, the choice of the number of frequencies b in the construction of the statistic depends on whether the spatial process is Gaussian or not. If time permits we describe how the results can also be used in variance estimation. And if we still have time some simulations and real data will be presented.

Charles Suquet: Detecting a changed segment in a sample.

Let $(X_n)_{n\geqslant 1}$ be a discrete time stochastic process. We want to detect the existence of an interval of time $[\![k^*, m^*]\!] \subset (1, n)$ during which there is some change in the distribution of the X_k's. To detect short changes, we propose some weighted scan-statistics and use Hölderian functional central limit theorems to study their asymptotic behavior. The talk is based on joint works with Alfredas Račkauskas and Jurgita Markevičiūtė from Vilnius University.

Dag Tjostheim: Some further properties and applications of local Gaussian approximation.

The Pearson correlation is the most used dependence measure in statistics. It has many weaknesses and really only works very well for Gaussian variables. I an earlier talk at CIRM, Luminy, I introduced the local Gaussian correlation as an alternative. The idea is to approximate a bivariate density locally by a bivariate Gaussian density. The correlation coefficient of the approximating Gaussian is taken as the local Gaussian correlation at this location. In the present talk I will review some recent developments, including the local Gaussian autocorrelation and its use in measuring nonlinear serial dependence in time series. Moreover, I plan to cover semiparametric multivariate density estimation with increasing dimension, conditional density estimation, local partial correlation and perspectives emanating from this. Illustrations will be given from recent publications and preprints.

Lionel Truquet: Parameter stability and semiparametric inference in time-varying ARCH processes.

In this work, we develop a complete methodology for detecting time-varying/non time-varying parameters in ARCH processes. For this purpose, we estimate and test various semiparametric versions of the time-varying ARCH model (tv-ARCH) which include two well known non stationary ARCH type models introduced in the econometric literature. Using kernel estimation, we show that non time-varying parameters can be estimated at the usual parametric rate of convergence and for a Gaussian noise, we construct asymptotically efficient estimates in a semiparametric sense. Then we introduce two statistical tests which can be used for detecting non time-varying parameters or for testing the second order dynamic in presence of non stationarity. Our results are illustrated by some applications to currency exchange rates or stock market indices.

Michael Vogt: Classification of nonparametric time trends.

In many applications, we observe a multitude of time series and are interested in whether they exhibit a similar trending behaviour. For instance, we may want to investigate whether temperature or ozone measurements observed at different spatial locations have parallel time trends. It is often natural to suppose that there are several groups of time series which exhibit a similar trending behaviour. As a modelling approach, we may thus suppose that the observed time series can be grouped into a number of classes whose members all share the same time trend. In the talk, we investigate a model with nonparametric time trends that have such a group structure. We develop a statistical procedure to estimate the unknown classes, their number and the associated group-specific time trends under general conditions on the stochastic behaviour of the observed time series.

Dalibor Volny: Martingale central limit theorems for random fields.

For sequences of random variables, martinagale approximations have been a powerful tool for proving central limit theorems. In last few years, several promising results appeared in the case of random fields with commuting filtrations. We will present several of them.

Rainer Von Sachs: Time-frequency analysis of locally stationary Hawkes processes.

In this talk we address generalisation of stationary Hawkes processes in order to allow for a time-evolutive second-order analysis. A formal derivation of a time-frequency analysis via a time-varying Bartlett spectrum is given by introduction of the new class of locally stationary Hawkes process. This model is most appropriate for the analysis of (potentially very) long stretches of observed self-exciting point processes, as introduced in the stationary case by A. Hawkes (1971), in one dimension (temporal) or in a higher dimensional (i.e. spatial) context. Motivated by the concept of locally stationary autoregressive processes, we apply however inherently different techniques to describe and capture the time-varying dynamics of self-exciting point processes in the frequency domain. In particular we derive a stationary approximation of the Laplace transform of a locally stationary Hawkes process. This allows us to define a local intensity function and a local Bartlett spectrum which can be used to compute approximations of first and second order moments of the process. We will also present some insightful simulation studies and propose and discuss preliminary asymptotic results on how to estimate the first and second order structure of the process.
Joint work with François Roueff and Laure Sansonnet