PREDICTION OF TIME SERIES AND NON STATIONARY TIME SERIES

February 10th-11th, 2012

RESUMES/ABSTRACTS

Eric Moulines (TELECOM-Paris)

Hidden Markov Models

TBA

Nathanael Mayo (CHEVREUX)

Non stationnarity of financial time series

There is strong evidence that most data available on financial market (stocks' prices, returns and volumes) are not stationary. We provide empirical illustrations of these properties, and describe how statistical models based on hidden variables, such as Hidden Markov Chain and Factor Models, can be used to capture various types of non stationarity, for both univariate and vector time series.

Michael Neumann (Jena)

Dependent wild bootstrap for degenerate U- and V –statistics

Abstract

Many important test statistics can be rewritten as or approximated by degenerate von Mises-(V-)statistics. In the first part, I will review new results on the asymptotic behavior of degenerate V- and related U-statistics under ergodicity or weak dependence.

To set critical values for tests, bootstrap methods are an important tool whenever the distribution of a given test statistics cannot be determined analytically. I will introduce a new variant of a dependent wild bootstrap and sketch the proof of its consistency.

The talk is based on joint work with Anne Leucht (currently at TU Braunschweig).

Literature:

- Leucht, A. & Neumann, M.H. (2011). Degenerate U- and V-statistics under ergodicity: Asymptotics, bootstrap and applications in statistics. *Reports of the Department of Mathematics and Computer Science, Friedrich Schiller University Jena* **11-01**.
- Leucht, A. & Neumann, M.H. (2011). Dependent wild bootstrap for degenerate U- and V-statistics, Manuscript.

Florence Merlevède (Marne la Vallée)

Invariance principles for linear processes with application to isotonic regression

TBA

Olivier Wintenberger (Dauphine)

Fast rates in forecasting with dependent observations (collaboration with P. Alquier)

TBA

Jean Michel Zakoian (CREST et Université Lille 3)

Strict stationarity testing and estimation of explosive and stationary GARCH models

The problem of testing strict stationarity of GARCH(1,1) Models is considered. We study the asymptotic properties of the quasi-maximum likelihood estimator without strict stationarity constraints. Except for the intercept, this estimator remains consistent and asymptotically normal in every situation. The asymptotic variance is different in the stationary and non-stationary situations, but is consistently estimated, with the same estimator, in both cases. Tests of strict stationarity and non stationarity are proposed. The tests developed for the classical GARCH(1,1) model are able to detect non-stationarity in more general GARCH models. A numerical illustration based on stock indices and individual stock returns is proposed. (Joint paper with Christian Francq)

Christine Jacob (INRA)

Conditional Least Squares Estimation in nonstationary nonlinear stochastic regression models

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Let $\{Z_n\}$ be a real nonstationary stochastic process such that $E(Z_n|\mathcal{F}_{n-1}) \overset{a.s.}{<} \infty$, $E(Z_n^2|\mathcal{F}_{n-1}) \overset{a.s.}{<} \infty$, where $\{\mathcal{F}_n\}$ is an increasing sequence of σ-algebra. We assume that $E(Z_n|\mathcal{F}_{n-1}) = g_n(\theta_0, \nu_0) = g_n^{(1)}(\theta_0) + g_n^{(2)}(\theta_0, \nu_0)$, where $g_n^{(1)}$ and $g_n^{(2)}$ are $\mathcal{F}_{n-1}$-measurable and may be nonlinear in $\theta_0 \in \mathbb{R}^p$, $\nu_0 \in \mathbb{R}^q$, $p < \infty$, $q \leq \infty$, $g_n(\theta, \widehat{\nu})$ is Lipschitz in θ, and $g_n^{(2)}(\theta_0, \widehat{\nu}) - g_n^{(2)}(\theta, \widehat{\nu})$ is assumed asymptotically negligible relatively to $g_n^{(1)}(\theta_0) - g_n^{(1)}(\theta)$.
We show the strong consistency and the asymptotic normality of the Weighted Conditional Least Squares Estimators (WCLSE) of θ_0, $\widehat{\theta}_n := \arg\min_\theta \sum_{k=1}^n (Z_k - g_k(\theta, \widehat{\nu}))^2 \lambda_k^{-1}$, where λ_k is $\mathcal{F}_{k-1}$-measurable, $\widehat{\nu}$ is any estimation of the nuisance parameter ν_0. The proofs are based on a new strong law of large numbers for a class of submartingales (SLLNSM). We illustrate the theoretical results with examples such as a nonstationary GARCH(1,1) model and branching processes modelling some biological phenomena.

