Raluca Balan

University of Ottawa

A functional limit theorem for linear sequences with heavy tails, in a non-Skorohod topology

Abstract

In the recent years, there has been an increased interest in investigating the asymptotic behavior of random variables with heavy tails, which arise naturally in various models for financial data. The oldest result in this direction is the stable limit theorem whose proof can be found in Feller's book (1971). This theorem states that the sum $S_n = \sum_{i=1}^n X_i$ of a sequence $(X_i)_{i\geq 1}$ of i.i.d. random variables with regularly varying tails of index $\alpha \in (0,2)$, normalized by a suitable constant a_n, converges in distribution to an α-stable random variable. The functional version of this result is due to Skorohod (1957) and gives the convergence in distribution of the process $\{S_{[nt]}\}_{t\geq 0}$ in the space $D[0,\infty)$ of cadlag functions (equipped with the Skorohod topology J_1) to an α-stable Lévy process. In 1986, Resnick gave a new proof of this result using a powerful idea based on the convergence of a sequence $(N_n)_n$ of point processes, each process N_n consisting of the points $(i/n, X_i/a_n)$ with $i \geq 1$ (an idea which can be traced back to Durrett and Resnick, 1978). In 1985, Davis and Resnick applied this idea to the more complex situation of linear sequences of the form $X_i = \sum_{j\in Z} c_j Z_{i-j}$, where $(Z_i)_i$ are i.i.d. random variables with heavy tails. However, as it was shown by Avram and Taqqu (1992), this result cannot be extended to a functional convergence result in the Skorohod topology J_1; on the other hand, if the coefficients $(c_j)_j$ have the same sign, then the functional convergence holds in the Skorohod topology M_1. This result was proved using the classical method of convergence of finite-dimensional distributions plus tightness. In the present talk, we will present a similar functional convergence result for a linear sequence whose coefficients do not necessarily have the same sign, in a weaker (non-Skorohod) topology on the space $D[0,\infty)$ introduced by Jakubowski (1997). Our proof will be based on the point process convergence. Various applications of this result will be discussed. This talk is based on joint work with Adam Jakubowski (Torun, Poland) and Sana Louhichi (Grenoble, France).

István Berkes

Graz University of Technology

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. 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 system $\{n\alpha\}$ and related problems for the convergence of sums $\sum c_k f(kx)$ for periodic measurable functions f.

David Brillinger

University of California, Berkeley

Stochastic Gradient Systems: Some Properties and Some Applications

Abstract

A gradient system is a dynamical system

$$x' = -\text{grad}\, V(x)$$

where V is real-valued, x is in a euclidian space, and where grad is the gradient, i.e. the vector of partial derivatives with respect to the individual coordinates of x. The system may be made stochastic in a variety of ways. Probabilistic properties that have been developed for the stochastic case will be reviewed. A variety of applications to trajectory analysis will be presented. An advantage in modelling is that the (unknown) function V is real-valued.

Alexander Bulinski

Lomonosov Moscow State University

New Statistical Methods for Analysis of Complex Diseases Risks

Abstract

We discuss the statistical problems of identification of the most significant combinations of genetic and nongenetic factors which could increase the risk of a complex disease. New theorems are proved to justify different methods of data analysis in the framework of specified stochastic models. The main attention will be paid to the new version of the MDR-method, various modifications of logic regression and machine learning methods. We apply the techniques of random trees, stochastic optimization and the random fields theory. The applications to analysis of cardio-vascular diseases (see [1]) are provided as well.

The work is partially supported by RFBR grant 10-01-00397.

Bibliography:

1. A.Bulinski, O.Butkovsky, V.Sadovnichy, A.Shashkin, P.Yaskov, A.Balatskiy, L.Samokhodskaya and V.Tkachuk *Statistical methods of SNP data analysis and applications.* Open Journal of Statistics, vol. 2, no. 1, 2012, 73–87.

Murray Burke

University of Calgary

Survival Models with Staggered Entries: A Change-Point Problem

Abstract

Staggered-entry semiparametric models, where the hazard rate depends on a vector of covariates, are considered. In this model there are two time axes to consider, the survival time of the patient (time after entering until reoccurrence or death) and the calendar time, the time since the start of the study. One instance of this is where subjects enter the study at random times and then are followed. These patients undergo treatment just after entering. Tests based on estimated martingale residuals will be considered where one wishes to determine if the model changes at some (calendar) time. It is shown that repeated significance tests are more appropriate than pure sequential tests for this model.

