International Workshop

Structured Nonparametric Modeling

on the occasion of

Enno Mammen’s 60’th birthday

Berlin, June 4 - 6 2015

Contents

General Information

Venue

The workshop takes place at Heilig-Geist-Kapelle at the Faculty of Economics of the Humboldt University of Berlin.

Wirtschaftswissenschaftliche Fakultät
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Supporting institutions

Weierstrass Institute for Applied Analysis and Stochastics
Leibniz Institute in Forschungsverbund Berlin e. V.
`http://www.wias-berlin.de`

Collaborative Research Center 649: Economic Risk
`http://sfb649.wiwi.hu-berlin.de`

International Research Training Group 1792:
High Dimensional Non Stationary Time Series
`www.wiwi.hu-berlin.de/de/forschung/irtg`

Research Unit 1735:
Structural Inference in Statistics: Adaptation and Efficiency
`www.mathematik.hu-berlin.de/de/for1735`

Program of the Workshop

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17:45 – 19:00	Poster session

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15:15 – 15:45	**Byeong U. Park** Additive functional regression
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Session 6	
16:15 – 16:45	**Dominique Picard** Bayesian procedures for data with geometrical structure
16:45 – 17:15	**Wolfgang Polonik** Extreme values of Gaussian random fields on growing manifolds with applications to filament estimation
17:15 - 17:45	**Markus Reiß** Sequential adaptation for statistical inverse problems
19:00	Conference dinner

Saturday, June 6

Session 7	
09:30 – 10:00	**Peter Bühlmann** Causal inference: 60 years ago and today
10:00 - 10:30	**Jianqing Fan** Modeling Large Portfolio Risks and Networks with Structured Nonparametrics
10:30 – 11:00	**Jean-Pierre Florens** Functional linear regression with functional response
11:00 - 11:30	Break
Session 8	
11:30 – 12:00	**Aad van der Vaart** On estimating a causal effect when there are many confounders
12:00 – 12:30	**Qiwei Yao** Identifying Cointegration by Eigenanalysis
12:30 – 13:00	**Harrison Zhou** Community Detection: Minimaxity and A Computationally Efficient Algorithm
13:00 – 13:30	Closing

Invited Talks

Hypercube Fits to the Multivariate Linear Model

Rudolf Beran

(University of California, Davis)

Hypercube fits to the multivariate linear model include, in reparametrized form, penalized least squares estimators with multiple quadratic penalties and submodel fits. They extend to general designs the risk reduction achieved by multiple Efron-Morris estimators or by multiple reduced-rank estimators for balanced designs.

Causal inference: 60 years ago and today

Peter Bühlmann

(ETH Zürich)

Inferring causal effects from data is a highly desirable but ambitious goal. 60 years ago and even earlier, potential outcome models (Neyman, 1923; Wilks, 1955) have been considered; later structural equation models and graphical modeling became powerful tools. A major challenge with the latter is that many methods and algorithms exhibit poor performance, particularly in the high-dimensional setting. We present a novel framework based on an invariance principle. It exploits the advantage of heterogeneity in larger datasets, arising from different experimental conditions. Despite fundamental identifiability issues, we construct a method for statistical confidence statements for causal inference, leading to more reliable results than alternative procedures based on graphical modeling. For illustration purposes, we discuss an application with large-scale gene knock-down experiments in yeast.

Optimal Sup-norm Rates, Adaptivity and Inference in Nonparametric Instrumental Variables Regression

Xiaohong Chen
(Yale University)