References

Jacob, C. (2009) Strong consistency of the Conditional Least Squares Estimator for a nonstationary process. Example of the GARCH model. *Pliska Stud. Math. Bulgar.*, **19**, 135–156.

Jacob, C. (2010) Conditional Least Squares Estimation in nonstationary nonlinear stochastic regression models. *Ann. Statist.*, **38(1)**, 566–597.

Pénisson, S. and Jacob, C. BSE epidemic in Great Britain: prediction of the disease spread and study of the very late extinction case scenario, based on a stochastic branching model. Submitted

Matthieu Cornec (INSEE)

High dimensional change-points detection

http://previsions.blogspot.com/

Dragi Anevski (Lund)

Isotonic regression for time series

TBA

Emilie Muzereau (GDF SUEZ / CEEME)

Modèle à changement de régime sur la saisonnalité des prix du gaz

TBA

Alain Célisse (ENS)

High dimensional change-points detection

Nowadays statiscians deal with very high dimensional or even inifite dimensional objects such as next generation sequencing data or functions for instance. The goal of the present work is to propose a unified strategy to handle such objects relying on Reproducing Kernel Hilbert Space (RKHS) structures.

The main focus is given to off-line change-points detection in the distribution of the fixed-design data mapped onto the RKHS through the choice of a kernel (Gaussian, Laplace,...).We will describe some theoretical settings (mainly homoscedastic and sometimes weakly heteroscedastic) in which oracle inequalities can be derived for the estimator of the mean element in the RKHS. Finally, the performance of the proposed strategy will be assessed on synthetic and real data.

Yannig Goude (EDF)

Combining Forecasts for Short Term Load Forecasting

We consider the application of sequential combining algorithms of arbitrary sequences based on experts advice to the short-term (one-day-ahead) forecasting of electricity consumption.

The aim is to combine a finite number of indivual forecasts -also called experts- in order to achieve under general assumptions, the predictive performance of an a-priori unknown referee called the Oracle predictor. We present the results obtained on practical applications on different electricity data sets.

Rainer Dahlhaus (Heidelberg)

Approximations and Expansions for Locally Stationary Processes

Locally stationary processes are models for nonstationary time series whose behaviour can locally be approximated by a stationary process. In this situation the classical characteristics of the process such as the covariance function at some lag k, the spectral density at some frequency lambda, or eg the parameter of an ARCH-process are curves which change slowly over time. The theory of locally stationary processes allows for a rigorous asymptotic treatment of various inference problems for such processes.

In order to investigate the structure of such processes and to investigate the properties of estimators we use the idea of a stationary approximation and a stationary derivative process. We define derivative processes and a Taylor type expansion for locally stationary processes and show how these techniques can be used for investigating the statistical properties of estimators for such processes. As an application we study in particular nonlinear processes.

Herold Dehling (Bochum)

Nonparametric Change-Point Tests for Long-Range Dependent Data

Authors: Herold Dehling, Aeneas Rooch and Murad S. Taqqu

Abstract We investigate nonparametric tests for change-points in long-range dependent time series. We consider observations

$$X_i = \mu_i + \epsilon_i,$$

where $(\epsilon_i)_{i\geq 1}$ is a long-range dependent stationary process with mean zero, and where $\mu_i \in \mathbb{R}$ are the unknown means. Based on observations $X_1, \ldots, X_n$, we wish to test the hypothesis $H : \mu_1 = \ldots = \mu_n$ that there is no change in the means of the data against the alternative

$$A : \mu_1 = \ldots = \mu_k \neq \mu_{k+1} = \ldots = \mu_n \text{ for some } k \in \{1, \ldots, n-1\}.$$

We derive the asymptotic distribution of a test statistic that is based on Wilcoxon's two-sample rank test under the null-hypothesis that no change occured. We assess the finite-sample behavior of our test in more general situations via a simulation study which shows that for heavy-tailed data, our test outperforms a difference-of-means test. For Gaussian data, we can analytically calculate the asymptotic power under local alternatives

$$A_{\tau,h_n}(n) : \mu_i = \begin{cases} \mu & \text{for } i = 1, \ldots, [n\tau] \\ \mu + h_n & \text{for } i = [n\tau] + 1, \ldots, n \end{cases}$$

with an appropriate jump of height $h_n \to 0$. We obtain the somewhat surprising result that for Gaussian data, the Wilcoxon test has the same asymptotic power as the difference-of-means test.

William Kengne (Paris 1)

A test for parameter change in general causal time series models

TBA