CIRM Workshop

Dependence in Probability and Statistics

Marseille - Luminy, 04. – 08. April 2011

Scientific Programme

Organizers:

Richard Bradley (Bloomington)
Herold Dehling (Bochum)
Paul Doukhan (Cergy-Pontoise)
Michael H. Neumann (Jena)

March 23, 2011

Monday, 4 April 2011

7:00–8:50 **Breakfast**

Morning Session

8:50–9:00 Opening of the Conference

9:00–9:45 Istvan Berkes (Graz):
Trimming and its Applications

9:45–10:30 Magda Peligrad (Cincinnati):
Central Limit Theorem for Non-homogeneous Markov chains

10:30–11:00 Coffee break

11:00–11:45 Adam Jakubowski (Torun):
One-Sequence Method in Limit Theorems for Extrema of Stationary Sequences

11:45–12:30 Florence Merlevède (Paris):
Rates of Convergence in the Almost Sure Invariance Principle in the Weak Dependent Setting

12:30 **Lunch**

Afternoon Session

16:30–17:15 Olivier Wintenberger (Paris):
Prediction of Time Series and Related Concentration Inequalities

17:15–18:00 Gabriel Lang (Paris):
Weakly Dependence Processes: Applications to Tests of Dependence

18:00–18:30 Jürgen Franke (Kaiserslautern):
Weak Dependence of Integer-Valued Time Series with Applications to Nonparametric Estimation and Walsh-Fourier Spectral Analysis

18:30-19:00 Siegfried Hörmann (Brussels):
Functional Principal Component Analysis for Sequential and Spatial Data

19:30 **Dinner**

Tuesday, 5 April 2011

7:00–9:00 **Breakfast**

Morning Session

9:00–9:45 Gerhard Keller (Erlangen):
A Brief Review of the Spectral Gap Technique for Dynamical Systems

9:45–10:30 Loïc Hervé (Rennes):
Rate of Convergence in the Asymptotic Normality of M-Estimators in Markov Models

10:30–11:00 Coffee break

11:00–11:30 Jérôme Dedecker (Paris):
Almost Sure Invariance Principles for Unbounded Functions of Expanding Maps of the Interval

11:30–12:00 Olivier Durieu (Tours):
An Empirical Process CLT and Applications to Dynamical Systems

12:00–12:30 Clémentine Prieur (Grenoble):
Estimation for Stochastic Damping Hamiltonian Systems

12:30 **Lunch**

Afternoon Session

16:30–17:00 Thomas Mikosch (Copenhagen):
Precise Large Deviations Probabilities for a Heavy-Tailed Random Walk

17:00–17:30 Brice Franke (Paris):
Limit Theorems for a Max-Iteration Model with Periodic Amplification

17:30–18:00 Johan Segers (Louvain):
The Tail Process of a Regularly Varying Time Series

18:00–18:30 Holger Drees (Hamburg):
Multiplier Block Bootstrap Processes for Rare Events

18:30–19:00 TBA

19:30 **Dinner**

Wednesday, 6 April 2011

7:00–9:00 **Breakfast**

Morning Session

9:00–9:45 Jean-Marc Bardet (Paris):
Detecting Multiple Change-Points in General Causal Time Series Using Penalized Quasi-Likelihood

9:45–10:30 Roland Fried (Dortmund):
Robust Monitoring of Time Series

10:30–11:00 Coffee break

11:00–11:30 Alexander Schmitz (Köln):
Backward Invariance Principles in Change-Point Analysis

11:30–12:00 Dominik Wied (Dortmund):
Testing for Structural Changes in the Dependence Structure of Random Vectors at an Unknown Point in Time

12:00–12:30 Claudia Kirch (Karlsruhe):
On Hierarchical Epidemic Changes in Dependent Functional Data

12:30 **Lunch**

19:30 **Dinner**

Thursday, 7 April 2011

7:00–9:00 **Breakfast**

Morning Session

9:00–9:30 Eva Löcherbach (Paris):
Hitting Times, Coupling and Regeneration

9:30–10:00 Markus Reiss (Berlin):
Small-Delta-Optimal Range-Based Estimation for Diffusions

10:00–10:30 Mathias Vetter (Bochum):
Estimation of Correlation for Continuous Semimartingales

10:30–11:00 Coffee Break

11:00–11:30 Anne Leucht (Jena):
Bootstrap-Aided Goodness-of-Fit Tests under Weak Dependence

11:30–12:00 Martin Wendler (Bochum):
Strong Invariance Principle for the Generalized Quantile Process under Dependence

12:00–12:30 Dimitris Politis (San Diego):
Nonparametric Spectral Estimation: Linear vs. Nonlinear

