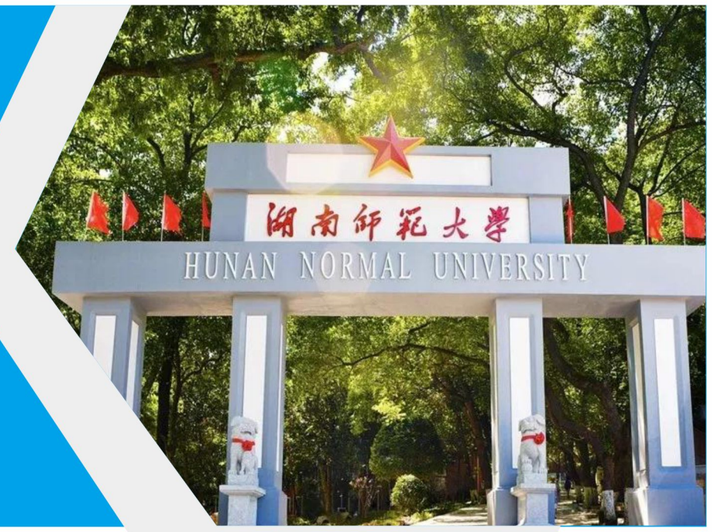
仁爱精勤

湖南師範大學
HUNAN NORMAL UNIVERSITY

中国现场统计研究会高维数据统计分会

第七届学术研讨会

程 序 册



主办单位：中国现场统计研究会高维数据统计分会

承办单位：湖南师范大学数学与统计学院

2023年5月19-21日 长沙

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会议委员会

程序委员会

主席

王启华

委员

艾明要　林华珍　唐年胜　王兆军　张日权

朱利平　邹国华

组织委员会

主席

郭水霞

委员

杨　晶　刘思晟　赵　维　耿旖旎　周杰明

陈　旭　张墨力　李　娟

会议须知

欢迎您参加中国现场统计研究会高维数据统计分会第七届学术研讨会，本着圆满完成此次会议宗旨，现将有关事宜宣告如下：

一、酒店安排

长沙茉莉花国际酒店（长沙市岳麓区金星中路 528 号）

长沙金麓国际大酒店（长沙市岳麓区岳麓大道 311 号）

二、就餐安排

日期	就餐时间	就餐地点
5 月 19 日	晚餐 18: 00-19: 30	茉莉花国际酒店
5 月 20 日	早餐 06: 30-08: 00	所住酒店
	午餐 12: 20-13: 30	茉莉花国际酒店
	晚宴 18: 00-19: 30	茉莉花国际酒店
5 月 21 日	早餐 06: 30-08: 15	所住酒店
	午餐 12: 10-14: 00	茉莉花国际酒店

三、注意事项

1、 请参会代表提前熟悉会议手册，按照会议议程准时参加各项学术活动。若会议议程时间、地点临时有变化，会务组将及时提前通知。

2、 会议期间，请参会代表佩戴代表证参加各项活动。切记将您的手机调至静音或震动状态。

3、 会议期间，请遵守疫情防控相关政策，如无特殊情况，请不要离会单独活动。

4、 会务组联系人：

杨晶：13548785657;　　刘思晟：18974166797

日程简表

日期	时间	事项	地点
5月19日（星期五）	09: 00-20: 00	会议报到、注册	茉莉花国际酒店
	18: 00-19: 30	晚餐	茉莉花国际酒店
5月20日（星期六）	06: 30-08: 00	早餐	所住酒店
	08: 10	乘车前往湖南师大附中报告厅	所住酒店门口
	08: 45-09: 30	开幕式、合影	湖南师大附中报告厅（道德讲堂）
	09: 30-10: 15	大会特邀报告 1	
	10: 15-11: 00	大会特邀报告 2	
	11: 00-11: 15	茶歇	
	11: 15-12: 00	大会特邀报告 3	
	12: 00	乘车回酒店用餐	湖南师大附中
	12: 20-13: 30	午餐	茉莉花国际酒店
	13: 30-17: 40	第一分会场报告	15 楼茉莉 1 厅
	13: 30-17: 40	第二分会场报告	15 楼茉莉 3 厅
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	08: 15-12: 10	第一分会场报告	15 楼茉莉 1 厅
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	10: 05-10: 20	茶歇	茉莉花国际酒店
	12: 10-14: 00	午餐	茉莉花国际酒店
	14: 00-	自由交流、离会	

