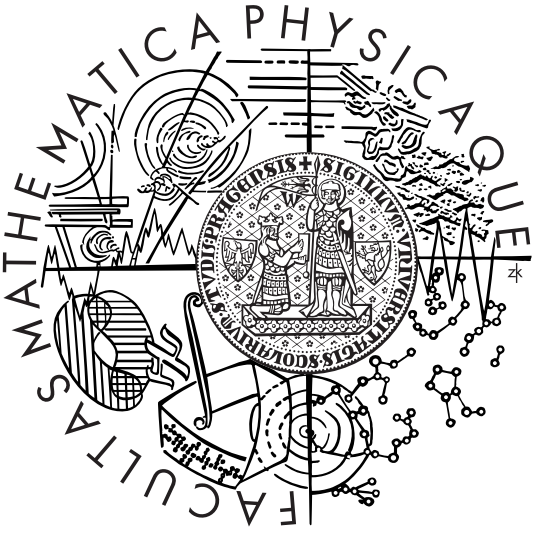
International Workshop on Recent Advances in Mathematical Statistics in honor of Professor Marie Hušková

Prague, November 30 – December 2, 2012

Programme

Book of Abstracts



Programme

Friday	**Malá Strana – Refectory**	
J. Antoch		
14.30 – 14.35	Z. Prášková	Opening
14.35 – 15.05	J. Štěpán	Prague school of statistics
15.05 – 15.20	W.R. van Zwet	International relations and collaboration in statistics
15.20 – 15.40		Opening addresses, laudations
15.40 – 16.00	Coffee break	
M. Hallin		
16.00 – 16.40	J.G. Steinebach	A change or not a change – Is this the question?
16.45 – 18.00	Buffet	
Saturday	**Karlín – K1**	
J. Jurečková		
8.50 – 9.30	P.K. Sen	Rank tests for short memory stationarity
9.30 – 10.10	S. Hörmann	Dynamic functional principal components
10.10 – 10.50	G. Rice	A portmanteau test for functional data
10.50 – 11.10	Coffee break	
P.K. Sen		
11.10 – 11.50	J. Picek	Statistics of extreme: The optimal sample fraction choice parameter estimation
11.50 – 12.30	M. Hallin	The double sin of the skew-normal: skew-symmetric distributions and Fisher information
12.30 – 14.00	Lunch time	
J. Steinebach		
14.00 – 14.40	L. Horváth	Limit theorems for panel data
14.40 – 15.30	Z. Prášková	Robust procedures in change-point problem
15.30 – 16.10	D. Jarušková, J. Antoch	Testing for multiple change points
16.10 – 16.30	Coffee break	
L. Horváth		
16.30 – 17.10	I. Berkes	Change point tests for dependent stable processes
17.10 – 17.50	S.G. Meintanis	The probability weighted empirical characteristic function and goodness-of-fit testing
19.30 – 22.00	Dinner	
Sunday	**Karlín – K1**	
N. Veraverbeke		
9.00 – 9.40	A. Pázman	Nonstandard asymptotical properties of designs of experiments
9.40 – 10.20	I. Gijbels	Change-point detection and break preserving local linear estimation of an unstable volatility function
10.20 – 10.40	J. Dupačová	Two financial applications of nonparametric regression
10.40 – 11.00	Coffee break	
W.R. van Zwet		
11.00 – 11.40	N. Veraverbeke	Recent results on conditional copulas
10.40 – 12.40	J. Jurečková	Score functions of distributions and their role
12.40 – 12.45	J. Antoch	Closing

Book of Abstracts

István Berkes

Change point tests for dependent stable processes

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The normed CUSUM functional of i.i.d. sequences converges weakly in the case of finite variances, as well as in the case of stable variables, leading to satisfactory tests for the change of location of such processes. In a rare instance in weak dependence theory, this phenomenon breaks down in the case of mixing random variables. We show that by a suitable trimming of the sample and after a random centering, the normed partial sums of dependent stable processes converge weakly to Brownian bridge, extending the change point theory for such cases. We also construct a ratio test for the same problem. Our results provide the first asymptotic results for trimmed dependent sequences and as simulations show, they have nice power properties even for moderate sample sizes.