This paper makes several contributions to the literature on the important yet difficult problem of estimating functions nonparametrically using instrumental variables. First, we derive the minimax optimal sup-norm convergence rates for nonparametric instrumental variables (NPIV) estimation of the structural function h_0 and its derivatives. Second, we show that a computationally simple sieve NPIV estimator can attain the optimal sup-norm rates for h_0 and its derivatives when h_0 is approximated via a spline or wavelet sieve. Our optimal sup-norm rates surprisingly coincide with the optimal L^2-norm rates for severely ill-posed problems, and are only up to a $[\log(n)]^\epsilon$ (with $\epsilon < 1/2$) factor slower than the optimal L^2-norm rates for mildly ill-posed problems. Third, we introduce a novel data-driven procedure for choosing the sieve dimension optimally. Our data-driven procedure is sup-norm rate-adaptive: the resulting estimator of h_0 and its derivatives converge at their optimal sup-norm rates even though the smoothness of h_0 and the degree of ill-posedness of the NPIV model are unknown. Finally, we present two non-trivial applications of the sup-norm rates to inference on nonlinear functionals of h_0 under low-level conditions. The first is to derive the asymptotic normality of sieve t-statistics for exact consumer surplus and deadweight loss functionals in nonparametric demand estimation when prices, and possibly incomes, are endogenous. The second is to establish the validity of a sieve score bootstrap for constructing asymptotically exact uniform confidence bands for collections of nonlinear functionals of h_0. Both applications provide new and useful tools for empirical research on nonparametric models with endogeneity.

Modeling Large Portfolio Risks and Networks with Structured Nonparametrics

Jianqing Fan (Princeton University)
joint with Yuan Liao and Weichen Wang

We propose a flexible factor model for estimating large covariance matrices with covariates and introduce a Projected Principal Component Analysis (Projected-PCA) technique, which strengthens signals-to-noise ratios. We show that the unobserved latent factors can be more accurately estimated than the conventional PCA if the projection is genuine and that they can be estimated accurately when the dimensionality is large, even when the sample size is finite. In an effort to more accurately estimating factor loadings, we propose a flexible semi-parametric factor model, which decomposes the factor loading matrix into the component that can be explained by subject-specific covariates and the orthogonal residual component. By using the newly proposed Projected-PCA, the rates of convergence of the smooth factor loading matrices are obtained, which are much faster than those of the conventional factor analysis. This leads us to developing nonparametric tests on whether observed covariates have explaining powers on the loadings and whether they fully explain the loadings. The proposed method is illustrated by extensive numerical studies.

Functional linear regression with functional response

Jean-Pierre Florens

(Université Toulouse I)

In this paper, we develop new estimation results for functional regressions where both the regressor $Z(t)$ and the response $Y(t)$ are functions of an index such as the time or a spatial location. Both $Z(t)$ and $Y(t)$ are assumed to belong to Hilbert spaces. The model can be thought as a generalization of the standard regression where the regression coefficient is now an unknown operator Π. An interesting feature of our model is that $Y(t)$ depends not only on contemporaneous $Z(t)$ but also on past and future values of Z. We propose to estimate the operator Π by Tikhonov regularization, which amounts to apply a penalty on the L2 norm of Π. We derive the rate of convergence of the mean-square error, the asymptotic distribution of the estimator, and develop tests on Π. Often, the full trajectories are not observed but only a discretized version is available. We address this issue in the scenario where the data become more and more frequent (in-fill asymptotics). We also consider the case where Z is endogenous and instrumental variables are used to estimate Π.

Key Words: Functional regression, instrumental variables, linear operator, Tikhonov regularization

Expansions of Entropy and Fisher-Information Distances

Friedrich Götze

(Univetsität Bielefeld)

We investigate the convergence of sums of random variables to Gaussian and stable laws in Entropy resp. Fischer-Information distances. In particular we show asymptotic expansions of such distances in terms of semi-invariants (under minimal assumptions) in the context of classical probability.

This is joint work with S. Bobkov, C. Chistyakov.

Distillation of News Flow into Analysis of Stock Reactions

Wolfgang Karl Härdle

(Humboldt Universität zu Berlin)

News carry information of market moves. The gargantuan plethora of opinions, facts and tweets on financial business offers the opportunity to test and analyze the influence of such text sources on future directions of stocks. It also creates though the necessity to distill via statistical technology the informative elements of this prodigious and indeed colossal data source. Using mixed text sources from professional platforms, blog fora and stock message boards we distill via different lexica sentiment variables. These are employed for an analysis of stock reactions: volatility, volume and returns. An increased (negative) sentiment will influence volatility as well as volume. This influence is contingent on the lexical projection and different across GICS sectors. Based on review articles on 100 S&P 500 constituents for the period of October 20, 2009 to October 13, 2014 we project into BL, MPQA, LM lexica and use the distilled sentiment variables to forecast individual stock indicators in a panel context. Exploiting different lexical projections, and using different stock reaction indicators we aim at answering the following research questions:

(i) Are the lexica consistent in their analytic ability to produce stock reaction indicators, including volatility, detrended log trading volume and return?