Afternoon Session

16:30–17:00 Youri Davydov (Lille):
On Convex Hulls of Sequences of Stochastic Processes

17:00–17:30 Zbigniew Szewczak (Torun):
Relative Stability for Random Sequences

17:30–18:00 Oleg Klesov (Kiev):
Renewal Theorem for Dependent Random Variables

18:00–18:30 Mohamed El Machkouri (Rouen):
Central Limit Theorem and Invariance Principles for a Class of Weakly Mixing Spatial Processes

18:30–19:00 TBA

19:30 **Dinner**

Friday, 8 April 2011

7:00–9:00 **Breakfast**

Morning Session

9:00–9:45 Sana Louhichi (Grenoble):
Functional Convergence to Stable Lévy Motions for Iterated Random Lipschitz Mappings

9:45–10:30 Liudas Giraitis (London):
Limit Theory for Sums of Weighted Periodogram

10:30–11:00 Coffee Break

11:00–11:30 Alexander Lindner (Braunschweig):
On the Sample Autocorrelation Function of Lévy Driven Continuous Time Moving Average Processes

11:30–12:00 Sergey Utev (Nottingham):
Extremal Problems

12:00–12:30 Dalibor Volny (Rouen):
Quenched Limit Theorems

12:30 **Lunch**

Afternoon Session

13:45–14:15 Dag Tjostheim (Bergen):
Local Gaussian Correlation: A New Measure of Dependence

14:15–15:00 Richard Davis (New York):
Functional Convergence of Stochastic Integrals with Application to Inference in Time Series Models

15:00 **Closing of the Conference**

19:30 **Dinner**

Saturday, 9 April 2011

7:00–9:00 **Breakfast**

Abstracts of Talks

1. Jean-Marc Bardet (Paris): *Detecting Multiple Change-Points in General Causal Time Series Using Penalized Quasi-Likelihood* (45 min)

   Abstract: This lecture is devoted to the off-line multiple change-point detection in a semiparametric framework. The time series is supposed to belong to a large class of models including AR(∞), ARCH(∞), TARCH(∞),... models where the coefficients change at each instant of breaks. The different unknown parameters (number of changes, change dates and parameters of successive models) are estimated using a penalized contrast built on conditional quasi-likelihood. Under Lipshitzian conditions on the model, the consistency of the estimator is proved when the moment order r of the process satises $r \geq 2$. If $r \geq 4$, the same convergence rates for the estimators than in the case of independent random variables are obtained. The particular cases of AR(∞), ARCH(∞) and TARCH(∞) show that our method notably improves the existing results as well in theory than in practice.

2. Istvan Berkes (Graz): *Trimming and its Applications* (45 min)

   Abstract: Trimming is a standard method to decrease the effect of large sample elements in statistical procedures, used, e.g., for constructing robust estimators. It is frequently employed in the theory of heavy tailed processes and is also a powerful tool in understanding deeper properties of partial sums of independent random variables, as substantial progress in this field in the past decades shows. In our talk we give a survey of the field and discuss also some new results.

3. Richard Davis (New York): *Functional Convergence of Stochastic Integrals with Application to Inference in Time Series Models* (45 min)

   Abstract: Assuming that $\{(U_n, V_n)\}$ is a sequence of *càdlàg* processes converging in distribution to (U, V) in the Skorohod topology, conditions are given under which $\{\int\int f_n(\beta, u, v)dU_n dV_n\}$ converges weakly to $\int\int f(\beta, x, y)dUdV$ in the space $C(\mathbb{R})$, where $f_n(\beta, u, v)$ is a sequence of "smooth" functions converging to $f(\beta, u, v)$. Integrals of this form arise as the objective function for inference about a parameter β in a stochastic model. Convergence of these integrals play a key role in describing the asymptotics of the estimator of β which optimizes the objective function. We illustrate this with a non-invertible moving average process. (Joint work with Li Song.)

4. Youri Davydov (Lille): *On convex hulls of sequences of stochastic processes* (30 min)

   Abstract: We study the asymptotic behaviour of convex hulls W_n of n independent copies of a given random process with values in R^d when n tends to infinity. It is proved that in Gaussian cases there exists a nonrandom limit shape. It is shown that in non-Gaussian cases, in contrast, the typical situation is completely different: the appropriatly normalized convex hulls W_n/b_n converge weakly to the convex hull of a Poissonian point process, and this random limit shape frequently is a polytope.

