Workshop on Statistics and Stochastic Analysis

2016年7月6-8日

山东大学

Workshop on Statistics and Stochastic Analysis
山东大学　　2016 年 7 月 6-8 日

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基金支持

会议举办地

山东省济南市山东大学中心校区（山大南路 27 号）知新楼 B1238

会议日程安排

时　间	主持人	报告人	报告题目
2016 年 7 月 7 日，周四			
8:00–8:20	注　册		
8:20–8:30	开幕式		
8:30–9:10	吴　臻	蔡宗武	A New Test on Asset Return Predictability with Structural Breaks
9:10–9:50		陈振庆	Stability of Heat Kernel Estimates for Symmetric Non-local Dirichlet Forms
9:50–10:10	茶　歇		
10:10–10:50	贾广岩	高付清	Cramer-type Moderate Deviations for Monotone Functions
10:50–11:30		宋　健	Hyperbolic Anderson Model with Space-time Homogeneous Gaussian Noise
11:30–12:10		冯峥晖	Nonparametric Variable Selection and Its Application to Additive Models
12:10	午　餐		
14:00–14:40	栾贻会	蒋文新	Bayesian Generalized Method of Moments and Variable Selection
14:40–15:20		张希承	Stochastic Hamiltonian Flow with Singular Drifts
15:20–16:00		嵇少林	Recursive Utility Optimization with Nonsmooth Coefficients
16:00–16:30	茶　歇		
16:30–17:10	林　路	钟　威	A New Test for High Dimensional Regression Coefficients
17:10–17:50		陈增敬	Limit Theorems for Capacities
17:50	晚　餐		

2016 年 7 月 8 日，周五			
时　　间	主持人	报告人	报告题目
8:30-9:10	石玉峰	杨立坚	Oracally Efficient Estimation and Consistent Model Selection for Auto-regressive Moving Average Time Series with Trend
9:10-9:50		赵怀忠	Ergodicity of Periodic Stochastic Dynamical Systems and Spectral Characterisation
9:50-10:10	茶　歇		
10:10-10:50	嵇少林	熊　捷	Leader-Follower Stochastic Differential Game with Asymmetric Information and Applications
10:50-11:30		董　昭	Stationary Measures for Stochastic Lotka-Volterra Systems with Application to Turbulent Convection
11:30-12:10		崔　霞	Identification and Estimation of Generalized Linear Models with Parametric Nonignorable Missing Data Mechanism
12:10	午　餐		
14:00-14:40	高付清	宋仁明	Potential Theory of Subordinate Brownian Motions
14:40-15:20		刘　磊	Estimating and Testing High-dimensional Mediation Effects in Epigenetic Studies
15:20-16:00		郑海涛	Maximum Likelihood Method Under Equation Constraints for Case-Control Study
16:00-16:30	茶　歇		
16:30-17:10	李　娟	任艳霞	Williams Decomposition for Superprocesses
17:10-17:50		林　路	Consistent Estimation for Distribution-uncertainty Regression Via Cross-sample and Semiparametric Methodologies
17:50	晚　餐		

备注

6日入住学人大厦

7日、8日午餐：学人大厦自助餐厅

茶歇：知新楼B1135

报告摘要（按照报告人姓名拼音顺序排列）

A New Test on Asset Return Predictability with Structural Breaks

蔡宗武，厦门大学   zongwucai@gmail.com

This paper considers a predictive regression with a structural break at some unknown date. We establish a testing procedure for testing asset returns predictability via empirical likelihood method based on weighted score equations. The proposed empirical likelihood method works well theoretically in the sense that the Wilks's theorem holds. It is noteworthy that theoretical results are derived under a unified framework that it is unneeded to distinguish whether the predicting regressors are stationary or nonstationary. Simulation experiments are provided to confirm theoretical results and to illustrate the finite sample performance. As empirical analyses, we test for predictability on the S&P 500 stock returns using the dividend-price ratio and the earnings-price ratio. Our empirical likelihood-based procedure suggests a clear improvement over existing tests and should be used in practical applications.