(ii) To which degree is there an asymmetric response given the sentiment scales (positive v.s. negative)?

(iii) Are the news of high attention returns diffusing faster and result in more timely and efficient stock reaction?

(iv) Is there a sector specific reaction from the distilled sentiment measures?

We find there is significant incremental information in the distilled news flow. The three lexica though are not consistent in their analytic ability. Based on confidence bands an asymmetric, attention-specific and sector-specific response of stock reactions is diagnosed.

Discrete parametrix method and its applications

Valentin Konakov

(Higher School of Economics, Moscow)

Discrete parametrix method was introduced by V. Konakov and S. Molchanov in 1984 and then systematically developed in a series of papers by Konakov and Mammen (2000, 2002, 2005, 2009). The talk will be devoted to different applications of this method in probability and statistics.

Adaptive estimation in the convolution structure density model

Oleg Lepski
(Aix-Marseille Université)

We address the problem of adaptive minimax estimation with L_p–loss over the scale of anisotropic Nikol'skii classes in the framework of convolution structure density model on R^d. We fully characterize behavior of the minimax risk for different relationships between regularity parameters and norm indexes in definitions of the functional class and of the risk.

Semiparametric Dynamic Portfolio Choice with Multiple Conditioning Variables

Oliver Linton (University of Cambridge)
with Jia Chen, Degui Li, and Zudi Lu

Dynamic portfolio choice has been a central and essential objective for institutional investors in active asset management. In this paper, we study the dynamic portfolio choice with multiple conditioning variables, where the number of the conditioning variables can be either fixed or diverging to infinity at certain polynomial rate of the sample size. We propose a novel data-driven method to estimate the optimal portfolio choice, motivated by the model averaging marginal regression approach suggested by Li, Linton and Lu (2015). More specifically, in order to avoid the curse of dimensionality associated with multivariate nonparametric regression problem and to make it practically implementable, we first estimate the marginal optimal portfolio choice by maximising the conditional utility function for each univariate conditioning variable, and then construct the joint dynamic optimal portfolio through the weighted average of the marginal optimal portfolio across all the conditioning variables. Under some regularity conditions, we establish the large sample properties for the developed portfolio choice procedure. Both simulation studies and empirical application well demonstrate the performance of the proposed methodology.

Object Oriented Data Analysis

Steve Marron

(University of North Carolina at Chapel Hill)

Object Oriented Data Analysis is the statistical analysis of populations of complex objects. In the special case of Functional Data Analysis, these data objects are curves, where standard Euclidean approaches, such as principal components analysis, have been very successful. In non-Euclidean analysis, the approach of Backwards PCA is seen to be quite useful. An overview of insightful mathematical statistics for object data is given, based on High Dimension Low Sample Size asymptotics, where the dimension grows, but the sample size is fixed

Fast FDR based Change Point Segmentation

Axel Munk

(Universität Göttingen)

Fast multiple change-point segmentation methods, which additionally provide faithful statistical statements on the number and size of the segments, have recently received great attention. We discuss such methods and introduce a new one which is based on a non-asymptotic upper bound for its false discovery rate. This allows to calibrate the method properly. The favorable performance of the proposed method is examined by comparisons with some state of the art methods on both simulated and real data.

In-sample forecasting applied to reserving and mesothelioma

Jens Perch Nielsen

(Cass Business School)

Recent published mortality projections with unobserved exposure can be understood as structured density estimation. The structured density is only observed on a sub-sample corresponding to historical calendar time. The mortality forecast is obtained by extrapolating the structured density to future calendar times using that the components of the density are identified within sample. The new method is illustrated on the important practical problem of forecasting mesothelioma for the UK population. Full asymptotic theory is provided. The theory is given in such generality that it also introduces mathematical statistical theory for the recent continuous chain ladder model. This allows a modern approach to classical reserving techniques used every day in any non-life insurance company around the globe. Applications to mortality data and non-life insurance data are provided along with relevant small sample simulation studies.