Endre Csáki

Alfréd Rényi Institute of Mathematics

Results and problems for anisotropic random walk on the plane I

Abstract

The anisotropic random walk has a huge literature, we and Miklós, our celebrated host, have spent some time to study it as well. This kind of random walk on the plane is defined by the transition probabilities

$$\mathbf{P}(\mathbf{C}(N+1) = (k \pm 1, j) | \mathbf{C}(N) = (k, j)) = \frac{1}{2} - p_j,$$

$$\mathbf{P}(\mathbf{C}(N+1) = (k, j \pm 1) | \mathbf{C}(N) = (k, j)) = p_j,$$

for $(k, j) \in \mathbb{Z}^2$, $N = 0, 1, 2, \ldots$, where $0 < p_j \le 1/2$, $j = 0, \pm 1, \pm 2, \ldots$, $\min p_j < 1/2$. The asymptotic results for the components depend on the sequence $\{p_j\}$. In particular, the number of horizontal steps can be approximated by the additive functional of the vertical component:

$$\sum_{j=-\infty}^{\infty} \xi(j, n) \frac{1 - 2p_j}{2p_j},$$

where $\xi(j, n)$ is the local time of vertical random walk. We give some results and problems concerning this additive functional in different cases: (1) p_j are separated from both 0 and 1/2, (2) p_j can be small for large $|j|$, (3) $1/2 - p_j$ can be small for large $|j|$. We can obtain different behaviors in these 3 cases.

Joint work with A. Földes and P. Révész.

Miklós Csörgő

Carleton University

Asymptotic methods in stochastic

Donald Dawson

Carleton University

Path properties of fifty years of research in Probability and Statistics: a tribute to Miklós Csörgő

Abstract

Over the past fifty years Miklós Csörgő has produced a remarkable series of contributions of great importance to probability and statistics that have had a profound impact on the development of these subjects. At the same time he has provided inspiration for the host of graduate students and postdoctoral fellows he has supervised and who have gone on to have an important impact on the development of probability and statistics across Canada and abroad. In my talk I will give some personal observations on his exceptional contributions to our discipline and our years together as colleagues.

Herold Dehling

Ruhr-University Bochum

Nonparametric Change-Point Tests for Long-Range Dependent Data

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 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 against the alternative that there is a level shift somewhere in the process, i.e.

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

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 occurred. We assess the finite-sample behavior of our test via a simulation study which shows that for heavy-tailed data, our test outperforms the classical cusum test. In some cases, 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 sequence of level shifts $h_n \to 0$. We obtain the somewhat surprising result that for Gaussian data, the Wilcoxon test has the same asymptotic power as the cusum test.
(This is joint work with Murad Taqqu (Boston) and Aeneas Rooch (Bochum).)

Bibliography:

1. H. Dehling, A. Rooch and M. S. Taqqu: Non-Parametric Change-Point Tests for Long-Range Dependent Data. *Scandinavian Journal of Statistics* (2012, to appear).

Dianliang Deng

University of Regina

Precise asymptotics in the deviation probability series of self-normalized sums

Abstract

Let $\{X, X_n, X_{\mathbf{n}}; n \in Z_+, \mathbf{n} \in Z_+^d\}$ be the independent and identically distributed (i.i.d.) random variables on a probability space $(\Omega, \mathcal{F}, P)$ where Z_+ denotes the set of positive integers and Z_+^d denotes the positive integer d-dimensional lattice with coordinate-wise partial ordering $\leq$. The notation $\mathbf{n} \leq \mathbf{m}$, where $\mathbf{m} = (m_1, m_2, ..., m_d)$ and $\mathbf{n} = (n_1, n_2, ..., n_d)$, thus means that $m_k \leq n_k$, for $k = 1, 2, ..., d$ and also $|\mathbf{n}|$ denotes $\prod_{k=1}^d n_k$, $\mathbf{n} \to \infty$ means $n_k \to \infty$ for $k = 1, 2, ..., d$. Set $S_n = \sum_{i=1}^n X_i, W_n^2 = \sum_{i=1}^n X_i^2, S_{\mathbf{n}} = \sum_{\mathbf{k} \leq \mathbf{n}} X_{\mathbf{k}}$, and $W_{\mathbf{n}}^2 = \sum_{\mathbf{k} \leq \mathbf{n}} X_{\mathbf{k}}^2$ where $n \in Z_+$ and $\mathbf{n} \in Z_+^d$. In the classical limit theory, the focus is on the asymptotic properties for the normalized partial sum $S_n/(EW_n^2)^{1/2}$ under the finite second moment assumption. However the current interest lies in studying the same properties for the self-normalized sums S_n/W_n without the finite moment assumption. In fact, the limit theorems of self-normalized sums have resulted in more and more attention and been widely used in statistical analysis. Griffin and Mason derived the asymptotic normality. Giné, Götze and Mason studied the asymptotic properties of the Student t-statistic