5. Jérôme Dedecker (Paris): *Almost sure invariance principles for unbounded functions of expanding maps of the interval* (30 min)

   Abstract: We consider two classes of expanding maps T of the unit interval I: the class

of uniformly expanding maps, for which there is an exponential decay of the correlations, and a class of intermittent maps with a neutral fixed point at zero, for which the decay of correlations is much slower. For both classes of expanding maps, we shall give a large class of unbounded functions $f : I \to \mathbb{R}$, such that the partial sums of $f \circ T^i$ satisfy an almost sure invariance principle. We shall discuss the optimality of the results. (Joint work with Sébastien Gouëzel and Florence Merlevède)

6. Holger Drees (Hamburg): *Multiplier Block Bootstrap Processes for Rare Events* (30 min)

   Abstract: Drees and Rootzén (2010) have introduced a general class of empirical processes (indexed by functionals) which describe certain aspects of extreme or other rare events in a time series setting. Moreover they have proved the asymptotic normality of these processes under suitable mixing conditions.

   Here we discuss the asymptotic behavior of bootstrap versions of these processes in which the functionals that are applied to whole blocks of observations are multiplied with independent, suitably normalized random variables. It is demonstrated that these processes can be used to assess the error of extreme value estimators if the bias is negligible.

   Drees, H., and Rootzén, H. (2010). Limit Theorems for Empirical Processes of Cluster Functionals, *Annals of Statistics* **38**, 2145–2186.

7. Olivier Durieu (Tours): *An empirical process CLT and applications to dynamical systems* (30 min)

   Abstract: We establish a multivariate empirical process central limit theorem for stationary $\mathbb{R}^d$ -valued stochastic processes $(X_i)_{i\geq 1}$ under weak conditions concerning the dependence structure of the process. We give applications in the setting of dynamical systems. Our result applies to dynamical systems having a spectral gap on some Banach space of functions. We can also prove the empirical process CLT for ergodic torus automorphisms. (Joint work with Herold Dehling)

8. Mohamed El Machkouri (Rouen): *Central limit theorem and Invariance principles for a class of weakly mixing spatial processes* (30 min)

   Abstract : Under conditions with quite simple forms, we present a central limit theorem and invariance principles for stationary real random fields $(X_i)_{i\in\mathbb{Z}^d}$ of the form $X_i = g(\varepsilon_{i-s}, s \in \mathbb{Z}^d)$ where $(\varepsilon_i)_{i\in\mathbb{Z}^d}$ are i.i.d. real random variables and g is a measurable function. (Joint work with Dalibor Volný and Wei Biao Wu)

9. Brice Franke (Paris Ouest): *Limit theorems for an max-iteration model with periodic amplification* (30 min)

   Abstract: In this session we want to understand the behaviour of the iterated sequence

   $$Z_n := \max\{Z_{n-1}, \lambda(Z_{n-1})X_n\},$$

   where X_n is an iid sequence with exponential distribution and λ is a periodic bounded non-negative function. We present a strong law for the sum

   $$\frac{1}{n}\sum_{i=1}^{n} f(\lambda(Z_i))$$

(here f is a continuous bounded function) and a distributional limit theorem for the sequence $Z_n - \log n$.

10. Jürgen Franke (Kaiserslautern): *Weak Dependence of Integer-Valued Time Series with Applications to Nonparametric Estimation and Walsh-Fourier Spectral Analysis* (30 min)

    Abstract: Recently, integer-valued stochastic processes have found renewed interest as models for time series of counts, e.g. in financial or medical applications. We consider nonparametric versions of basic models of that kind, e.g. of the integer-valued autoregression of order 1 or INAR(1)-process. This *functional coefficient integer-valued autoregression* or FINAR(1)-process is given by

    $$X_{t+1} = \alpha(X_t) \circ X_t + \epsilon_{t+1}, \tag{1}$$

    where ϵ_t are i.i.d. innovations in $\mathbb{N}\cup\{0\}$, $\alpha : \mathbb{N}\cup\{0\} \to [0,1]$ is a monotone function of its argument, and $\circ$ denotes the binomial thinning operator, i.e. conditional on X_t, $\alpha(X_t) \circ X_t$ denotes a binomially distributed random variable with parameters $(X_t, \alpha(X_t))$.

    Under appropriate conditions on $\alpha(x)$, which for the common INAR(1)-process, where $\alpha(x) \equiv \alpha$, reduces to the well-known stationarity condition $\alpha < 1$, we prove the existence of a strictly stationary process satisfying (1) which is also weakly dependent in the sense of Dedecker, Doukhan, Lang, Leon, Louhichi and Prieur (2007) with exponentially decreasing dependence coefficients. To estimate the function $\alpha(x)$ nonparametrically, we consider sieve estimates, in particular those based on neural networks with increasing complexity. Applying a recent Bernstein inequality of Doukhan and Neumann for weakly dependent processes, we prove consistency of such estimates under a suitable growth condition on the number of parameters.