Asymptotic equivalence of pure quantum state estimation and Gaussian white noise

Michael Nussbaum

(Cornell University)

Consider a unit vector in Hilbert space; in quantum theory this describes a so-called pure state. We consider a statistical model given by the n-fold tensor product of a pure state with itself, which then gives a quantum analog of a nonparametric model of i.i.d. observations with unknown density. We will discuss the problem of approximating this quantum statistical experiment by a Gaussian one, and present an outline of a solution. The Gaussian experiment must be made up of pure Gaussian states, and these turn out to be the so-called coherent states which play a central role in quantum optics. Some of the techniques used are related to the work of Le Cam and Mammen on informational content of additional observations in statistical experiments.

The talk is based on joint work with C. Butucea and M. Guta.

Additive functional regression

Byeong U. Park
(Seoul National University)

In various functional regression settings one observes i.i.d. samples of paired stochastic processes (X,Y), and is interested to predict the trajectory of Y, given the trajectory X. For example, one may wish to predict the future of a process from observing an initial segment of the trajectory. Commonly used functional regression models are based on representations that are obtained separately for X and Y. In contrast to these established methods, we base our approach a on a singular expansion of the paired processes X, Y with singular functions that are derived from the cross-covariance surface between X and Y. The motivation for this approach is that the resulting singular components are tuned towards reflecting the association between X and Y. The regression relationship is then based on the assumption that the singular components of Y follow an additive regression model with the singular components of X as predictors. The resulting singular additive model is fitted by smooth backfitting. We will discuss asymptotic properties of the estimates as well as their practical behavior in simulations and data analysis.

Bayesian procedures for data with geometrical structure

Dominique Picard

(Universités Paris 6 & 7)

We consider the problem of data with a geometrical structure such as directional data, or data on some specific manifolds such as graphs, trees, or matrices. We consider Gaussian a-priori measures. In particular, the problem of adaptation shows the need for adapting the a priori distribution to an harmonic analysis of the structure of the data. We also investigate the problem from the more explicit angle of an a priori measure on 'manifold-wavelet ' coefficients. We extend the Ghosal, Ghosh and van der Vaart, on the concentration a posteriori measures, for the case of geometrical data.

Extreme values of Gaussian random fields on growing manifolds with applications to filament estimation

Wolfgang Polonik

(University of California, Davis)

A result on the extreme value behavior of certain non-stationary Gaussian random fields indexed by growing manifolds is presented. This result can be considered as a generalization of some classical work by Bickel and Rosenblatt (1973) and work by Piterbarg and Stamatovich (2001). We then indicate how our result is used in the derivation of distributional results for a plug-in estimator of filaments or ridge lines of a density. By doing so we also present a brief overview of recent developments in filament estimation. This is joint work with Wanli Qiao, University of California, Davis.

Sequential adaptation for statistical inverse problems

Markus Reiß,
(Humboldt Universität zu Berlin)

We consider iterative methods for statistical inverse problems where the number of iterations determines the amount of regularisation. In all classical adaptive estimation approaches (like cross validation or Lepski's method) a large number of iterations has to be calculated in order to reduce the potential bias and then to select an estimator which might only require a few iteration steps. We therefore ask for a sequential method where the final estimator is defined by a stopping rule (the last iteration is taken). It turns out that a clear sequential adaptation theory can be developed. Major findings are oracle inequalities and mini-max optimal intervals of adaptivity for the smoothness parameter. Our stopping rule is based on level crossings for the residuals and performs well in simulations.
(joint work with Gilles Blanchard, Potsdam, and Marc Hoffmann, Paris)

A Discontinuity Test for Identification in Triangular Nonseparable Models

Christoph Rothe

(Columbia University)

This paper presents a test for the validity of control variable approaches to identification in triangular nonseparable models. Assumptions commonly imposed to justify such methods include full independence of instruments and disturbances and existence of a reduced form that is strictly monotonic in a scalar disturbance. We show that if the data has a particular structure, namely that the distribution of the endogenous variable has a mass point at the lower (or upper) boundary of its support, validity of the control variable approach implies a continuity condition on an identified function, which can be tested empirically.

