Speaker: Istvan Berkes, Graz University

Title: Weakly dependent processes in analysis.

Abstract: The theory of weak dependence starts with the investigations of Gauss (1812) on continued fractions and until the 1950's the theory dealt almost exclusively with weak dependence phenomena in analysis and number theory such as Diophantine approximation (Khinchin), distribution of arithmetic functions (Erdős and Kac), lacunary trigonometric series (Salem and Zygmund), etc. Starting with the seminal papers of Rosenblatt (1956) and Ibragimov (1962), the theory turned into a 'purely stochastic' direction and today we have a wide and nearly complete theory giving a satisfactory description of the asymptotic properties of weakly dependent systems. The theory, however, does not cover the analytic and arithmetic applications it was motivated by and "concrete" function systems in analysis exhibit weak dependence phenomena not explained by the general theory. In our talk we discuss such phenomena, in particular the fascinating probabilistic properties of the trigonometric system and related function series, giving an unusual picture on weak dependence.

Speaker: Philippe Berthet, Université Toulouse III

Title: Biased Brownian Coupling of the Empirical Process of Stationary Weakly Dependent Data.

Abstract: Given a stationnary sequence of weakly dependent random variables $(X_i)_{i\geq 1}$ we consider the empirical process α_n based on $X_1, ..., X_n$ indexed by a Donsker class of functions $\mathcal{F}$. Note that α_n can be viewed as a dependent sum of Banach space valued random variables $\widetilde{X}_i : f \in \mathcal{F} \to f(X_i) \in \mathbb{R}$. Under some conditions on the sequence of mixing coefficients, α_n weakly converges to a limiting Gaussian process $\mathbb{G}_\infty$ indexed by $\mathcal{F}$, this is a Uniform Central Limit Theorem. The problem of the Gaussian coupling of α_n is to build a Gaussian process $\mathbb{G}_n$ close to α_n uniformely over $\mathcal{F}$ and a sharp control of this coupling provides rates in the UCLT. Various rates of Gaussian approximation have been computed by Berthet and Mason in the independent case, when $\mathbb{G}_n$ has the same law as $\mathbb{G}_\infty$. Now, in the mixing case the structure of $\mathbb{G}_\infty$ takes all asymptotic interactions into account so that an accurate Gaussian approximation is no more possible at finite time n. The choice made by Berthet and Settati is to approximate α_n by a simpler Gaussian process $\mathbb{G}_n$ having a covariance close to the covariance of α_n and the limiting covariance of $\mathbb{G}_\infty$. This is what we call covariance biased Gaussian approximations, and we obtain strong invariance principles along the sequence of $\mathbb{G}_n$. Under various hypotheses on $\mathcal{F}$, our computed rates show that even for exponentially mixing sequences it remains a gap with the independent case. This is due to the blocking arguments that are necessary to forget the past periodically, but slow the learning of the covariance of α_n.

Speaker: Rick Bradley, University of Bloomington

Title: A strictly stationary, “causal,” 5-tuplewise independent counterexample to the central limit theorem.

Abstract: A strictly stationary sequence of random variables is constructed with the following properties: (i) the random variables take the values -1 and +1 with probability 1/2 each, (ii) every five of the random variables are independent of each other, (iii) the sequence is “causal” in a certain sense (and hence “isomorphic to a Bernoulli shift”), (iv) the sequence has a trivial double tail sigma-field, and (v) regardless of the normalization used, the partial sums do not converge to a (nondegenerate) normal law (even along a subsequence). The example has some features in common with a recent construction (for an arbitrary fixed positive integer N), by Alexander Pruss and the author [3], of a strictly stationary (ergodic) N-tuplewise independent counterexample to the central limit theorem. This talk will be an expanded version of the talk by the author [1] at the AMS meeting in Bloomington in April 2008. At that time, the paper was in preparation. Since then, the paper has been prepared and posted by the author [2] as a preprint on arXiv. The result is an extension of the one discussed in the talk by the author at the 9th Rencontres Mathematiques de Rouen in 2007.