    We conclude by having a look at the related class of fucntional coefficient INGARCH models with some application to transaction count data of stocks and with some application to Walsh-Fourier spectral analysis which, for discrete-valued time series, seems to be more natural than the classical Fourier spectral analysis. (Joint work with Lea Triebsch)

11. Roland Fried (Dortmund): *Robust monitoring of time series* (45 min)

    Abstract: Automatic measurement of a multitude of variables in short time lags is common nowadays. Such time series data are often disturbed by a high level of noise and different types of measurement artifacts. A basic question is whether the underlying data-generating mechanism is stable over time. For a robust statistical analysis of this problem we need to distinguish between short-term fluctuations and (patches of a few) outlying observations on the one hand and long-term changes like level shifts on the other hand. Reliable methods for sequential ("online") detection and classification of changes in the data-generating mechanism are an essential component of decision support. Motivated by online monitoring in intensive care, we have developed robust statistical procedures for signal extraction and shift detection in noisy time series, based on a combination of localized robust regression techniques with two-sample testing applying the median difference. The asymptotics of the latter is derived for weakly dependent data. (Joint work with Ursula Gather and Herold Dehling)

12. Liudas Giraitis (London): *Limit theory for sums of weighted periodogram* (45 min)

    Abstract: We establish asymptotic normality of weighted sums of periodograms of a stationary linear process where weights depend on the sample size. Such sums appear in numerous statistical applications and can be regarded as a discretized versions of the quadratic forms involving integrals of weighted periodograms. Conditions for asymptotic normality of these weighted sums are simple and resemble Lindeberg-Feller condition for weighted sums of independent and identically distributed random variables. Results are valid for short, long or negative memory processes. The proof is based on sharp bounds derived for Bartlett type approximation of these sums by the corresponding sums of weighted periodograms of independent and identically distributed random variables.

13. Loïc Hervé (Rennes): *Rate of convergence in the asymptotic normality of M-estimators in Markov models* (45 min)

    Abstract: The recent improvements in the spectral method allow to study, for certain Markov models, the rate of convergence in the central limit theorem under the (almost) expected moment conditions and with a control of the bounds. The results have been recently applied to prove limit theorems in M-estimation of Markov models.

    In my talk I will present such a statistical result, obtained with J. Ledoux and V. Patilea, providiing the Berry-Esseen bound for M-estimators associated with geometrically ergodic Markoc chains. In the independent case, this result corresponds to a well-known theorem due to Pfanzagl. I will explain how Pfanzagl's method can be used in Markov models thanks to the above mentioned improvements in limit theorems of Markov additive functionals.

    If time permits, I will also mention other statistical results that can be obtained similarly, and other Markov models to which this method applies.

14. Siegfried Hörmann (Brussels): *Functional Principal Component Analysis for Sequential and Spatial Data* (30 min)

    Abstract: Data in many fields of science are sampled from processes that can most naturally be described as functional. Examples include growth curves, temperature curves, curves of financial transaction data and patterns of pollution data. Functional data analysis (FDA) is concerned with the statistical analysis of such data.

    A problem that we encounter in studying functional data is the "curse of dimensionality". Indeed, functions are intrinsically infinite dimensional objects and it seems evident that tools for reducing dimensionality are even more important then in the multivariate context. A key technique for dimension reduction and analyzing functional data is the functional principal component analysis (FPCA). This technique has been used in huge number of applications, often silently assuming that the functional data are independent. However, the assumption of independence is many times clearly violated in some of those applications, even in prime examples in FDA literature.

    In this talk we propose a framework that is taking into account the temporal or spatial dependence of functional observations. We show when FPCA is robust against such dependence but we also formulate conditions for the lack thereof. (Joint work with Piotr Kokoszka)

15. Adam Jakubowski (Torun): *One-sequence method in limit theorems for extrema of stationary sequences* (45 min)

    Abstract: It is a tradition that goes back to Gnedenko to consider limit theorems for extrema of stochastic processes in an analogous way as limit theory for sums: covergence in distribution under suitable normalization and centering, three types of extreme value limit distributions, domains of atractions etc. There exists however another approach initiated by O'Brien which restricts the attention to studies of limit behaviour of $P(M_n \leq v_n)$ along one sequence $\{v_n\}$ of levels only. We shall discuss such methods in detail, including existence of a phantom distribution function, extremal index and limit theory for higher order statistics.

16. Gerhard Keller (Erlangen): *A brief review of the spectral gap technique for dynamical systems* (45 min)

    Abstract: The time evolution of many Markov chains and of many hyperbolic dynamical systems can fruitfully be described in terms of associated transfer operators acting on spaces of (generalized) functions.

    In the first part of my talk I will outline the formal similarities and the differences in interpretation between these two settings. I also plan to explain briefly a perturbation theorem that has turned out to be useful in both settings.