Link:
http://www.christophrothe.net/papers/discontinuity_nov2014.pdf

On estimating a causal effect when there are many confounders

Aad van der Vaart
(Leiden University)

We consider estimating a one-dimensional parameter defined on a very high-dimensional semiparametric model. This is motivated by problems with missing outcomes or problems of estimating a causal effect. The dimensionality is so high that good estimators must solve a bias-variance trade-off. We show that minimax estimators can be obtained using estimating equations in the form of U-statistics that try to mimic higher-order influence functions of the parameter. (joint work with James Robins et al.).

Identifying Cointegration by Eigenanalysis

Qiwei Yao

(London School of Economics)

We propose a new and easy-to-use method to identify cointegrated components for a vector time series. The method boils down to a simple eigenanalysis for a positive definite matrix. Our setting is general in the sense that the basic requirement is that each component series is a weak $I(d)$ process with $d > 0$ being an integer. Furthermore we allow d to be different for different component series. Asymptotic properties of the proposed methods are investigated. Illustration with both simulated and real data sets is also reported. The method and the associate asymptotic theory have been extended to the cases when nonstationary component series have fractional integrated orders.

Community Detection: Minimaxity and A Computationally Efficient Algorithm

Harrison Zhou

(Yale University)

Recently network analysis has gained more and more attention in statistics, as well as in computer science, probability, and applied mathematics. Community detection for stochastic block model (SBM) is possibly the most studied topic in network analysis. Many methodologies have been proposed. Several beautiful and signcant phase transition results are obtained in various settings. In this talk, we provide a general minimax theory for community detection. It gives the minimax rates of mis-match ratio for a wide rage of settings including homogeneous and inhomogeneous SBM, dense and sparse networks, finite and growing number of communities. The result immediately implies threshold phenomenon for consistent community detection, exact recovery as well as a convergence rate sandwiched in-between. The rate is in an exponential form. We obtain the upper bound by a penalized likelihood approach. The lower bound is achieved by novel reduction from a global mis-match ratio to a local clustering problem for one node through the exchangability property. If time permits, we present a computationally feasible two-stage method that achieves optimal statistical performance in misclassication proportion for stochastic block model under very weak regularity conditions. Our two-stage procedure consists of a generic renement step that can take a wide range of weakly consistent community detection procedures as initializer, to which the renement stage applies and outputs a community assignment achieving optimal misclassification proportion with high probability.

Poster talks

Conformalized ridge regression and its efficiency

Evgeny Burnaev

(Institute for Information Transmission Problems, Moscow)

Conformal prediction is a method of producing prediction sets that can be applied on top of a wide range of prediction algorithms. The method has a guaranteed coverage probability under the standard IID assumption regardless of whether the assumptions (often considerably more restrictive) of the underlying algorithm are satisfied. However, for the method to be really useful it is desirable that in the case where the assumptions of the underlying algorithm are satisfied, the conformal predictor loses little in efficiency as compared with the underlying algorithm (whereas being a conformal predictor, it has the stronger guarantee of validity). In this paper we explore the degree to which this additional requirement of efficiency is satisfied in the case of Bayesian ridge regression; we find that asymptotically conformal prediction sets differ little from ridge regression prediction intervals when the standard Bayesian assumptions are satisfied.