Thanks: The talk is based on joint work with Lajos Horváth and Alina Bazarova.

Jitka Dupačová

Two financial applications of nonparametric regression

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Yield curve and yield volatilities are important inputs for pricing interest rate derivatives, for generation of interest rate scenarios, etc. Non anticipated errors in their estimates may essentially influence the resulting prices, yields and risks, cf. [1]. In [2] we explored and compared several types of parametric and nonparametric regression models which provide also an information about the precision of the fitted curves. The parametric models of yield curves were represented by the nonlinear and linearized Bradley-Crane model which was compared with Nadaraya-Watson and Priestley-Chao nonparametric estimators and with cubic splines. The reported numerical experience was based on data from the Italian bond market. In the second application, cf. [3], the influence of individual countries on the EURO yield curve is analyzed. To this purpose we assume that each of individual yield curves equals the sum of a common effect curve and of a country specific one, interpreted as a spread. This allows to apply a two-stage nonparametric regression model. Both the estimated regression curves and the nonparametric bootstrap test indicated significant differences among EMU countries due to government debts, different bonity, etc.

References

[1] M. Bertocchi, J. Dupačová, and V. Moriggia (2000) Sensitivity of bond portfolio's behavior with respect to random movements in yield curve: A simulation study. Ann. Oper. Res. **99**, 267 – 286.

[2] J. Dupačová, J. Abaffy, M. Bertocchi and M. Hušková (1997) On estimating the yield and volatility curves. Kybernetika **33**, 659 – 673.

[3] J. Abaffy, J. Dupačová, M. Bertocchi, R. Giacometti, M. Hušková and V. Moriggia (2003) A nonparametric model for analysis of the EURO yield curve. J. Econ. Dynamics Control **27**, 1113 – 1131.

Irène Gijbels

Change-point detection and break preserving local linear estimation of an unstable volatility function

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Nonparametric estimation of curves or surfaces with possible irregularities (e.g. abrupt changes or discontinuities in the function itself, or abrupt directional changes) has deserved considerable attention in the last decades. In a first part of the talk we briefly discuss some of the available methods for detecting changes in a mean regression function, and for inference about a possible irregular mean regression function. Among others, we discuss methods based on local linear estimation.

In a second part of the talk we focus on the estimation of unstable volatility functions for independent and asymptotically independent processes. Structural breaks in the conditional mean and/or conditional volatility functions are common in finance. We introduce a break preserving local linear estimator, study its asymptotic properties, and discuss choices of bandwidth parameters. A small simulation study illustrates the finite-sample performance of the break preserving local linear estimator of the volatility function.

Thanks: The talk is based on joint work with Isabel Casas.

Marc Hallin

The double sin of the skew-normal : skew-symmetric distributions and Fisher information

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In [2] we investigate and fully characterize the Fisher singularity phenomenon in univariate and multivariate families of `skew-symmetric distributions` introduced by [1]. We pursue here the analysis of this Fisher degeneracy problem, showing that it can be more or less severe, inducing $n^{1/4}$ ("simple singularity"), $n^{1/6}$ ("double singularity"), or $n^{1/8}$ ("triple singularity") consistency rates for the skewness parameter. We show, however, that simple singularity (yielding $n^{1/4}$ consistency rates), if any singularity at all, is the rule, in the sense that double and triple singularities are possible for generalized skew-normal families only. We also show that higher-order singularities, leading to worse-than-$n^{1/8}$ rates, cannot occur.

Thanks: The talk is based on joint work with Christophe Ley, Université libre de Bruxelles.

References

[1] A. Azzalini (1985) A class of distributions which includes the normal ones, Scandinavian Journal of Statististics **12**, 171 – 178.

[2] M. Hallin, Ch. Ley (2012) Skew-symmetric distributions and Fisher information—a tale of two densities, Bernoulli **18**, 747 – 763.

Siegfried Hörmann

Dynamic functional principal components

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Data in many fields of science are sampled from processes that can most naturally be described as functional. Functional data analysis (FDA) is concerned with the statistical analysis of such data. Since these are intrinsically infinite dimensional objects, tools for dimension reduction are desirable. The functional principal analysis (FPCA) takes here a leading role. It is a key tool in many important empirical and theoretical problems. However, a problem with classical FPCA is that it operates in a static way and doesn't take into account any possible serial dependence of the functional observations. Such dependence occurs quite frequently, e.g. if the data consist of a continous time process which has been cut into segments (e.g. days).