    In the second part I will concentrate on dynamical systems and present a few examples of particular spaces of (generalized) functions restricted to which the transfer operator has good spectral properties, and, if time permits, I will discuss the particular consequences these spectral properties have for the asymptotic behaviour of the dynamics.

17. Claudia Kirch (Karlsruhe): *On hierarchical epidemic changes in dependent functional data* (30 min)

    Abstract: Recently, change-point analysis has been highlighted as a useful technique in psychological experiments performed with functional Magnetic Resonance Imaging (fMRI) where different subjects react differently to stimuli such as stress or anxiety.

    While current methodology is applied pointwise across spatial locations, our approach is based on recently developed change-point procedures for functional data. Of specific interest are procedures for dependent data and epidemic changes. Because of the very high-dimensionality of the data an approach based on a general covariance structure is computationally not feasible. Therefore, a special case, that of multidimensional separable functional covariance structures will be considered.

    In the above application multiple subjects are usually scanned, indicating a hierarchical nature of the change-points within the experiments, with the distribution of the change-points over all subjects an item of interest. In this case it is possible to estimate the distribution and density of a change-point based on estimators derived from the above procedures. (Joint work with John Aston)

18. Oleg Klesov (Kiev): *Renewal theorem for dependent random variables* (30 min)

    Abstract: We discuss some definitions of renewal processes constructed from random walks with multidimensional time (in other words, from multiple sums of random variables with several indices).

The asymptotic behavior of these processes (and their expectations as well) differs from the case of ordinary renewal processes. Some results are presented on the asymptotics of renewal processes and renewal functions.

A relationship between the rate of convergence of renewal processes and the asymptotics in the Dirichlet divisors problem is outlined. The precise rate of convergence depends on the best approximation in the Dirichlet problem which is valid if the Riemann hypothesis on zeros of the zeta function is true.

19. Gabriel Lang (Paris): *Weak dependence processes : applications to the test of dependence* (45 min)

    Abstract : We give a definition of weak dependence for point processes, that extends the definition of weak dependence of Doukhan and Louhichi. We prove that Cox processes are weak dependent under smoothness and weak dependence conditions on the generating field. We use the weak dependence property to prove the asymptotic normality of classical estimators of clustering (K-function of Ripley and k-neighbours points of Grabarnik and Chiu). From this, we build test statistics of independence for point processes. We hope for extensions of these results to Markov processes, namely Strauss processes. (Joint work with P. Doukhan)

20. Anne Leucht (Jena): *Bootstrap-aided goodness-of-fit tests under weak dependence* (30 min)

    Abstract: We establish consistent L_2-type tests for time series data that are asymptotically unbiased against certain local alternatives. Besides a model-specification test concerning the conditional mean function, tests for symmetry and the parametric class of the marginal distribution based on the empirical characteristic function are considered. The corresponding test statistics can be approximated by degenerate U- and V-statistics. Their asymptotics are then derived using the results of Leucht (2011). In contrast to most of the results in the literature on degenerate U-statistics under weak dependence, the prerequisites of this approach, namely moment constraints and smoothness assumptions concerning the kernel functions, are easy to check.

    In all three cases, the limit distributions of the test statistics have a complicated structure and depend on unknown parameters. Therefore, (asymptotic) critical values of the tests cannot be derived directly. We propose model-based bootstrap algorithms to overcome these difficulties. It turns out that the naive application of the bootstrap counterparts of the test statistics in order to determine critical values may fail. This is due to the fact that the approximating bootstrap statistics are no longer degenerate in general. Similar problems occur when Efron's bootstrap is used to imitate these test statistics in the i.i.d. context; see Dehling and Mikosch (1994). Inspired by their work, we derive bootstrap consistency for certain recentered versions of the test statistics.

    Dehling, H. and Mikosch, T. (1994). Random quadratic forms and the bootstrap for U-statistics. *J. Multivariate Anal.* **51**, 392–413.

    Leucht, A. (2011). Degenerate U- and V-statistics under weak dependence: Asymptotic theory and bootstrap consistency. Accepted for *Bernoulli*.