This is the joint work with Seong Yeon Chang at WISE, Xiamen University.

Limit Theorems for Capacities

陈增敬，山东大学   zjchen@sdu.edu.cn

Motivated by Ellsberg-type models and problems in mathematical finance, we investigate limit behaviors of two different models: one is the very simple Bernoulli trials with ambiguity (or called Ellsberg-type model), and the other is sub-linear expectations arising from mathematical finance. With a new notion of ϕ-convolution for random variables, we show that empirical averages obtained from a large number of trials in both models have the same limit distribution. We also investigate the relation between this limit theorem and the weak law of large numbers for nonadditive probability, and show that they are equivalent under the assumption of ϕ-convolution on random variables. Our results generalize well-known laws of large numbers (LLNs), using the proofs that are completely different from those in the existing literature. Finally, we discuss four models which satisfy the assumptions of our main results.

Stability of Heat Kernel Estimates for Symmetric Non-local Dirichlet Forms

陈振庆，University of Washington　　　　　　　zqchen@uw.edu

In this talk, we consider symmetric jump processes of mixed-type on metric measure spaces under general volume doubling condition, and establish stability of two-sided heat kernel estimates and heat kernel upper bounds. We obtain their stable equivalent characterizations in terms of the jumping kernels, variants of cut-off Sobolev inequalities, and the Faber-Krahn inequalities. In particular, we will present stability results of heat kernel estimates for α-stable-like processes even with $\alpha\ge 2$ when the underlying spaces have walk dimensions larger than 2, which has been one of the major open problems in this area.

Based on joint work with Takashi Kumagai and Jian Wang.

Identification and Estimation of Generalized Linear Models with Parametric Nonignorable Missing Data Mechanism

崔霞，广州大学　　　　　　　　　　　cuixia@gzhu.edu.cn

We address the problem of identifying and estimating generalized linear models when the response values are nonignorably missing. A Logistic/Probit/Log-log pattern is taken to specify the missing data mechanism. In this situation, likelihood based on observed data may not be identi_able. In this article, we prove the models parameters are identifiable under very mild conditions and then construct estimators based on a likelihood-based approach. The proposed estimators are shown to be consistent and asymptotically normal. Simulation studies demonstrate that the proposed inference procedure performs well in many settings. We apply the proposed method to a dataset from research in a real study.

Stationary Measures for Stochastic Lotka-Volterra Systems with Application to Turbulent Convection

董昭，中国科学院　　　　　　　　　　dzhao@amt.ac.cn

In this talk I will give some ergodicity and nonergodicity for a class of stochastic Lotka-Volterra systems as the noise intensity vanishes. The nonergodicity case can be illustrated the turbulent characteristics. It is a phenomenon that the turbulence in a fluid layer heated from below and rotating about a vertical axis is robust under stochastic disturbances. This is a joint work with Lifeng Chen, Jifa Jiang, Lei Niu and Jianliang Zhai.

Nonparametric Variable Selection and Its Application to Additive Models

冯峥晖，厦门大学   zhfengwise@gmail.com

For multivariate nonparametric regression models, existing variable selection methods with penalization require high-dimensional nonparametric approximations in objective functions. When the dimension is high, none of methods with penalization in the literature are readily available. Also, ranking and screening approaches cannot have selection consistency when iterative algorithms cannot be used due to inefficient nonparametric approximation. In this paper, a novel and easily implemented approach is proposed to make existing methods feasible for selection with no need of nonparametric approximation. Selection consistency can be achieved. As an application to additive regression models, we then suggest a two-stage procedure that separates selection and estimation steps. An adaptive estimation to the smoothness of underlying components can be constructed such that the consistency can be even at parametric rate if the underlying model is really parametric. Simulations are carried out to examine the performance of our method, and a real data example is analyzed for illustration.