$$T_n = \frac{S_n}{W_n} \left(\frac{n-1}{n - (S_n/W_n)^2} \right)^{1/2}$$

and proved the asymptotic normality of T_n under some conditions. Most recently, Csörgő and Martsynyuk established functional central limit theorems for self-normalized type versions of the vector of the introduced least squares processes for (β, α), as well as for their various marginal counterparts for each of the least squares processes alone. They also discussed joint and marginal central limit theorems for Studentized and self-normalized type least squares estimators of the slope and intercept. Their results provide a source for completely data-based asymptotic confidence intervals for β and α. In the present talk we examine the precise asymptotic behavior for the general deviation probability series of self-normalized sums, S_n/W_n and $S_{\mathbf{n}}/W_{\mathbf{n}}$, for singly indexed random variables $\{X_n; n \in Z_+\}$ and multidimensionally indexed random variables $\{X_{\mathbf{n}}; \mathbf{n} \in Z_+^d\}$. The results can be considered as the generalization of that in the complete moment convergence, law of iterated logarithm and large deviation for self-normalized sums.

Richard Dudley

MIT

On p-variation and differentiability in survival analysis

Abstract

Major and Rejto in 1988 showed that over an interval $[0, T]$ on which the Kaplan-Meier estimator is asymptotically defined and bounded away from 0 by some $\delta > 0$, the estimator converges uniformly to the true survival function, and the difference, times $\sqrt{n}$, converges in distribution with respect to the supremum norm to a Gaussian pro- cess at a rate $log(n)/\sqrt{n}$. This is the well-known Komlós, Major and Tusnáady rate in the absence of censoring, so the rate is clearly optimal with censoring. Using Major and Rejto's construction, I show convergence with the supremum norm replaced by the stronger q-variation norms for $2 < q < 4$, but at slower rates. For $q = 3$ the rate proved is $O(n^{\epsilon-1/6})$ for any $\epsilon > 0$, which comes within ϵ of the optimal rate in the absence of censoring. For $q \leq 2$ convergence fails, and for $q \geq 4$, some remainder terms in the proof would not converge to 0 at all. As q decreases from 3 toward 2, the rate would become slower, also in the absence of censoring. As q increases from 3 toward 4, some terms in the proof would converge to 0 more slowly. The proof is based on facts found for the classical empirical process in q-variation norm for $2 < q < \infty$ by Yen-Chin Huang (Ph. D. thesis 1994, Ann. Prob. 2001) and in p- variation for $1 < p < 2$ by Jinghua Qian (Ann. Prob. 1998), and facts on differentiability of several functionals with respect to p-variation norms, in the book *Concrete Functional Calculus* with Rimas Norvaiša (Springer, 2010).

Shui Feng

McMaster University

Gamma-Dirichlet Structure

Abstract

The Gamma-Dirichlet structure corresponds to the decomposition of the gamma process into the independent product of a gamma random variable and a Dirichlet process. This structure allows us to study the properties of the Dirichlet process through the gamma process and vice versa. In this talk, we present several new results on this structure and its dynamical analogue including the large deviations of the jump sizes of the gamma process, the quasi-invariance of the two-parameter Poisson-Dirichlet distribution, and an alternative proof of the reversibility of the Fleming-Viot process.