FASTEC-FActorizable Sparse Tail Event Curves

Shih-Kang Chao
(Humboldt Universität zu Berlin, CRC 649)

Reduced-rank multiple regression problems are of interest in a wide variety of science fields, for example the Capital Asset Pricing Model (CAPM) and Arbitrage Pricing Theory (APT) can be estimated by this technique without specifying the factors. However, it gives little information for the conditional distributions other than the expected values. For $\tau \in (0, 1)$, the conditional τ-quantile functions, particularly for τ is close to 0 or 1, are crucial in many applications, such as risk management. In the current study, the estimation of large multiple quantile regression models regularized by nuclear norm is considered. The rank of the coefficient matrix is interpreted as the number of factors for the tail event functions, and is sparse in the spirit of CAPM and APT. Hence, we call the estimated quantile functions as FASTEF: FActorisable Sparse Tail Event Functions. As the empirical loss function and the nuclear norm are non-smooth, an efficient algorithm which combines smoothing techniques and effective proximal gradient methods is developed, for which explicit deterministic convergence rates are derived. It is shown that the estimator enjoys nonasymptotic oracle properties under rank sparsity condition. The technique is applied to a multivariate variation of the famous Conditional Autoregressive Value-at-Risk (CAViaR) model of Engle and Manganelli (2004), which is called Sparse Asymmetric Conditional Value- at-Risk (SAMCVaR). With a dataset consists of stock prices of global financial firms ranging over 2007-2010, the major market risk contributors and market sensitive firms are selected by our method.

Stochastic gradient descent methods with inexact oracle in nonparametric modeling

Alexander Gasnikov

(Moscow Institute of Physics and Technology)

The talk was based on the joint survey with P. Dvurechensky and Yu. Nesterov (Automatica and Remoue Control, July 2015, `arXiv:1411.4218`). The main ingridient is a trade off between approximation of infinit dimension problem and the rate of convergence of proper stochastic gradient descent with inexact oracle (because of approximation) procedure (considered to be an aggregation of estimation procedure).

Efficient nonparametric regression when the support is bounded

Moritz Jirak
(Humboldt Universität zu Berlin)

We consider the model of non-regular nonparametric regression where smoothness constraints are imposed on the regression function f and the regression errors are assumed to decay with some sharpness level at their endpoints. The aim is to construct an adaptive estimator for the regression function f. In contrast to the standard model where local averaging is fruitful, the non-regular conditions require a substantial different treatment based on local extreme values. We study this model under the realistic setting in which both the smoothness degree $\beta > 0$ and the sharpness degree $\mathfrak{a} \in (0, \infty)$ are unknown in advance. We construct adaptation procedures applying a nested version of Lepski's method and the negative Hill estimator which show no loss in the convergence rates with respect to the general L_q-risk and a logarithmic loss with respect to the pointwise risk. Optimality of these rates is proved for $\mathfrak{a} \in (0, \infty)$. In a related context, given a stochastic boundary defined by a semi-martingale X_t, a rate-optimal estimator for its quadratic variation $\langle X, X \rangle_t$ is constructed based on observations in the vicinity of X_t. The problem is embedded in a Poisson point process framework, which reveals an interesting connection to the theory of Brownian excursion areas. A major application is the estimation of the integrated squared volatility of an efficient price process X_t from intra-day order book quotes. We derive $n^{-1/3}$ as optimal convergence rate of integrated squared volatility estimation in a high-frequency framework with n observations (in mean). This considerably improves upon the classical $n^{-1/4}$-rate obtained from transaction prices under microstructure noise.

Quantile regression for counts

Igor Kheifets

(New Economic School, Moscow)

Quantile regression provides a simple way to model semi-parametrically conditional distribution function. However standard quantile regression estimation methods work poorly for counts because of non-continuity. To smooth the discreteness of the data it is usually suggested to introduce jitters, some random noise. Here we study an alternative approach, which does not require additional noise. We show theoretically and with simulations, that our estimator is more efficient and more computationally attractive than those based on randomization.

Bootstrap log-likelihood ratio test for linear hypothesis in problem with instrumental variables under both strong and weak identification

Anjei Koziuk

(Institute for Information Transmission Problems, Moscow)

In this work bootstrap analogue of log-likelihhod ratio test (BLR) is constructed and justified to recover real world log-likelihood ratio (LR) test statistic. This procedure is further used to test hypothesis in linear regression model with instrumental variables (IV) included when hypothesis is formed on associated with IV parameters. It was numerically demonstrated that testing hypothesis using such a data driven approach provides nice power properties in the case of both weak and strong IV and also under finite sample assumption with possible model misspecification.