[1] R.C. Bradley. A strictly stationary, “causal,” 5-tuplewise independent counterexample to the central limit theorem. Abstract 1038-60-39. Abstracts of Papers Presented to the American Mathematical Society 29 (2008) 513.

[2] R.C. Bradley. A strictly stationary, “causal,” 5-tuplewise independent counterexample to the central limit theorem. arXiv:0911.2905v1 [math.PR] 15 Nov 2009.

[3] R.C. Bradley and A.R. Pruss. A strictly stationary, N-tuplewise independent counterexample to the central limit theorem. Stochastic Processes and their Applications 119 (2009) 3300-3318.

Speaker: Fabienne Comte, Université Paris Descartes

Title: Nonparametric methods for dependent data: the example of the Stochastic Volatility model.

Abstract: In my talk, I will describe both the discrete time and the continuous time stochastic volatility model. In discrete time, this model can be seen as an autoregressive model with errors in variables. Therefore, all methods of deconvolution or of regression and variance functions estimation in presence of measurement errors have to be generalized to the dependent context. Most of the time, beta-mixing is considered but new tau-mixing studies are also available. I will describe the estimators with particular attention to the problems related with dependence of the variables. In continuous time, discrete time samples are nevertheless still considered, but high frequency data contexts are often considered: the sample step of observation is small and the number of observations and the time interval of observation are large. Here, the methodology is very different and mean-square strategies can be used. But I will explain what questions related to the dependency of the variables (here, beta-mixing only) have to be answered.

Speaker: Jérôme Dedecker, Université Paris 6
(joint work with Florence Merlevède)

Title: Finkelstein theorem for intermittent maps

Abstract: We prove the compact law of the iterated logarithm for the empirical distribution function of a stationary sequence, under a dependence condition involving only indicators of half lines. The result apply to the Markov chain whose transition operator is the Perron-Frobenius operator of an intermittent map T of the unit interval, but not directly to the iterates of T. We shall see how to use a recent result by Melbourne and Nicol (Annals of Probability 2009) in order to prove the compact law for the empirical distribution function of the iterates of T.

Speaker: Herold Dehling, Ruhr-Universität Bochum
(joint work with Roland Fried, TU Dortmund)

Title: Asymptotic Distribution of Two Sample Empirical U-Quantiles for Dependent Data.

Abstract: Let $(X_i)_{i\geq 1}$, $(Y_i)_{i\geq 1}$ be two stationary ergodic $\mathbb{R}$-valued processes and let $h:\mathbb{R}^2 \to \mathbb{R}$ be a measurable function. We consider the empirical distribution of the values $h(X_i, Y_j)$, $1 \leq i \leq n_1$, $1 < j \leq n_2$, i.e.

$$U_{n_1,n_2}(x) = \frac{1}{n_1\, n_2} \sum_{i=1}^{n_1} \sum_{j=1}^{n_2} 1_{\{h(X_i,Y_j)\leq x\}},$$

as well as the associated two-sample empirical U-quantiles

$$Q_{n_1,n_2}(p) = \inf\{x\, :\, U_{n_1,n_2}(x) \geq p\}.$$

Under suitable conditions on the processes $(X_i)_{i\geq 1}$ and $(Y_i)_{i\geq 1}$, we prove an empirical process central limit theorem for U_{n_1,n_2} and derive from that via a Bahadur-Kiefer representation the asymptotic distribution of $Q_{n_1,n_2}(p)$. As an application, we investigate the asymptotic distribution of the two sample Hodges-Lehmann estimator in the case of dependent data.

Our methods also apply to the study of the empirical distribution of $h(X_i, X_j)$, $1 \leq i \leq n_1 < j \leq n_1 + n_2$, and of the associated empirical U-quantiles, when $(X_i)_{i\geq 1}$ is a single stationary ergodic sequence. This setting has applications in the analysis of nonparametric change-point tests in the case of dependent data.

References:

Herold Dehling and Roland Fried: Robust Estimation for Two-Sample Problems with Dependent Data. *Work in Progress*

Speaker: Mikhail Gordin, V.A. Steklov Institute of Mathematics

Title: Functional limit theorems for von Mises statistics of a measure preserving transformation.