Antonia Földes

College of Staten Island, CUNY

Results and problems for anisotropic random walk on the plane II

Abstract

In this second talk we will discuss some results and open questions about recurrence and transience, range and local time. We will concentrate on the following special cases:

a./ Comb:

$$p_0 = 1/4,\ p_i = 1/2, \quad i \neq 0.$$

b./ Vertically slowing down walk:

$$p_0 = 1/4, \quad p_i = p_{-i} \quad \text{and} \quad p_i \to 0 \quad \text{for} \quad i = 1, 2, \cdots .$$

c./ Half plane half comb walk:

$$p_i = 1/4 \quad \text{for} \quad i = 0, 1, 2, \cdots \quad \text{and} \quad p_i = 1/2 \quad \text{for} \quad i = -1, -2, \cdots .$$

Joint work with E. Csáki and P. Révész.

Peter Glynn

Stanford University

A Flexible Point Process Model for Describing Arrivals to a Service Facility

Abstract

In many applied settings, one needs a description of incoming traffic to the system. In this talk, we argue that the Palm-Khintchine superposition theorem dictates that the process should typically look "locally Poisson". However, there are usually obvious time-of-day effects that should be reflected in the model. Furthermore, in many data sets, it appears that medium-scale burstiness is also present. In this talk, we consider a Poisson process that is driven by a mean-reverting Feller "square root" diffusion as a flexible vehicle for modeling such traffic. We argue that this model is tractable computationally, is parsimonious, has physically interpretable parameters, and can flexibly model different behaviors at different scales. We discuss different estimation methods and hypothesis tests that are relevant to this model, and illustrate the ideas with call center data. This work is joint with Jeff Hong and Xiaowei Zhang.

Edit Gombay

University of Alberta

Sequential monitoring and change detection

Abstract

We consider new sequential monitoring strategies, and compare them to open ended strategies. Their advantages are demonstrated, and some examples from applications are presented. These include multi-armed longitudinal clinical trials, monitoring surgical performance, and time series type data. The methods are simple and relatively easy to apply. Their theoretical background relies on stochastic processes that can be approximated by Brownian motions. One can describe these monitoring procedures as the continuous time versions of the well-known Pocock and O'Brien-Fleming group sequential procedures.

Karl Grill

TU Wien

On the ergodic properties of a simple model from statistical mechanics

Abstract

One of the simplest conceivable models in statistical mechanics consists of two particles moving on a line segment and undergoing elastic collisions with each other and the with walls of the container. To this model, we add a square-well interaction between the particles and study the ergodic properties of the resulting system.

Lajos Horváth

University of Utah

Change–point detection in panel data

Abstract

We consider N panels and each panel is based on T observations. We are interested to test if the means of the panels remain the same during the observation period against the alternative that the means change at an unknown time. We provide tests which are derived from a likelihood argument and they are based on the adaptation of the CUSUM method to panel data. Asymptotic distributions are derived under the no change null hypothesis and the consistency of the tests are proven under the alternative. The asymptotic results are shown to work in case of small and moderate sample sizes via Monte Carlo simulations.

Gail B. Ivanoff

University of Ottawa

Martingale methods for planar point processes

Abstract

Martingale techniques play a fundamental role in the analysis of point processes on $[0, \infty)$. For example, the compensator of a point process uniquely determines and is determined by its distribution, and an explicit formula involving conditional interarrival distributions is well-known. The asymptotic distribution of a sequence of point processes can be determined by the behaviour of the corresponding sequence of compensators. Furthermore, martingale methods lead to powerful nonparametric estimation techniques which are key to the analysis of censored data. Extensions of martingale methods to point processes on $[0, \infty)^2$ have met with some success. In two dimensions there are many possible definitions of a point process compensator, and we will focus on the one that has been the most useful in practice: the so-called *-compensator. Although existence of the *-compensator is well understood, in general it does not determine the law of the point process and it must be calculated on a case-by-case basis. However, when a certain property of conditional independence (usually denoted by (F4)) is satisfied, the *- compensator determines the law of the point process and an explicit formula can be given. The basic building block of the planar model is the *single line* process (a point process with incomparable jump points). Its law can be characterized by a class of avoidance probabilities which are the two-dimensional counterpart of the interarrival distributions on $[0, \infty)$. Conditional avoidance probabilities then play the same role in the construction of the *-compensator as conditional interarrival distributions do for compensators in one dimension. These facts have many applications, including a new martingale approach to nonparametric inference for renewal processes in both one and two dimensions.