会议议程

5 月 19 日

会议报到 9: 00-20: 00

晚餐 18: 00-19: 30 **地点：**茉莉花国际酒店

5 月 20 日 上午

乘车前往湖南师大附中报告厅 8:10

开幕式及合影 8:45-9:30 **地点：**湖南师大附中报告厅（道德讲堂）

主持人：郭水霞 副院长 湖南师范大学数学与统计学院

湖南师范大学副校长 谢资清教授 致辞

中国现场统计研究会理事长 郭建华教授 致辞

中国现场统计研究会高维数据统计分会理事长 王启华教授 致辞

全体人员合影 **地点：**湖南师大附中

大会特邀报告 9:30-12:00 **地点：**湖南师大附中报告厅（道德讲堂）

大会特邀报告 1 9:30-10:15

报告题目: Statistical Inference on a Four-regime Segmented Regression Model

报告人：陈松蹊 北京大学

主持人：王启华 中国科学院数学与系统科学研究院

大会特邀报告 2 10:15-11:00

报告题目：Transfer Learning: Optimality and Adaptive Algorithms

报告人：Tony Cai 宾夕法尼亚大学

主持人：林华珍 西南财经大学

茶歇 时间: 11:00-11:15

大会特邀报告 3 11:15-12:00

报告题目：Large-scale Detection of Differential Sparsity Structure

报告人：邹长亮 南开大学

主持人：邹国华 首都师范大学

乘车回酒店用餐 12:00

午餐 12:20-13:30 **地点：**茉莉花国际酒店

5 月 20 日 下午

分会场报告（20.1.1-20.3.8） 13: 30-17: 40 **地点：**茉莉花国际酒店 15 楼

第一分会场（20.1.1-20.1.4） **地点: 15 楼茉莉 1 厅**

主持人: 张立新 浙江大学

1、邀请报告（20.1.1） 13:30-14:05

报告题目：Multi-Consensus Decentralized Primal-dual Fixed Point Algorithm for Distributed Learning

报告人: 刘卫东 上海交通大学

2、报告（20.1.2） 14:05-14:30

报告题目：Communication-efficient Distributed Estimation of Partially Linear Additive Models for Large-scale Data

报告人: 王磊 南开大学

3、报告（20.1.3） 14:30-14:55

报告题目: A Two-stage Optimal Subsampling Estimation for Missing Data Problems with Large-scale Data

报告人: 苏苗苗 北京邮电大学

4、**报告（20.1.4）** 14:55-15:20

报告题目: Estimation and Inference for Ultra-high Dimensional Quasi-likelihood Models Based on Data Splitting

报告人: 蒋学军 南方科技大学

第二分会场（20.2.1-20.2.4）　　地点: 15 楼茉莉 3 厅

主持人: 石坚　中科院数学与系统科学研究院

1、邀请报告（20.2.1） 13:30-14:05

报告题目: Model-free Test and Measure for Partial Mean Dependence

报告人: 钟威　　厦门大学

2、报告（20.2.2） 14:05-14:30

报告题目: Estimation and Order Selection for Multivariate Exponentional Power Mixture Models

报告人: 冯峥晖　哈尔滨工业大学（深圳）

3、报告（20.2.3） 14:30-14:55

报告题目: Tensor t-distribution and Tensor Response Regression

报告人: 王宁　　北京师范大学

4、报告（20.2.4） 14:55-15:20

报告题目: A Weighted Iterative Projection Estimation Procedure for Robust Tensor Factor Model with Tucker Decomposition

报告人: 胡雪梅　　重庆工商大学

第三分会场（20.3.1-20.3.4）　　地点: 15 楼贵宾厅

主持人：张忠占　北京工业大学

1、邀请报告（20.3.1） 13:30-14:05

报告题目: High Dimensional (Mean) Independence Tests Based on Rank Indices in the Presence of Heterogeneity

报告人: 朱利平　　中国人民大学

2、报告（20.3.2） 14:05-14:30

报告题目: Score Function-based Tests for Ultrahigh-Dimensional Linear Models

报告人: 郭旭　　北京师范大学

3、报告（20.3.3） 14:30-14:55

报告题目: Detecting communities in attributed networks through bi-direction penalized clustering and its application

报告人：杨虎　　中央财经大学

4、报告（20.3.4） 14:55-15:20

报告题目：New Tests for High-Dimensional Two-sample Mean Problems with Consideration of Correlation Structure