Abstract: In a joint paper with Herold Dehling and Manfred Denker [1], for a measure preserving transformation T of a probability space, a class of functionals of the form

$$x \mapsto \sum_{k_1=0}^{N-1} \cdots \sum_{k_d=0}^{N-1} f(T^{k_1}x, \ldots, T^{k_d}x),$$

x being a generic point, was introduced. Notice that the kernel f here is a function in d variables; this function should admit a well defined restriction to some subsets of measure zero to give sense to the expressions of the form $f(T^{k_1}x, \ldots, T^{k_d}x)$. Suitable classes of kernels are defined in terms of the projective tensor products of the L_p spaces in one variable. The goal was to work out a "coordinate free" analogues of such familiar statistics of stationary processes as von Mises statistics and U-statistics. Among other results, some versions of the CLT for von Mises statistics were established. In the talk some results on functional limit theorems will be discussed. The transformation T is assumed to be non-invertible (which is equivalent to considering adapted kernels in the invertible case). The basic tool is approximation by aggregates of one-dimensional martingale differences.

References

[1] H. Dehling, M. Denker, M. Gordin. *Some limit theorems for von Mises statistics of a measure preserving transformation.* Paper in preparation.

Speaker: Allan Gut, Uppsala University

Title: Between the LIL and the LSL for random fields.

Abstract: In [1] we extend Lai's law of the single logarithm (LSL) for delayed sums or windows to a multiindex setting in which the edges of the $\mathbf{n}$ th window grow like $|\mathbf{n}|^\alpha$ for some $\alpha \in (0,1)$. In [2] we allow the windows to extend with different α's in different directions. A follow-up concerns the question of window sizes which grow faster than this, but not linearly. In [3] we treat this boundary case between the LSL and the LIL when $d = 1$, more precisely, the case when the window size equals $n/L(n)$, for L slowly varying—typically, a(n iterated) logarithm. A multiindex version of the latter is given in [4], which, in [5], is followed by the extension of Chow's strong law to the present context.

I am convinced that Magda is capable of extending much of this to various mixing cases; cf. [6].

References

[1] Gut, A. and Stadtmüller, U. (2008). Laws of the single logarithm for delayed sums of random fields. *Bernoulli* **14**, 249-276.

[2] Gut, A. and Stadtmüller, U. (2008). Laws of the single logarithm for delayed sums of random fields II. *J. Math. Anal. Appl.* **346**, 403-414.

[3] Gut, A., Jonsson, F. and Stadtmüller, U. (2010). Between the LIL and the LSL *Bernoulli* **16**, 1-22.

[4] Gut, A. and Stadtmüller, U. (2009). On the LSL for random fields. *J. Theoret. Probab.* (to appear).

[5] Gut, A. and Stadtmüller, U. (2009). On the strong law of large numbers for delayed sums and random fields. *U.U.D.M. Report* **2009:26** (submitted).

[6] Peligrad, M. and Gut, A. (1999). Almost sure results for a class of dependent random variables. *J. Theoret. Probab.* **12**, 87-104.

Speaker: Adam Jakubowski, Nicolaus Copernicus University

Title: Truncated moments of perpetuities and a central limit theorem for GARCH(1,1) processes.

Abstract: We consider a class of perpetuities which admit direct characterization of asymptotics of the key truncated moment. The class contains perpetuities without polynomial decay of tail probabilities and thus not satisfying Kesten's theorem. We show how to apply the results in deriving a new central limit theorem for GARCH(1,1) processes in a critical case.

Speaker: Oleg Klesov, National Technical University of Ukraine.

Title: A relationship between maximal inequalities and strong laws of large numbers.

Abstract: A general method is exhibited that allows one to

1. derive a Háyek–Rényi type inequality from a maximal inequality, and
2. deduce a SLLN from a Háyek–Rényi type inequality.

An advantage of the presented method is that it does not rely on any assumption about a specific dependence structure of the underlying sequence of random variables.

The well known Kolmogorov SLLN for independent random variables can be obtained by using this method. Another example of possible applications is the Menschoff–Rademacher SLLN for orthogonal random variables. Other examples are also discussed.