Cramer-type Moderate Deviations for Monotone Functions

高付清，武汉大学   fqgao@whu.edu.cn

We introduce Cramer-type moderate deviations for nonparametric maximum likelihood estimators of monotone functions and their applications.

Recursive Utility Optimization with Nonsmooth Coefficients

嵇少林，山东大学   jsl@sdu.edu.cn

This paper study the recursive utility maximization problem. We assume that the coefficients of both the wealth equations and the recursive utilities may be nonlinear and nonsmooth. After given an equivalent backward formulation of our problem, we employ the variational formulation to deal with the nonsmooth coefficients. By the convexity duality method, the primal "sup-inf" problem is translated to a dual minimization problem and the characterization of the saddle point of this game is derived. Finally, we obtain the optimal terminal wealth. To illustrate our results, three cases are explicitly worked out under some special assumptions. (joint work with Xiaomin Shi)

Bayesian Generalized Method of Moments and Variable Selection

蒋文新，Northwestern University，山东大学   mwj60208@yahoo.com

An important practice in statistics is to use robust likelihood-free methods, such as the estimating equations, which only require assumptions on the moments instead of specifying the full probabilistic model. We propose a Bayesian approach for such likelihood-free methods, based on (quasi-)posterior probabilities from the Bayesian Generalized Method of Moments (BGMM). This novel concept allows us to incorporate two important advantages of a Bayesian approach: the expressiveness of posterior distributions and the convenient computational method of MCMC. Many different applications are possible, including modeling the correlated longitudinal data, the quantile regression, and the graphical models based on partial correlation. We demonstrate numerically how our method works in these applications. Under mild conditions, we show that theoretically the BGMM can achieve the posterior consistency for selecting the unknown true model, and that it possesses a Bayesian version of the oracle property, i.e. the posterior distribution for the parameter of interest is asymptotically normal and is as informative as if the true model were known. In addition, we show that the proposed quasi-posterior is valid to be interpreted as an approximate conditional distribution given a data summary.

Consistent Estimation for Distribution-uncertainty Regression Via Cross-sample and Semiparametric Methodologies

林路，山东大学   linlu@sdu.edu.cn

Motivating by the famous Ellsberg paradox, ambiguity (distribution-uncertainty) is quantitively and qualitatively important in behavior finance. We consider a type of distribution-uncertainty regressions that contains endogenous variable regression and semiparametric regression as its special cases. For such models, however, classical estimating function does involve infinitely many nuisance parameters caused by the uncertain distributions. Consequently, the parameters of interest cannot be consistently estimated and the corresponding prediction is imprecise, even aimless. In this paper, cross-sample and semiparametric techniques, together with a hidden-constant function, are proposed for dealing with the infinitely many nuisance parameters. The resultant estimating function only contains the parameters of interest, and the estimators of them are always consistent and normally distributed with standard convergence rate. Moreover, the newly proposed methodologies can avoid the use of instrumental variable or nonparametric estimation even if actually the model under study contains endogenous variables or nonparametric components. On the other hand, the methodologies for numerical computation are simple, and the corresponding computation procedures are somewhat similar to those for the distribution-certainty models. The main difference from the classical regression analysis is that the estimation efficiency is related to the level of distribution-uncertainty.

Estimating and Testing High-dimensional Mediation Effects in Epigenetic Studies

刘磊，Northwestern University   Lei.liu@northwestern.edu

DNA methylation is an important epigenetic mechanism to regulate gene expression. Genome-wide DNA methylation markers, e.g., measured by Illumina Infinium HumanMethylation450 BeadChip, are ultra-high dimensional (around 480K). DNA methylation markers may mediate pathways linking environmental exposures with health outcomes. However, there is a lack of analytical methods to identify significant mediators for high-dimensional mediation analysis. Based on sure independent screening and minimax concave penalty (MCP) techniques, we have developed a joint significance test for the mediation effect. We demonstrate its practical performance using Monte Carlo

simulation studies and apply this method to investigate the extent to which DNA methylation markers mediate the causal pathway from smoking to reduced lung function in the Normative Aging Study.