21. Alexander Lindner (Braunschweig): *On the sample autocorrelation function of Lévy driven continuous time moving average processes* (30 min)

Abstract: Let $L = (L_t)_{t\in\mathbb{R}}$ be a two-sided Lévy process with expectation 0 and finite variance and let $f : \mathbb{R} \to \mathbb{R}$ be an L^2-function. We consider the continuous time moving average process

$$X_t = \int_{\mathbb{R}} f(t-s)\, dL_s, \quad t \in \mathbb{R},$$

which is observed at discrete times $t = 1, 2, 3, \ldots$ In joint work with Serge Cohen (in preparation), we study the asymptotic behaviour of the sample mean $\overline{X}_n = \frac{1}{n}\sum_{t=1}^n X_t$ and the sample autocovariances

$$\gamma_n^*(h) = \frac{1}{n}\sum_{t=1}^{n} X_t X_{t+h}, \quad h \in \mathbb{N}_0,$$

as $n \to \infty$. A limit theorem for the sample autocorrelations is also obtained together with a Bartlett-type formula. This formula differs significantly from the corresponding discrete time moving average process case, since in the discrete time setting, the fourth moment of the driving noise sequence drops out, which in general is not the case for the continuous time setting. The results have applications for the estimation of the Hurst parameter of fractional Lévy noise. (Joint work with Serge Cohen, Toulouse)

22. Eva Löcherbach (Paris): *Hitting times, coupling and regeneration* (30 min)

    Abstract: Consider a strong Markov process in continuous time taking values in some Polish state space. We show how to relate the existence of a polynomial modulated moment for hitting times to Nash inequality via coupling. This permits in turn to caracterize the speed of convergence to equilibrium of the process. (Joint work with Dasha Loukianova and Oleg Loukianov)

23. Sana Louhichi (Grenoble): *Functional convergence to stable Lévy motions for iterated random Lipschitz mappings* (45 min)

    Abstract: Partial sums processes which are elements of $D([0,1])$ (the space of right-continuous functions on $[0,1]$ with left limits) don't always converge weakly in the J_1-topology sense.

    Avram and Taqqu (1992) proved in fact that the J_1-topology is not appropriate for the convergence of a partial sum process constructed from a finite order moving average with at least two non-zero coefficients. But if the coefficients of the moving average are all of the same sign, then the convergence holds in D equipped with the M_1-topology, is much weaker than the J_1 ones (cf. for instance [1], [3], [7] for a discussion about the M_1-topology).

    The purpose of my talk is to prove that if the jumps of the partial sum process are associated then a FCLT holds in $D([0,1])$ equipped with the M_1-topology as soon as the convergence of the finite-dimensional distributions holds.

    We apply our result to some stocastically monotone Markov chains. arising from the family of iterated Lipschitz models. We shall first recall some important facts about iterated Lipschitz models having a unique in law stationary and heavy-tailed solution with exponent $\alpha > 0$ and next we shall recall, the conditions ensuring the convergence in law of the properly normalized and centered partial sum of this stochastic recursion model to an α-stable law with $\alpha \in]0, 2]$ (cf. for instance [2] and [6]).

A functional convergence for the partial-sum processes constructed from this stochastic recursion model is then obtained. The limit process is a strictly stable Lévy process if $\alpha \in]0,2[\backslash\{1\}$, a stable Lévy process if $\alpha = 1$ and a Brownian motion otherwise.

In order to prove our main result, we establish the tightness property in the Skorohod M_1-topology. Our main tools are a well known maximal inequality and an Ottaviani type inequality, which is up to our knowledge new for strictly stationary associated sequences.

References:

1. Avram and Taqqu (1992) Weak convergence of sums of moving averages in the α-stable domain of attraction.

2. K. Bartkiewicz, A. Jakubowski, Th. Mikosch, O. Wintenberger. Stable limits for sums of dependent infinite variance random variables. Probab. Theory Relat. Fields. To appear.

3. B. Basrak, D. Krizmani?, J. Segers (2010). A functional limit theorem for partial sums of dependent random variables with infinite variance. http://arxiv.org/abs/1001.1345

4. Louhichi, S. and Rio, E. (2011). Convergence du processus de sommes partielles vers un processus de Lévy pour les suites associées. C. R. Acad. Sci. Paris, Ser. I 349, 89-91.

5. Louhichi, S. and Rio, E. (2011). Functional convergence to stable Lévy motions for iterated random Lipschitz mappings. In preparation.

6. Mirek, M. (2010). Heavy tail phenomenon and convergence to stable laws for iterated Lipschitz maps. Probab. Theory Relat. Fields. To appear.

7. Whitt, W. (2002). Stochastic-process limits. Springer Series in Operations Research. Springer-Verlag. New-York.
(Joint work with Emmanuel Rio ([4], [5])).

24. Florence Merlevède (Paris): *Rates of convergence in the almost sure invariance principle in the weak dependent setting* (45 min)

Abstract: In this talk, I shall present some recent results on the rates of convergence in the strong invariance principle for weakly dependent sequences of real random variables. The conditions obtained will be expressed either in terms of the alpha-dependent coefficients (c.f. [1]), either in terms of projective criteria (c.f. [2]). Some applications will be also provided.
References :
(1) Merlevède, F. and Rio, E. (2010) : Rates of convergence in the strong invariance principle under weak dependence conditions (submitted).
(2) Dedecker, J., Doukhan, P. and Merlevède, F. (2011) : Rates of convergence in the strong invariance principle under projective criteria (submitted).