The case of random fields also fits this approach. The latter is a stochastic object that depends on several parameters while a sequence depends on one parameter. Some SLLN for random fields are also presented.

Speaker: Sana Louhichi, Université Paris Sud.

Title: Functional central limit theorem in spatio-temporal dependence.

Abstract: I shall first recall the general construction of some stochastic monotone Markov processes, (cf. Liggett 1985). Those models can be found in various fields such that reliability, biology and epidemiology. I shall next describe their dependence structure: they are weakly dependent in space and positively dependent in time. A covariance inequality is established for suitable classes of functions. This covariance inequality allows to prove a functional central limit theorem for the models under discussion. Finally I shall discuss, as an application of the functional limit theorem, a central limit theorem for certain hitting times. This talk is a common work with Paul Doukhan, Gabriel Lang and Bernard Ycart.

Speaker: David Mason, University of Delaware
(joint work with Peter Kevei)

Title: A Tale of Two Inequalities

Abstract: In the first part of my talk I will show how an extension of a quantile inequality due to Komlos, Major and Tusnday (1975) yields a number of interesting couplings of a statistic and a standard normal random variable. These statistics include standardized sums of dependent random variables under various mixing conditions. Associated with these couplings are certain generalized Bernstein-type inequalities. In order to apply these couplings it is often helpful to have a maximal Bernstein-type inequality. This need led to a new and unexpected maximal Bernstein-type inequality, which will be described in the second part of my talk, along with applications. It is especially useful to bound the tails of the maximum of sums of dependent random variable. This part of my talk is based upon joint work with Peter Kevei.

Speaker: Thomas Mikosch, University of Copenhagen
(Joint work with K. Bartkiewicz (Torun), A. Jakubowski (Torun) and O. Wintenberger (Paris Dauphine))

Title: Infinite variance stable limits for sums of dependent random variables.

Abstract: We provide conditions which ensure that the affinely transformed partial sums of a strictly stationary process converge in distribution to an infinite variance stable law. Conditions for this convergence to hold are known in the literature. However, most of these results are qualitative in the sense that the parameters of the limit law are expressed in terms of some limiting point process. In this paper we will be able to determine the parameters of the limiting stable law in terms of some tail characteristics of the underlying stationary sequence. We will apply our results to some standard time series models, including the GARCH process and its squares, the stochastic volatility model and solutions to stochastic recurrence equations.

Speaker: Eric Moulines, Telecom Paris

Title: Limit Theorems for interacting Markov Chain Monte Carlo Algorithms.

Abstract: The interactive Markov chain Monte Carlo algorithms (MCMC) form a new class of methods showing much better mixing property than the traditional MCMC algorithms in difficult scenarios (e.g. molecular dynamic or Bayesian inverse problem). Instead of running a single Markov Chain, several chain are run in parallel and interactions of the a given chain with the whole past of the chain are permitted (a chain may be restarted from a value drawn in the past of the previous chain). The analysis of such scheme is of course difficult because the Markovian property is no longer retained. We will in this talk survey the results that we have obtained so far in this direction, explaining the tools used in the proof. This talk is based on a joint work with Gersende Fort, Pierre Priouret and Pierre Vandekerkhove.

Speaker: Clémentine Prieur, Université Joseph Fourier
(joint work with Elena Di Bernardino and Véronique Maume-Deschamps)

Title: Estimating Bivariate Tails.

Abstract: We consider the general problem of estimating the tail of a bivariate distribution. An extension of the threshold method for extreme values is developed, using a two-dimensional version of the Pickands-Balkema-de Hann Theorem. We construct a two-dimensional tail estimator and we provide its asymptotic properties. The dependence structure between the marginals is described by a copula.

Speaker: Emmanuel Rio, Université de Versailles

Title: Almost sure invariance principles for stationary weakly dependent sequences.

Abstract: In this talk, we give precise rates of convergence in the strong invariance principle for the partial sums associated to a weakly dependent sequences. We give applications of these results to strongly mixing sequences and to some dynamical systems on the unit interval.

Speaker: Murray Rosenblatt, University of California
(joint work with Keh-shin Lii)

Title: Problems of estimation for processes with almost periodic covariance function.