Jana Jurečková

Charles University in Prague

Asymptotics versus finite-sample in statistical estimation

Abstract

Many estimators are asymptotically normal with increasing number of observations. However, some of their properties are always non-asymptotic, despite a widely accepted view that the virtues corresponding to moderate sample sizes are inherited from the asymptotic normality. The asymptotic (normal) distribution of an estimator approximates well the central part, but not the tails of its true distribution. Robust estimators, advertised as resistant to heavy-tailed distributions, can be themselves heavy-tailed. Though asymptotically admissible, many are not finite-sample admissible for any distribution. A classical example is the sample median which is not finite-sample admissible with respect to any convex loss even for the Laplace distribution, for which it is the maximum likelihood estimator. It is widely believed in that using robust procedures prevents the shortages of classical procedures; typically their insensitivity to the heavy-tailed distributions is often cited. This is true only to some extent. It can be shown that distribution of an equivariant estimator of location is heavy-tailed for any finite n provided the parent distribution is heavy tailed. Although the Pareto exponent of tails of an estimator increases with n, its distribution never gets exponentially tailed.

Moreover, when we consider the one- or k-step version of an estimators in linear model, starting with a consistent initial estimator (the Newton-Raphson iteration), then its asymptotic distribution coincides with that of the non-iterated estimator. However, we can show that its tail-behavior is determined by that of the initial estimator. Hence, before taking a recourse to the asymptotics, we should first analyze finite-sample properties of an estimator, whenever possible. We illustrate some of the most distinctive differences between the asymptotic and finite-sample properties of robust estimators.

References:

1. J. Jurečková and L. B. Klebanov (1997). Inadmissibility of robust estimators with respect to L_1-norm. L_1-Statistical Procedures and Related Topics (Y. Dodge, ed.). *IMS Lecture Notes - Monographs Series* 31, 71-78.
2. J. Jurečková and L. B. Klebanov (1998). Trimmed, Bayesian and admissible estimators. *Statist. and Probab. Letters* 42, 4751. [3]
3. J. Jurečková and J. Picek (2011). Finite-sample behavior of robust estimators In: Recent Researches in Instrumentation, Measurement, Circuits and Systems (S. Chen, N. Mastorakis, F. Rivas-Echeverria, V. Mladenov, eds.), pp. 1520.
4. J. Jurečková and R. Sabolová (2011). Finite-sample density and its small sample asymptotic approximation. *Statist. Probab. Letters* 81, 1311-1318.
5. Jurečková (2012). Tail-behavior of estimators and of their one-step versions. *Journal de la Société Francaise de Statistique* (to appear).

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Reg Kulperger

University of Western Ontario

Rare Multinomial and A Poisson Limit Law

Abstract

A well known result in probability is the Poisson limit for rare independent Bernoulli trials. McDonald (1980) extended this to a multinomial setting. An interesting data type is a survival process in which one observes many individuals over time periods. The risk set is all those available at the beginning of each time period, thus the same individual can appear in successive risk sets. Individuals exit rarely. In our motivating example these are corporations who exit a public trading system by default or merger, so there are several exit types, hence the multinomial setting. We study the numbers of exits over time. Under rare multinomial conditions we show that the exits types converge to independent Poisson laws with respect to the exit types (analogue of McDonald) and also with respect to time. This is a joint work with Taehan Bae.

Deli Li

Lakehead University

A Refinement of the Kolmogorov-Marcinkiewicz-Zygmund Strong Law of Large Numbers

Abstract

Let $\{X_n;\ n \geq 1\}$ be a sequence of independent copies of a real-valued random variable X and set $S_n = X_1 + \cdots + X_n,\ n \geq 1$. This talk is devoted to a refinement of the classical Kolmogorov-Marcinkiewicz-Zygmund strong law of large numbers. In particular, we show that for $0 < p < 2$,

$$\sum_{n=1}^{\infty} \frac{1}{n} \left(\frac{|S_n|}{n^{1/p}} \right) < \infty \ \text{ almost surely}$$

if and only if

$$\begin{cases} \mathbb{E}|X|^p < \infty & \text{if } \ 0 < p < 1, \\ \mathbb{E}X = 0,\ \displaystyle\sum_{n=1}^{\infty} \frac{|\mathbb{E}XI\{|X| \leq n\}|}{n} < \infty, \text{ and } \sum_{n=1}^{\infty} \frac{\int_{\min\{u_n, n\}}^{n} \mathbb{P}(|X| > t)dt}{n} < \infty & \text{if } \ p = 1, \\ \mathbb{E}X = 0 \text{ and } \displaystyle\int_0^{\infty} \mathbb{P}^{1/p}(|X| > t)dt < \infty & \text{if } \ 1 < p < 2, \end{cases}$$