Williams Decomposition for Superprocesses

任艳霞，北京大学   yxren@math.pku.du.cn

We are interested in a spinal decomposition for superprocesses involving the ancestral lineage of the last individual alive (Williams' decomposition).

For superprocesses with homogeneous branching mechanism, the spatial motion is independent of the genealogical structure. As a consequence, the law of the ancestral lineage of the last individual alive does not distinguish from the original motion. Therefore, in this setting, the description of the process at the extinction time may be deduced from Abraham and Delmas (2009) where no spatial motion is taken into account.

For nonhomogeneous branching mechanisms on the contrary, the law of the ancestral lineage of the last individual alive should depend on the distance to the extinction time. Using the Brownian snake, Delmas and H\'{e}nard (2013) provide a description of the genealogy for superprocesses with non-homogeneous quadratic branching mechanism.

We would like to find conditions such that the Williams' decomposition works for superprocesses with eneral non-homogeneous branching mechanisms. The talk is based on a working paper with Renming Song and Rui Zhang.

Hyperbolic Anderson Model with Space-time Homogeneous Gaussian Noise

宋健，香港大学   txjsong@hku.hk

In this article, we study the stochastic wave equation in arbitrary spatial dimension d with multiplicative noise, also known in the literature as the Hyperbolic Andreson Model. This equation is perturbed by a general Gaussian noise, which is homogeneous in both space and time. We prove the existence of a solution of this equation (in the Skorohod sense) and the Holder continuity of its sample paths, under the same respective conditions on the spatial spectral measure of the noise as in the case of the white noise in time, regardless of the

temporal covariance function of the noise. This is joint work with R. M. Balan.

Potential Theory of Subordinate Brownian Motions

宋仁明，University of Illinois   rsong@illinois.edu

A subordinate Brownian motion can be obtained by replacing the time parameter of a Brownian motion by an independent increasing Levy process (i. e., a subordinator). Subordinate Brownian motions form a large subclass of Levy processes and they are very important in various applications. The generator of of a subordinate Brownian motion is a function of the Laplacian. In this talk, I will give a survey of some of the recent results in the study of the potential theory of subordinate Brownian motions. In particular, I will present recent results on sharp two-sided estimates on the transition densities of killed subordinate Brownian motions in smooth open sets, or equivalently, sharp two-sided estimates on the Dirichlet heat kernels of the generators of subordinate Brownian motions.

Leader-Follower Stochastic Differential Game with Asymmetric Information and Applications

熊捷，澳门大学   xiong79@yahoo.com

This talk is concerned with a leader-follower stochastic differential game with asymmetric information, where the information available to the follower is based on some sub-σ-algebra of that available to the leader. Such kind of game problems has wide applications in finance, economics and management engineering such as newsvendor problems, cooperative advertising and pricing problems. Stochastic maximum principles and verification theorems with partial information will be presented. As an application, a linear-quadratic leader-follower stochastic differential game with asymmetric information is studied. It is shown that the open-loop Stackelberg equilibrium admits a state feedback representation if some system of Riccati equations is solvable. This talk is based on a joint work with Shi and Wang.

Oracally Efficient Estimation and Consistent Model Selection for Auto-regressive Moving Average Time Series with Trend

杨立坚，清华大学   yanglijian@tsinghua.edu.cn

Most time series that are encountered in practice contain non-zero trend, yet textbook approaches to time series analysis are typically focused on zero-mean stationary auto-regressive moving average (ARMA) processes. Trend is often estimated by ad hoc methods and subtracted from time series, and the residuals are used as the true ARMA noise for data analysis and inference, including parameter estimation, lag selection and prediction. We propose a theoretically justified two-step method to analyse time series consisting of a smooth trend function and ARMA error term, which is computationally efficient and easy for practitioners to implement. The trend is estimated by B-spline regression, and the maximum likelihood estimator based on residuals is shown to be oracally efficient in the sense that it is asymptotically as efficient as if the true trend function were known and then removed to obtain the ARMA errors. In addition, consistency of the Bayesian information criterion for model selection is established for the detrended residual sequence. Finite sample performance of the procedure is illustrated by simulation studies and real data analysis.