Abstract: Random processes with almost periodic covariance function are considered from a spectral outlook. Given suitable conditions, spectral estimation problems are discussed for processes of this type that are neither stationary nor locally stationary. Spectral mass is concentrated on lines parallel to the main diagonal in the spectral plane. A method of estimation of the support of spectral mass under appropriate restraints is considered. Some open questions are discussed. Extension of the methods for processes with mean value function a trigonometric regression is noted.

Speaker: Donatas Surgailis, University of Vilnius
(joint work with Donata Puplinskaitė (Vilnius university))

Title: Aggregation of random coefficient AR(1) process with infinite variance.

Abstract: Contemporaneous aggregation of N independent copies of AR(1) process with random slope coefficient $a \in (-1, 1)$ and i.i.d. innovations belonging to the domain of attraction of $\alpha-$stable law $(0 < \alpha < 2)$ is discussed. We show that, under normalization $N^{1/\alpha}$, the limit aggregate exists, in the sense of weak convergence of finite-dimensional distributions, and is a mixed stable moving average as studied in Surgailis, Rosinski, Mandrekar and Cambanis (1993). The main attention is given to the case of slope coefficient a having probability density vanishing regularly at $a = 1$ with exponent $b \in (0, \alpha - 1)$, for $\alpha \in (1, 2)$. We show that in this case, the limit aggregate $\{\bar{X}_t\}$ exhibits long memory. In particular, for $\{\bar{X}_t\}$, we investigate the decay rate of the codifference, the limit of partial sums, and the long-range dependence (sample Allen variance) property of Heyde and Yang (1997).

Speaker: Dag Tjoestheim, University of Bergen

Title: Limit theorems for nonstationary threshold processes

Abstract: Markov theory for null recurrent chains is used to establish asymptotic distributions for parameter estimates in a threshold model, where one regime is stationary and the other one is a nonstationary unit root regime. The convergence rate is slower than the square-root-n rate in the stationary regime and faster than this rate in the unit root case. Appropriately scaled, the distribution is asymptotically normal in the stationary regime, but not in the unit root regime. The theory is illustrated by simulation and a real data example.

Speaker: Ciprian Tudor, Université Lille 1

Title: Hsu-Robbins theorem for the correlated sequences.

Abstract: A famous result by Hsu and Robbins says that if $X_1, X_2, \ldots$ is a sequence of independent identically distributed random variables with zero mean and finite variance and $S_n := X_1 + \ldots + X_n$, then $\sum_{n \geq 1} P(|S_n| > \varepsilon n) < \infty$ for every $\varepsilon > 0$. We will analyze this result in the case when the random variables X_i are correlated (they are related to the increments of the fractional Brownian motion). Our techniques are based on multiple stochastic integrals, Malliavin calculus and Stein's method.

Speaker: Sergey Utev, University of Nottingham

Title: Inequalities for Dependent Variables.

Abstract: I review moment and maximal moment inequalities under various type of dependence. Several open questions inspired by discussions with Magda Peligrad will be outlined.

Speaker: Dalibor Volný, Université de Rouen

Title: On martingale approximation of stationary processes.

Abstract: For a given stationary process and a filtration, we will study the existence of an approximating martingale.

Speaker: Michael Woodroofe , University of Michigan

Title: Central Limit Theorems For Superlinear Processes.

Abstract: The Central Limit Theorem is studied for stationary sequences that are sums of countable collections of linear processes. Two sets of sufficient conditions are obtained. One restricts only the coefficients and is shown to be best possible among such conditions. The other involves an interplay between the coefficients and the distribution functions of the innovations and is shown to be necessary for the Conditional Central Limit Theorem in the case of a causal process with independent innovations.

Speaker: Wei Biao Wu , University of Chicago

Title: Strong Invariance Principles under Dependence.

Abstract: I will talk about strong invariance principles for stationary processes. Under appropriate conditions on physical dependence measures (Wu, 2005), we show that strong invariance principle holds with nearly optimal rates, up to a multiplicative logarithmic factor. I will also discuss Gaussian approximations for non-stationary processes.