where $u_n = \inf\left\{t :\ \mathbb{P}(|X| > t) < \frac{1}{n}\right\},\ n \geq 1$. Versions of above results in a Banach space setting are also presented. To establish these results, we invoke the remarkable Hoffmann-Jørgensen (1974) inequality to obtain some general results for for sums of the form $\sum_{n=1}^{\infty} a_n \left\| \sum_{i=1}^{n} V_i \right\|$ (where $\{V_n;\ n \geq 1\}$ is a sequence of independent B-valued random variables and $a_n \geq 0,\ n \geq 1$) which may be of independent interest but which we apply to $\sum_{n=1}^{\infty} \frac{1}{n} \left(\frac{|S_n|}{n^{1/p}} \right)$. (Joint work with with Yongcheng Qi and Andrew Rosalsky). Part of this work has been published in Journal of Theoretical Probability (2011) 24: 1130-1156.

Zhengyang Lin

Zhejiang University

Weak convergence to stochastic integrals

Abstract

Weak convergence of various general functionals of partial sums of dependent random variables (statistics) to stochastic integrals now play an important role in the modern statistical theory. In this work, we obtain the weak convergence of various general functionals of partial sums of causal processes to stochastic integrals driven by both the Brownian motion and Lévy-stable process.

Peter March

Ohio State University

Models of semiflexible polymers in dilute solution

Abstract

We review the Freely Rotating Chain model of a semiflexible polymer in dilute solution and describe it's scaling limit. We also discuss recent results on physically motivated modifications of the model.

Yuliya Martsynyuk

University of Manitoba

Invariance Principles for a Multivariate Student Process in the Generalized Domain of Attraction of the Multivariate Normal Law

Abstract

For a d-variate Student process based on independent copies of a random vector X, with trajectories in the space of $\mathbb{R}^d$-valued cadlag functions on $[0,1]$, our main result establishes a uniform Euclidean norm approximation in probability with a sequence of appropriate d-variate processes with Wiener process components, assuming that X is in the generalized domain of attraction of the multivariate normal law (GDAN) and some additional conditions. As a consequence, a functional central limit theorem is also concluded for the Student process. The condition $X \in \mathrm{GDAN}$ for these invariance principles is shown to be not only sufficient, but also necessary.

Don McLeish

University of Waterloo

Almost exact simulations using Characteristic Functions

Abstract

Asymptotic statistics explores the questions like when and how do functions of observed data behave like functions of normal random variables? and much of the work of Miklos Csorgo and his coauthors can be described analogously as when and how do functionals of an observed path behave like the those of corresponding Gaussian processes? . For much of the past century, asymptotics provided the main approximation tool in probability and statistics. Although it is now supplemented with other approximation tools such as numerical methods and simulation, asymptotics remains a key to understanding the behaviour or random phenomena. This being said, we will present in this talk an approach to simulation using a version of the inverse characteristic function which permits virtually unbiased simulations. Specific examples include simulating properties of Brownian meanders, applied to pricing multilevel Parisian options, and pricing forward starting options in the Heston stochastic volatility model. This is joint work with Carole Bernard and Zhenyu Cui.

Masoud Nasari

Carleton University

Central Limit Theorems for Randomized Partial sums: Application to randomized and bootstrapped confidence intervals for the population mean

Abstract

In this talk conditional and unconditional central limit theorems (CLT's) will be presented for properly normalized randomized sums of independent and identically distributed random variables and their rate of convergence will be derived. These CLT's will be employed to establish randomized asymptotic $100.\alpha\%$, $0 < \alpha < 1$, confidence intervals (RCI) for the population mean of the data. Then, these newly introduced RCI's will be compared to the classical bootstrapped confidence intervals.

This talk is based on joint works with Miklós Csörgő.