Stochastic Hamiltonian Flow with Singular Drifts

张希承，武汉大学   XichengZhang@gmail.com

In this report, I will introduce recent progress about stochastic Hamitonian flow with singular drifts.

Ergodicity of Periodic Stochastic Dynamical Systems and Spectral Characterisation

赵怀忠，Loughborough University   H.Zhao@lboro.ac.uk

Ergodicity of random dynamical systems in the random periodic regime where a periodic measure exists on a Polish space is obtained. In the Markovian random dynamical systems

case, the idea of Poincar\'e sections is introduced. It is proved if the τ-periodic measure is PS-ergodic, then it is ergodic. Moreover, if the infinitesimal generator of the Markov semigroup has only $\{{2m\pi\over \tilde \tau}i\}_{m\in {\mathbb Z}}$ as simple eigenvalues on the imaginary axis, where $\tilde \tau={\tau\over k}$ for some $k\in {\mathbb N}\setminus \{0\}$, then the periodic measure is PS-ergodic. Furthermore, if the semigroup on Poincar\'e sections has spectral gap, then the periodic measure is PS-mixing. The distinction between random periodic and stationary regimes is given by a sufficient and necessary condition in terms of the spectral structure of the infinitesimal generators. In particular if the τ-periodic measure is PS-mixing, then the infinitesimal generator of the Markovian semigroup has only $\{{2m\pi\over \tilde \tau}i\}_{m\in {\mathbb Z}}$ as simple eigenvalues on the imaginary axis, where $\tilde \tau={\tau\over k}$ for some $k\in {\mathbb N}\setminus \{0\}$, if and only if the minimal period of the periodic measure is no less than $\tilde \tau$.

Maximum Likelihood Method Under Equation Constraints for Case-Control Study

郑海涛，西南交通大学   htzheng@home.swjtu.edu.cn

In case-control study, the restricted maximum likelihood method does not work and the corresponding asymptotic properties have yet been studied. In this article, we considered the maximum likelihood(ML) method for case-control study under equation constraints. We studied the asymptotic properties of the restricted ML estimators and the related likelihood ratio test converges to a chi^2 distribution asymptotically. Simulation studies were performed to evaluate the proposed method and corresponding theoretical properties.

A New Test for High Dimensional Regression Coefficients

钟威，厦门大学   wzhong@xmu.edu.cn

Testing a hypothesis for high dimensional regression coefficients is of fundamental importance in the statistical theory and applications. This paper aims to develop a new U-type test for coefficients in high dimensional linear regression models based on an estimated U-statistics of order two. With the aid of martingale central limit theorem, we prove that the asymptotic null distributions of the proposed test are normal under two

different distribution assumptions. The idea of refitted cross-validation (RCV) approach is utilized to reduce the bias of the sample variance in the estimation of the test statistic. We assess the finite-sample performance of the proposed test by examining its size and power via Monte Carlo simulations which show that the new test based on the RCV estimator of the variance achieves higher powers, especially for the sparse cases. We also illustrate the application of the proposed test by an empirical analysis of a microarray data set on Yorkshire gilts.

参加会议人员

蔡宗武　University of Kansas

陈增敬　山东大学

陈振庆　University of Washington

崔　霞　广州大学

董　昭　中国科学院

冯新伟　山东大学

冯峥晖　厦门大学

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胡明尚　山东大学

黄宗媛　山东大学

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