报告人：杨松山　　中国人民大学

茶歇 时间: 15:20-15:40

第一分会场（20.1.5-20.1.8）　　地点：15 楼茉莉 1 厅

主持人：艾明要　北京大学

1、邀请报告（20.1.5） 15:40-16:15

报告题目：深度非线性降维

报告人：於州　　华东师范大学

2、邀请报告（20.1.6） 16:15-16:50

报告题目：Regulation-incorporated Network-based Heterogeneity Analysis

报告人：张庆昭　　厦门大学

3、报告（20.1.7） 16:50-17:15

报告题目：非线性期望与统计机器学习

报告人：严晓东　　山东大学

4、报告（20.1.8） 17:15-17:40

报告题目：Robust Transfer Learning in High-dimensional GLM via γ-divergence

报告人：徐福芝　　厦门大学

第二分会场（20.2.5-20.2.8）　　地点：15 楼茉莉 3 厅

主持人：薛留根　河南大学

1、邀请报告（20.2.5） 15:40-16:15

报告题目：Tensor Model Averaging

报告人：张新雨　　中国科学院

2、邀请报告（20.2.6） 16:15-16:50

报告题目：Introducing the Specificity Score: Measuring the Credibility of Causal Associations

报告人：苗旺　　北京大学

3、报告（20.2.7） 16:50-17:15

报告题目：Rank-based Greedy Model Averaging for High-dimensional Survival Data

报告人：贺百花　　中国科学技术大学

4、报告（20.2.8） 17:15-17:40

报告题目：Time-varying Complete Subset Averaging in a Data-rich Environment

报告人：李海奇　　湖南大学

第三分会场（20.3.5-20.3.8） **地点：15 楼贵宾厅**

主持人：林路　山东大学

1、邀请报告（20.3.5） 15:40-16:15

报告题目：Statistical Inferences for Complex Dependence of Multimodal Imaging Data

报告人：常晋源　　西南财经大学、中国科学院数学与系统科学研究院

2、邀请报告（20.3.6） 16:15-16:50

报告题目：The Aggregation-heterogeneity Trade-off in Federated Learning

报告人：林伟　　北京大学

3、报告（20.3.7） 16:50-17:15

报告题目：Sequential Data Integration under Dataset Shift

报告人：盛赢　　中国科学院数学与系统科学研究院

4、报告（20.3.8） 17:15-17:40

报告题目：Federated Survival Analysis via Data Augmentation Using Multi-task Variational Autoencoder

报告人：王洪　　中南大学

晚餐： 18:00-19:30　　地点：茉莉花国际酒店

5 月 21 日 上午

分会场报告（21.1.1-21.3.8） 8: 15-12: 10 **地点：**茉莉花国际酒店 15 楼

第一分会场（21.1.1-21.1.4） **地点: 15 楼茉莉 1 厅**

主持人: 朱仲义 复旦大学

1、邀请报告（21.1.1） 8:15-8:50

报告题目: Feature Screening for Clustering Analysis

报告人: 席瑞斌 北京大学

2、报告（21.1.2） 8:50-9:15

报告题目: Generalization Ability of Wide Neural Networks

报告人: 赖建发 清华大学

3、报告（21.1.3） 9:15-9:40

报告题目: Citation Counts Prediction of Statistical Publications Based on Multi-layer Academic Networks via Neural Network Model

报告人: 潘蕊 中央财经大学

4、**报告（21.1.4）** 9:40-10:05

报告题目: Dimension Reduction for Covariates in Network Data

报告人: 赵俊龙 北京师范大学

第二分会场（21.2.1-21.2.4） **地点: 15 楼茉莉 3 厅**

主持人: 刘小惠 江西财经大学

1、邀请报告（21.2.1） 8:15-8:50

报告题目: Tuning-parameter-free Propensity Score Matching Approach for Causal Inference Under Shape Restriction

报告人: 刘玉坤 华东师范大学

2、报告（21.2.2） 8:50-9:15

报告题目: Novel Statistical Methods for High-dimensional Microbiome Data Analysis

报告人: 占翔 北京大学

3、报告（21.2.3） 9:15-9:40

报告题目: High-dimensional Response Growth Curve Modeling for Longitudinal Neuroimaging Analysis

报告人：王璐　　中南大学

4、报告（21.2.4） 9:40-10:05

报告题目：Generalized Liquid Association Analysis for Multimodal Data Integration

报告人：曾靖　　中国科学技术大学

第三分会场（21.3.1-21.3.4） **地点：15 楼贵宾厅**

主持人：程维虎　北京工业大学

1、邀请报告（21.3.1） 8:15-8:50

报告题目：Group-orthogonal Subsampling for Big Data Linear Mixed Models

报告人：孙法省　　东北师范大学

2、报告（21.3.2） 8:50-9:15

报告题目：Debiased and Thresholded Ridge Regression for Linear Nodels with Heteroskedastic and Correlated Errors

报告人：张云翼　　香港中文大学（深圳）

3、报告（21.3.3） 9:15-9:40

报告题目：Sketched Ridgeless Linear Regression: The Statistical Role of Sketching

报告人：曾奕程　　深圳市大数据研究院

4、报告（21.3.4） 9:40-10:05

报告题目：Classified Generalized Linear Mixed Model Prediction Incorporating Pseudo-prior Information