Emmanuel Parzen

Texas A&M University

Modeling, Dependence, Classification, United Statistical Science, Many Cultures

Abstract

Two fundamental problems of Modern Applied Statistics are the dependence problem and the classification-dependence problem. A basic dependence problem observes many variables (features); we seek to identify (select) which pairs of variables are most dependent, and on the scatter plot of each pair display non-parametrically computed conditional mean and conditional quantile. A basic classification dependence problem observes (Y, X) where Y is binary and X can have p variables; we seek rules to non-parametrically predict (classify) Y from X . Our approach will be outlined by discussing following topics: Four aspects for research to have impact; many cultures of united statistical science; modeling (X, Y), unification of discrete and continuous variables; comparison probability, copula, Bayes theorem; Classification, hepatitis data example; Dependence, detect novel association; Comparison density, copula density of (X, Y), score functions; Conditional mean $E[g(Y)|X]$ estimation; LP comoments $LP(j, k; X, Y)$ to identify most dependent variables; Logistic regression, maximum entropy density estimation. This is a joint work with Subhadeep Mukhopadhyay.

Magda Peligrad

University of Cincinnati

Asymptotic Properties of Linear Processes with Long Memory

Abstract

We shall discuss the central limit theorem and convergence to fractional Brownian motion for long memory time series having independent innovations with infinite second moment. For the sake of applications we derive the self-normalized version of this theorem. The study is motivated by models arising in economical applications where often the linear processes have long memory, and the innovations have heavy tails. The talk is based on joint work with Hailin Sang.

J.N.K. Rao

Carleton University

Large Sample Theory for Sampling from Finite Populations: an overview

Abstract

Extensive asymptotic theory exists for the IID case. IID assumption is not satisfied in the case of survey sampling due to finiteness of the population, unequal selection probabilities, clustering and stratification. In this talk, I will trace some key developments in large sample theory for surveys, based on extensions and modifications of the IID theory. I will present some central limit theorems and results on design-consistency of estimators and associated variance estimators that can be used to construct asymptotically valid confidence intervals on finite population parameters. Some recent work on goodness-of-fit tests will also be mentioned.

Bruno Remillard

HEC Montreal

Empirical processes for consecutive residuals of ARMA models and its applications

Abstract

In view of applications to diagnostic tests of ARMA models, the asymptotic behavior of multivariate empirical and copula processes based on residuals of ARMA models is investigated. Multivariate empirical processes based on squared residuals and other functions of the residuals are also investigated. It is shown how these processes can be used to develop distribution free tests of change-point analysis and serial independence. It is also demonstrated that these empirical processes provide an easy mechanism for developing goodness-of-fit tests for the distribution of the innovations, and that the well-known Lilliefors test can be applied to the residuals of ARMA models without any change.

Pál Révész

Alfréd Rényi Institute of Mathematics

On the area of the largest square covered by a comb-random-walk

Abstract

In the last 5 years Miklós and some of his friends (Bandi, Toncsi and myself) investigated the properties of the comb-random-walk. In the present paper I continue this project. I am interested in the area of the largest disc around the origin completely covered by a comb-random-walk.

Murray Rosenblatt

UC, San Diego

Short range and long range dependence

Abstract

A discussion of the evolution of a notion of strong mixing as a measure of short range dependence and with additional restrictions a sufficient condition for a central limit theorem, is given. A characterization of strong mixing for stationary Gaussian sequences is noted. Examples of long range dependence leading to limit theorems with nonnormal limiting distributions are specified. Open questions concerning limit theorems for finite Fourier transforms are remarked on. There are also related queries on the use of Fourier methods for a class of nonstationary sequences.

Susana Rubin-Bleuer

Statistic Canada

Counting processes, survival analysis and the joint design-model space

Abstract

Survival data from complex surveys are subject to selection bias and clustering due to the sampling design. Results developed for a random sample from a 'super-population' model may not apply. The martingale approach to the statistical analysis of censored failure time data has provided a unifying counting process framework. However, the theory cannot be directly applied to the joint design-model space used by survey statisticians to analyze survival data from complex surveys. Tools of counting processes can be easily extended to this joint design-model space. This enables us to develop non-parametric and semi-parametric survival methods for the analysis of survey data. We present some applications of this methodology and illustrate its advantages.

Tom Salisbury

York University

Random walk in degenerate random environment

Abstract

I will speak about some RWRE results on the two-dimensional integer lattice, in which there are forbidden transitions. This means abandoning the uniform ellipticity conditions typically assumed in the study of RWRE, and instead resolving percolation questions for naturally associated directed random graphs. This is joint work with Mark Holmes (Auckland).