25. Thomas Mikosch (Copenhagen): *Precise large deviations probabilities for a heavy-tailed random walk* (30 min)

Abstract: In this talk we will consider the tail probabilities of partial sum processes for stationary processes whose marginal distribution has power law tails. These results generalize the classical results by A.V. and S.V. Nagaev who showed that the "heavy-tail

heuristics" applies in this case: the power law tails of the partial sums are essentially due to the maximum term in the sum.

The situation changes in the case of dependent sequences. Then extremal clusters shape the form of the tails of the partial sums. In contrast to the tail behavior of partial maxima there are only very few particular cases where we can determine the tail behavior of partial sums for stationary sequences. We will consider some known cases, compare them with the iid case and indicate how these large deviation results can be used to proved results about ruin probablities.

26. Magda Peligrad (Cincinnati): *Central Limit Theorem for Non-homogeneous Markov chains* (45 min)

    Abstract: The talk will survey and further discuss several results on the central limit theorem for Markov chains. Two directions will be considered. First, we shall discuss the central limit theorem for triangular arrays of non-homogeneous Markov chains under a condition imposed on the maximal coefficient of correlation. The proofs are based on martingale techniques and a sharp lower bound estimate for the variance of partial sums. Then, we survey some results on the almost sure central limit theorem started at a point for general processes and additive functionals of reversible Markov chains.

27. Dimitris Politis (San Diego): *Nonparametric spectral estimation: linear vs. nonlinear* (30 min)

    Abstract: Traditional kernel spectral density estimators are linear as a function of the sample autocovariance sequence. The purpose of the presentation is to propose and analyze two new spectral estimation methods that are based on the sample autocovariance in a nonlinear way. The rate of convergence of the new estimators is quantified, and practical issues such as bandwidth and/or threshold choice are addressed. The new estimators are also compared to the traditional ones using flat-top lag-windows in a simulation experiment involving sparse time series models. (Joint work with Stathis Paparoditis)

28. Clémentine Prieur (Grenoble): *Estimation for Stochastic Damping Hamiltonian Systems* (30 min)

    Abstract: In this work, we are interested in harmonic oscillators perturbed with a white noise. More precisely, we consider $\big(Z_t := (x_t, y_t) \in \mathbb{R}^2\,,\ t \geq 0\big)$ governed by the following Ito stochastic differential equation :

$$\left\{ \begin{array}{rcl} dx_t & = & y_t dt \\ dy_t & = & \sigma\, I\, dW_t - (c(x_t, y_t) y_t + \nabla V(x_t)) dt \end{array} \right.$$

    For such oscillators, we aim at studying inference issues such as the estimation of the density of the invariante measure, as far as the estimation of the volatility. Even in case the potential is the Duffing's one $V(x) = x^4/4 - x^2/2$ (Kramers oscillator) this problem is not so easy as one does not observe the derivatives y_t which have to be approximated by finite differences. A preliminary step is to well understand the mixing properties of the stationary solution. The starting point for our work are the references [1,2]. (Joint work with José R. León)

    References :

[1] Talay D. (2002). Stochastic Hamiltonian Systems : Exponential Convergence to the Invariant Measure, and Discretization by the Implicit Euler Scheme. *Markov Processes Relat. Fields* 8, p. 1-36.
[2] Wu L. (2001). Large and moderate deviations and exponential convergence for stochastic damping Hamiltonian systems. *Stochastic Processes and their Applications* 91, p. 205-238.

29. Markus Reiss (Berlin): *Small-Delta-optimal range-based estimation for diffusions* (30 min)

    Abstract: We extend the theory of small Δ-optimality for ordinary martingale estimating functions that are constructed by means of equidistant observations to a situation where the maxima and the minima of the observation intervals are added to the sample. The sampling frequency is denoted with Δ. Second order expansions of the expression $E_x(g(H_\Delta, L_\Delta, X_\Delta)$ with respect to $\sqrt{\Delta}$ are used to establish lower bounds of the variance for different classes of estimating functions. the case of Ornstein-Uhlenbeck processes is studied in detail. (Joint work with Hartmuth Henkel)

30. Alexander Schmitz (Köln): *Backward Invariance Principles in Change-Point Analysis* (30 min)

    Abstract: We will address dependence issues arising from nonparametric change-point analysis based on weighted approximations. Motivated by recent contributions of Ling [*Ann. Stat.* 35, 1213–1237 (2007)], we will present some new "backward" strong invariance principles for linear processes with strongly mixing errors. As a consequence, we are able to establish Darling-Erdős type limit theorems for certain weighted tied-down partial sums within an ARMA-GARCH framework. In particular, Aue, Berkes & Horváth [*Bernoulli* 12, 583–608 (2006)] proposed weight functions to detect structural breaks with better power. We will consider a complementary class of weight functions and derive related limit theorems.

