Université / / Paris Seine

ESSEC BUSINESS SCHOOL

Labex MME-DII
Modèles Mathématiques et Économiques de la Dynamique, de l'Incertitude et des Interactions

1st Nonstationary Day
December 12, 2018

PROGRAM

9h00	Welcome participants
9:30-10:15	**Herold DEHLING** (Ruhr University, Bochum) *Power comparison of nonparametric change-point tests*
10:15-11:00	**Pierre ALQUIER** (ENSAE Saclay) *Exponential inequalities for nonstationary Markov Chains*
11:00-11:30	Pause
11:30-12:15	**Jean-Marc BARDET** (SAMM Panthéon Sorbonne University) *Local semi-parametric estimation for locally stationary process with infinite memory*
12:15-13:00	**Lionel TRUQUET** (ENSAI Rennes) *Time-varying time series models for categorical data*
13:00-15:00	*Lunch*
15:00-15:45	**Anne VAN DELFT** (Ruhr University, Bochum) *A similarity measure for second order properties of non-stationary functional time series with applications to clustering and testing*
15:45-16:30	**François ROUEFF** (Telecom Paristech) *Prediction of weakly locally stationary processes by auto-regression*
16:30-17:15	**Karine BERTIN** (CIMFAV Valparaiso) *Selection procedures for local stationary AR(1) processes*

Organizers: **Paul Doukhan, Olga Klopp, Nicolas Marie, Jean-Luc Prigent**

Amphitheater Jade, Telecom Paristech
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Pierre ALQUIER

Exponential inequalities are main tools in machine learning theory.

To prove exponential inequalities for non i.i.d random variables allows to extend many learning techniques to these variables. Indeed, much work has been done both on inequalities and learning theory for time series, in the past 15 years. However, for the non independent case, almost all the results concern stationary time series. This excludes many important applications: for example any series with a periodic behaviour is non-stationary. In this paper, we extend the basic tools of Dedecker and Fan (2015) to nonstationary Markov chains. As an application, we provide a Bernstein-type inequality, and we deduce risk bounds for the prediction of periodic autoregressive processes with an unknown period.

Jean-Marc BARDET

Local semi-parametric estimation for locally stationary process with infinite memory

We first prove the existence of a general non stationary model with infinite memory. In the case of local-stationarity and under Lipshitzian conditions, we obtain limit theorem for a general contrast convoluted by a kernel. We deduce the asymptotic behavior of a non-parametric estimator of the time-varying parameters of the model. Examples of least square, least absolute value or quasi-maximum likelihood are proposed as well for ARMA, GARCH processes as for integer-valued process...

Herold DEHLING

Power comparison of nonparametric change-point tests

We will present some recent results on the power of non-parametric change-point tests. As one example, we will investigate the power of two tests derived from one-sample U-statistics, and compare their power, both under local as well as under fixed alternatives.

Anne VAN DELFT

A similarity measure for second order properties of non-stationary functional time series with applications to clustering and testing

Due to the surge of data storage techniques, the need for the development of appropriate techniques to identify patterns and to extract knowledge from the resulting enormous data sets, which can be viewed as collections of dependent functional data, is of increasing interest in many scientific areas. We develop a similarity measure for spectral density operators of a collection of functional time series, which is based on the aggregation of Hilbert-Schmidt differences of the individual time-varying spectral density operators. Under fairly general conditions, the asymptotic properties of the corresponding estimator are derived and asymptotic normality is established. The introduced statistic lends itself naturally to quantify (dis)-similarity between functional time series, which we subsequently exploit in order to build a spectral clustering algorithm. Our algorithm is the first of its kind in the analysis of non-stationary (functional) time series and enables to discover particular patterns by grouping together 'similar' series into clusters, thereby reducing the complexity of the analysis considerably. The algorithm is simple to implement and computationally feasible. As a further application we provide a simple test for the hypothesis that the second order properties of two non-stationary functional time series coincide.

François ROUEFF

Prediction of weakly locally stationary processes by auto-regression

We introduce locally stationary time series through the local approximation of the non-stationary covariance structure by a stationary one. This allows us to define autoregression coefficients in a non-stationary context, which, in the particular case of a locally stationary Time Varying Autoregressive (TVAR) process, coincide with the generating coefficients. We provide and study an estimator of the time varying autoregression coefficients in a general setting. The proposed estimator of these coefficients enjoys an optimal minimax convergence rate under limited smoothness conditions. In a second step, using a bias reduction technique, we derive a minimax-rate estimator for arbitrarily smooth time-evolving coefficients, which outperforms the previous one for large data sets. In turn, for TVAR processes, the predictor derived from the estimator exhibits an optimal minimax prediction rate.

Lionel TRUQUET

Time-varying time series models for categorical data

We study some general stationary or locally stationary time series models for categorical data. Exogeneous covariates of a general form can be included in the dynamic. Using a powerful coupling method, we first develop a perturbation technique for a general class of finite-state stochastic processes, the chains with complete connections, which lead to some new probabilistic results of independent interest. These results are then applied to study stationarity, local stationarity and mixing properties of these finite-state stochastic processes. Asymptotic properties of the likelihood or local likelihood estimators are also considered as well as that of some bootstrap versions.