Qi-Man Shao

Hong Kong University of Science & Technology

Testing for Independence and m-Dependence in High and Ultra-High Dimension

Abstract

Consider a random sample of size n from a p-dimensional population distribution. To test whether the p-variates of the population are independent, the coherence of the sample correlation matrix has been used a test statistic and its limiting distribution proved to be an extreme distribution of type I. It is well-understood that the rate of convergence for this type of extreme distribution is typically slow, of order of $O(1/\log n)$. In this talk we introduce a new test statistic and prove that the new statistic also has an extreme distribution of type I but with a rate of convergence $O((\log n)^3/n^{1/2})$. Necessary and sufficient conditions for the asymptotic distribution of the coherence as well as applications to testing for m-dependence in ultra-high dimension will also be discussed.

Zhan Shi

Université Paris VI

Martingales in a branching random walk

Abstract

I am going to discuss asymptotic properties of some martingales naturally associated with the branching random walk. Joint work with E. Aidekon

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Josef G. Steinebach

University of Cologne

On the Reaction Time of Moving Sum Detectors

Abstract

In this talk, we discuss some asymptotics, under the null hypothesis as well as under the alternative, concerning the reaction time of on-line monitoring schemes to detect a change in the mean. The stopping rules are based on "moving sums", that is, they sequentially compare a "training sample" of size m to the average of the $h = h(m)$ most recent observations. Perhaps surprisingly, the limit distributions (as $m \to \infty$) crucially depend on the asymptotic relation of h and m, posing potential problems in applications. A small simulation study will also be presented to illustrate the theoretical results.

The talk is based on joint work with A. Aue (Davis), L. Horváth (Salt Lake City), and M. Kühn (Cologne).

Qiying Wang

University of Sydney

Martingale limit theorem revisited and non-linear cointegrating regression

Abstract

For a certain class of martingales, the convergence to mixture normal distribution is established under the convergence in distribution for the conditional variance. This is less restrictive in comparison with the classical martingale limit theorem where one generally requires the convergence in probability. The extension partially removes a barrier in the applications of the classical martingale limit theorem to non-parametric estimates and inferences with non-stationarity, and enhances the effectiveness of the classical martingale limit theorem as one of the main tools in the investigation of asymptotics in statistics, econometrics and other fields. The main result is applied to the investigations of asymptotics for the conventional kernel estimator in a nonlinear cointegrating regression, which improves the existing works in literature.

Martin Wendler

Ruhr-University Bochum

Robust Change Point Detection under Dependence

Abstract

Classic change point tests are based on partial sums, but heavy tailed might lead to false rejection or false acceptance of the hypothesis (no change). We present robust tests for structural breaks under dependence based on the on-sample or the two-sample Hodges-Lehmann estimator. The test statistic is the difference of the median of the pairwise means respectively the median of the differences. To investigate its asymptotic behavior, we prove a functional central limit theorem for on-sample and for two-sample -U-quantiles. Our results apply to observations which are near epoch dependent on an underlying mixing process.

Wei Biao Wu

University of Chicago

A Sharp Strong Invariance Principle For Stationary Processes

Abstract

I will present an optimal strong invariance principle for stationary processes, a long time open problem in probability theory. Under the framework of stationary causal processes and functional dependence measures of Wu (2005), we adopt a triadic decomposition method and show that, under natural moment conditions, the partial sum processes can be approximated by Brownian motions with a sharp rate. Our dependence conditions are mild and easily verifiable. This work is joint with Istvan Berkes and Weidong Liu.

Marc Yor

Université Paris VI

Peacocks and associated martingales

Hao Yu

University of Western Ontario

Goodness-of-fit Test for the Error Distribution of Nonstationary Autoregressive Models

Abstract

Ling (1998) shows that the limiting process of empirical process based on residuals of nonstationary autogressive (AR) models depends on model parameters and hence the classic Kolmogorov-Smirnov (KS) goodness-of-fit test fails to provide an adequate test for the error distribution. In this talk, a modified empirical process based on residuals of nonstationary AR models is proposed. It is shown that the modified empirical process converges weakly to the same Gaussian process as if the residuals are asymptotically iid and the limiting Gaussian process is free of model parameters. This modified empirical process leads to a KS type goodness-of-fit test. A simulation study shows that this new test provides a promising performance under various unit root settings.