31. Johan Segers (Louvain): *The tail process of a regularly varying time series* (30 min)

    Abstract: Extremes of univariate heavy-tailed first-order Markov chains are known to behave under general conditions as a multiplicative random walk, the tail chain. This property is found to be a particular case of a much more general one stating that a stationary multivariate time series is multivariate regularly varying if and only if the following property holds: conditionally on the value of the process at a fixed time point being large (in norm), the process converges in the sense of finite-dimensional distributions to a limit process, the tail process. The tail process is found to possess a number of remarkable properties. Moreover, all kinds of interesting tail quantities can be expressed in terms of the tail process. A particularly rich class of examples is the one of linear time series with random coefficient matrices.

32. Zbigniew Szewczak (Torun): *Relative stability for random sequences* (30 min)

    Abstract: Relative stability results will be presented for weakly and strongly dependent non-negative random sequences with infinite expectations

33. Dag Tjostheim (Bergen): *Local Gaussian Correlation: A new measure of dependence* (30 min)

Abstract: We propose a new local dependence measure, a local correlation, based on approximating a bivariate density locally by a family of bivariate Gaussian densities using local likelihood. At each point, the correlation coefficient of the approximating Gaussian distribution is taken as the local correlation. A number of properties such as existence, limit theorems and use in tail dependence are given for the local Gaussian correlation and its estimate. The new concept is illustrated on real and simulated data.

34. Sergey Utev (Nottingham): *Extremal problems* (30 min)

    Abstract: A class of Extremal Problems for non-linear statistics connected with random matrices and non-commutative probability will be introduced. Several new results and open problems will be outlined.

35. Mathias Vetter (Bochum): *Estimation of correlation for continuous semimartingales* (30 min)

    Abstract: In this talk we are concerned with inference on the correlation parameter ρ of two Brownian motions, when only high-frequency observations from two one-dimensional continuous Ito semimartingales, driven by these particular Brownian motions, are available. Estimators for ρ are constructed in two situations: Either when both components are observed (at the same time), or when only one component is observed and the other one represents its volatility process and thus has to be estimated from the data as well. In the first case it is shown that our estimator has the same asymptotic behaviour as the standard one for i.i.d. observations, whereas a feasible estimator can still be defined in the second framework, but with a slower rate of convergence.

36. Dalibor Volny (Rouen): *Quenched Limit Theorems* (30 min)

    Abstract: Every (strictly) stationary sequence can be expressed as a functional $(f(X_i))$ of a homogeneous Markov Chain (X_i). A limit theorem is said to be quenched if it remains true for almost every (with respect to the stationary measure) starting point. We will study the question which of known limit theorems for stationary processes are quenched.

37. Martin Wendler (Bochum): *Strong invariance principle for the generalized quantile process under dependence* (30 min)

    Abstract: A strong invariance principle for the empirical distribution function (the approximation by a Kiefer-Müller process) has been established by Berkes and Philipp (1977) for dependent data. We extend this results to the empirical U-process (the empirical process of the values $h(X_i, X_i)$ for a bivariate, symmetric function h). With the help of a generalized Bahadur representation, it follows that such a strong invariance principle also holds for the empirical U-quantile process and consequently for GL-statistics (linear combination of U-quantiles). Many commonly used estimators of scale fall into the class of GL-statistics, but they only have been studied under independence. We obtain the functional central limit theorem and the functional law of the iterated logarithm for GL-statistics under dependence as straightforward corollaries.

38. Dominik Wied (Dortmund): *Testing for structural changes in the dependence structure of random vectors at an unknown point in time* (30 min)

    Abstract: There are many empirical hints that the dependence structure of financial

assets cannot be assumed to be constant over time. This talk presents a formal statistical test for constant correlation between two time series. The test only needs mild assumptions, e.g. the possible change point need not be known a priori. This test can be applied to detect "shift contagion" or to develop trading strategies. For the latter case, the results of the test can be used to detect time points in which a portfolio change might be necessary. Such a trading strategy works well in practice and can help to hedge against financial crises. As a second contribution the talk presents corresponding change point tests for copulas or copula-based dependence measures. The procedures are robust against outliers and work well without the assumption of finite moments. We present the extension of a previously suggested test for constant copula in a given point to the case of mixing random variables and present a new test for overall copula constancy. The latter is based on the integral over the empirical copula and simultaneously tests for constancy of Spearman's rho.

39. Olivier Wintenberger (Paris): *Prediction of time series and related concentration inequalities* (45 min)