Determination of Vector Error Correction Models in Higher Dimensions

Chong Liang

(Karlsruher Institut für Technologie)

We provide a shrinkage type methodology which allows for simultaneous model selection and estimation of vector error correction models (VECM) in one step. Model determination is treated as a joint selection problem of cointegrating rank and autoregressive lags. We show consistency of the selection mechanism by the resulting Lasso-VECM estimator under sparsity in lags and cointegration relations. In contrast to existing two-step approaches based on information criteria, we also derive the asymptotic properties of the final estimator. Moreover, with only linear computational complexity, the procedure remains computationally tractable also for higher dimensions. We demonstrate the effectiveness of the proposed approach by a simulation study and an empirical application to recent CDS data after the financial crisis.

Hypercube Fits to the Multivariate Linear Model

Andrija Mihoci

(Humboldt Universität zu Berlin, CRC 649)

We propose a local adaptive multiplicative error model (MEM) accommodating time-varying parameters. MEM parameters are adaptively estimated based on a sequential testing procedure. A data-driven optimal length of local windows is selected, yielding adaptive forecasts at each point in time. Analysing 1-minute cumulative trading volumes of five large NASDAQ stocks in 2008, we show that local windows of approximately 3 to 4 hours are reasonable to capture parameter variations while balancing modelling bias and estimation (in)efficiency. In forecasting, the proposed adaptive approach significantly outperforms a MEM where local estimation windows are fixed on an ad hoc basis.

Kernel density estimation with no curse of dimensionality using simplified vines

Thomas Nagler
(Technische Universität München)

Practical applications of multivariate kernel density estimators in more than three dimensions suffer a great deal from the well-known curse of dimensionality: convergence slows down as dimension increases. We propose a kernel based estimator that avoids the curse of dimensionality by assuming a simplified vine copula model. We prove the estimator's consistency and show that the speed of convergence is independent of dimension. Simulation experiments illustrate the large gain in accuracy compared with the classical multivariate kernel density estimator — even when the true density does not belong to the class of simplified vines.

Adaptation to lowest density regions with application to support recovery

Tim Patschkowski

(Ruhr-Universität Bochum)

A scheme for locally adaptive bandwidth selection is proposed which sensitively shrinks the bandwidth of a kernel estimator at lowest density regions such as the support boundary which are unknown to the statistician. In case of a Hölder continuous density, this locally minimax-optimal bandwidth is shown to be smaller than the usual rate, even in case of homogeneous smoothness. Besides the classical minimax risk bounds at some fixed point, some new type of risk bounds with respect to a standardized uniform loss of this estimator is established. These bounds are fully non-asymptotic and allow to deduce convergence rates at lowest density regions that can be substantially faster than $n^{-1/2}$. Our bounds are complemented by a weighted minimax lower bound. This lower bound splits into two regimes depending on the value of the density. The new estimator adapts into the first regime, and it is shown that simultaneous adaptation into the fastest regime is not possible in principal. Consequences on plug-in rules for support recovery based on the new estimator are worked out in detail. In contrast to those with classical density estimators, the plug-in rules based on the new construction are minimax-optimal, up to some logarithmic factor.

Multiscale change point detection

Alexandra Suvorikova
(IRTG 1792, Berlin)

The general change-point problem arises in many fields of research, e.g bioinformatics, econometrics, computer science and many others. It is the cornerstone of detection of homogeneous regions in observed data. This work presents a new approach of change-point detection, based on the idea of data analysis in a multi-scale rolling window. Decision about existence of a change point is made using critical values computed from the data: threshold tuning is carried out using multiplier bootstrap procedure for multiple testing. This allows algorithm to be applied even if the nature of random process under consideration is not known.

List of participants

Daniel Becker, Bonn Graduate School of Economics, University of Bonn

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Pierre Bellec, ENSAE-CREST, Paris

Rudolf Beran, University of California, Davis

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