In this talk we will propose a dynamic version of FPCA for general data structures (Hilbertian data) and study its properties. An empirical analysis and a real data example will be given.

Thanks: The talk is based on joint work with Łukasz Kidziński and Marc Hallin.

Lajos Horváth

Limit theorems for panel data

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We consider statistical inference based on the panel data $y_{i,t}, 1 \le i \le N, 1 \le t \le T$, i.e. we observe N panels, each panel has T observations. Usually T is small, and might not be enough to have estimation or hypothesis testing based on a single panel. It is assumed that the panels contain common parameters so using all the NT observations better inference can be obtained. We discuss some models based on panel data and discuss the effect of dependence between the panels on the estimators.

Thanks: Talk is based on joint work with Marie Hušková.

Daniela Jarušková, Jaromír Antoch

Testing for multiple change points

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Detection of multiple changes and/or data segmentation are among the basic problems we encounter in statistics and data analysis. In this paper we concentrate on testing for multiple changes in the mean of a series of independent random variables. Our method applies a maximum type test statistic. Our primary focus is on an effective calculation of critical values for very large sample sizes comprising (tens of) thousands observations and a moderate to large number of segments. To that end, Monte Carlo simulations and a modified Bellman's principle of optimality are used. In addition, the formula that can be used to get approximate asymptotic critical values using the theory of exceedance probability of Gaussian fields over a high level will be presented.

Jana Jurečková

Score functions of distributions and their role

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Score functions play a basic role in the statistical inference. We observe that the role of the score function $\psi_f(X) = -\frac{f'(X)}{f(X)}$ under density f in the location model is analogous to that of X under the normal f, and the role of $\bar{\psi}_n = n^{-1}\sum_{i=1}^n \psi_f(X_i)$ under distribution f is analogous to that of $\bar{X}_n$ under normal f. Unlike under the normality, $\bar{\psi}_n$ is generally neither linear nor equivariant, hence many of its properties, but not all, hold only asymptotically for $n \to \infty$. But the analogy between $\bar{X}_n$ and $\bar{\psi}_n$ is surprising; some properties are still being discovered under various circumstances. Similar phenomenon we observe in the model with scale and regression parameters.

We shall describe some properties of the score functions which we find of interest.

Simos G. Meintanis

The probability weighted empirical characteristic function and goodness-of-fit testing

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We introduce the notion of the probability weighted characteristic function (PWCF) which is a generalization of the characteristic function of a probability distribution. Then some of its properties are studied, and its potential use in goodness–of–fit testing is examined.

Andrej Pázman

Nonstandard asymptotical properties of designs of experiments

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We shall consider briefly some cases when the standard approach in experimentsl design, which consists in using the limit design matrix for finite optimum designs, or which consists in approximating asymptotically a nonlinear regression model by a linear model, may be false.

Jan Picek

Statistics of extreme : The optimal sample fraction choice parameter estimation based on resampling method

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In this contribution, we discuss the estimation of an extreme value index, the primary parameter in Statistics of Extremes. The estimation of the extreme value index is usually performed on the basis of the largest k order statistics in the sample on the excesses over a high level u. The question that has been often addressed in practical applications is the choice of the sample fraction k. We shall mainly focus on the bootstrap methodology to choose the optimal sample fraction. We shall be also interested in the use of resampling-based computer-intensive methods for an choice of the thresholds. The used methods will be demonstrated by numerical illustrations.

Zuzana Prášková

Robust procedures in change-point problem

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Detecting possible changes in the stochastic structure of observed data is one of the most important statistical problems. A large spectrum of methods has been developed to test and identify changes in parameters of statistical models in the last three decades. We will focus on robust procedures for detecting changes in linear models that were developed to reduce some sensitivity of statistical decision procedures against outlying observations and heavy-tailed distributions. A review of some recent methods and asymptotic results will be presented. Then we will consider a class of CUSUM-type test statistics based on M-estimators and M-residuals assuming that both the regressors and the errors are sequences of weakly dependent random variables or vectors, and study limit properties of the proposed test statistics. Off-line and on-line procedures as well as their computational aspects will be discussed.

Thanks: Talk is based on joint work with Marie Hušková.

Gregory Rice

A portmanteau test for functional data

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A common assumption in functional data analysis is that the observed curves are observations of independent, identically distributed random functions. Several procedures have been proposed to check the validity of this assumption in univariate and multivariate sample data, perhaps the most popular of which was introduced by Box, Ljung and Pierce and then adapted by many others. We propose a procedure for functional data along these lines which is based on the sum of the L^2 norms of the empirical correlation functions. The limit distribution of the proposed test statistic is established under the

null hypothesis and consistency under the alternative when the sample size as well as the number of lags used in the statistic tend to infinity. A Monte Carlo study illustrates the small sample behavior of the test and the procedure is applied to two data sets, Eurodollar futures and magnetogram records.

Thanks: Talk is based on joint work with Lajos Horváth and Marie Hušková.

Pranab K. Sen

Rank tests for short memory stationarity

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The term short memory is used as synonymous to weakly dependence or short range dependence and is implemented through a strong mixing condition. A rank test for null hypothesis of short memory stationarity possibly after linear detrending is proposed. This test statistics is analogous to the popular KPSS statistic based on the cumulative sum but involves their ranks. For the trend-stationarity, the sam e rank statistic is applied to the residuals of a Theil-Sen regression on a linear trend. The asymptotic distribution of the Theil-Sen estimator under short-memory errors is derived and incorporated in these aligned rank tests. Asymptotic relative efficiency results have been studied in detail along with extensive numerical studies. The article is to appear in the Journal of Econometrics in 2012-2013.

Thanks: The talk is based on joint work with Matteo M. Pelagatti, Universitá degli studi di Milano Bicocca.

Josef G. Steinebach

A change or not a change – Is this the question ?

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In this review talk, we discuss some selected developments in the area of change-point analysis over the past two decades. Naturally, our point of view shall be a rather subjective and personal one, focussing on various significant contributions of Marie Hušková to this area and some of our joint works over many years. Topics to be covered among others include the testing and estimation of (gradual) changes, monitoring changes in linear models, resampling procedures and the simulation of critical values, the detection of changes in autoregressive time series, delay times in monitoring procedures, and the sequential testing and robust monitoring of portfolio betas in the Capital Asset Pricing Model (CAPM).

Noël Veraverbeke

Recent results on conditional copulas

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Studying the relationship between two (or more) random variables in the presence of a covariate can be done based on a conditional version of Sklar's theorem: there exists a copula

function expressing the joint conditional distribution as a function of the one dimensional conditional marginal distributions. We discuss recent results on several estimators of this unknown copula function. First of all there is the nonparametric method which uses empirical estimators with weights that smooth over the covariate space. An application is the asymptotic theory for association measures like the conditional Kendall's tau ([2], [4]). A second method is semiparametric in nature: it starts from a parametric family of copulas in which the parameter depends on the covariate. This parameter function is estimated by local likelihood ([1]). A third method provides a smooth estimator by the use of Bernstein polynomials ([3]).

Thanks: The talk is based on joint work with Marek Omelka, Irène Gijbels, Fentaw Abegaz, Paul Janssen and Jan Swanepoel.

References

[1] F. Abegaz, I. Gijbels and N. Veraverbeke (2012) Semi-parametric estimation of conditional copulas. J. Multivariate Analysis **110**, 43 – 73.

[2] I. Gijbels, N. Veraverbeke and M. Omelka (2011) Conditional copulas, association measures and their applications. Computational Statistics and Data Analysis **55**, 1919 – 1932.

[3] P. Janssen, J. Swanepoel and N. Veraverbeke (2012) Large sample behavior of the Bernstein copula estimator. J. Statist. Planning and Inference **142**, 1189 – 1197.

[4] N. Veraverbeke, M. Omelka and I. Gijbels (2011) Estimation of a conditional copula and association measures. Scandinavian J. Statistics **38**, 766 – 780.