报告人：马海强　　江西财经大学

茶歇 时间: 10:05-10:20

第一分会场（21.1.5-21.1.8） **地点：15 楼茉莉 1 厅**

主持人：张日权　上海对外经贸大学

1、邀请报告（21.1.5） 10:20-10:55

报告题目：广义离群随机矩阵的极限理论、统计推断和交叉应用

报告人：姜丹丹　　西安交通大学

2、报告（21.1.6） 10:55-11:20

报告题目: Weighted Residual Empirical Processes, Martingale Transformations, and Model Checking for Regressions

报告人: 谭发龙 湖南大学

3、报告（21.1.7） 11:20-11:45

报告题目: Regularized t Distribution: Definition, Properties and Application

报告人: 胡宗良 深圳大学

4、报告（21.1.8） 11:45-12:10

报告题目: Randomization-based Joint Central Limit Theorem and Efficient Covariate Adjustment in Randomized Block 2K Factorial Experiments

报告人: 杨玥含 中央财经大学

第二分会场（21.2.5-21.2.8） **地点: 15 楼茉莉 3 厅**

主持人: 岳荣先 上海师范大学

1、邀请报告（21.2.5） 10:20-10:55

报告题目: One-way or Two-way Factor Model for Matrix Sequences?

报告人: 孔新兵 南京审计大学

2、报告（21.2.6） 10:55-11:20

报告题目: 基于结构化随机森林的地震波初至拾取方法

报告人: 张春霞 西安交通大学

3、报告（21.2.7） 11:20-11:45

报告题目: Functional Additive Expectile Regression in the Reproducing Kernel Hilbert Space

报告人: 刘育孜 江西财经大学

4、报告（21.2.8） 11:45-12:10

报告题目: A General Framework to Select Tuning Parameter for Nonparametric Derivative Estimation.

报告人: 刘思晟 湖南师范大学

第三分会场（21.3.5-21.3.8） **地点: 15 楼贵宾厅**

主持人: 张崇岐 广州大学

1、<u>邀请报告（21.3.5）</u> 10:20-10:55

报告题目: Heterogeneity-aware Clustered Distributed Learning for Multi-source Data Analysis

报告人: 方匡南 厦门大学

2、报告（21.3.6） 10:55-11:20

报告题目: Distribution-free Simultaneous Prediction Bands for Clustered Data with Missing Responses

报告人: 唐炎林 华东师范大学

3、报告（21.3.7） 11:20-11:45

报告题目: Renewable Quantile Regression for Streaming Data Sets

报告人: 姜荣 上海第二工业大学

4、报告（21.3.8） 11:45-12:10

报告题目: Smooth-threshold GMM Estimation of Higher-order Semiparametric Spatial Autoregressive Model with Increasing Dimension

报告人: 杨晶 湖南师范大学

午餐: 12:10-14:00 地点：茉莉花国际酒店

自由交流、离会: 14:00-

报告题目和摘要（按报告顺序）

大会特邀报告 1: Statistical Inference on a Four-Regime Segmented Regression Model

报告人：陈松蹊 教授　北京大学

摘要：Segmented regression models are attractive for their flexibility and interp retability as compared to the global parametric and the nonparametric models, and yet are challenging in both estimation and inference. We consider a four-re gime segmented model for temporally dependent data with two segmenting bou ndaries depending on multivariate covariates with non-diminishing boundary eff ects. A mixed integer quadratic programming algorithm is formulated to facilita te the least square estimation to both the regression and the boundary coefficie nts. The rates of convergence and the asymptotic distributions of the least squa re estimators are obtained, which shows differential convergence rates and limit ing distributions between the regression and the boundary coefficients. Estimati on and testing for degenerated segmented models with less than four segments are also considered with a testing procedure to decide if neighboring segments can be merged. Numerical simulations and a case study on air pollution in B eijing are conducted to demonstrate the proposed model and the inference resul ts. In particular, it shows that the segmented models with three or four regime s are suitable for the modeling of the meteorological effects on the PM2.5 con centration.

大会特邀报告 2: Transfer Learning: Optimality and Adaptive Algorithms

报告人：Tony Cai　Professor　宾夕法尼亚大学

摘要：Human learners have the natural ability to use knowledge gained in one setting for learning in a different but related setting. This ability to transfer knowledge from one task to another is essential for effective learning. However, in statistical learning, most procedures are designed to solve one single task, or to learn one single distribution, based on observations from the same setting. In this talk, we discuss statistical transfer learning in various settings under the posterior drift model, which is a general framework and arises in many practical problems. The results show that significant benefit of incorporating data from the source distributions for learning under the target distribution.

大会特邀报告 3: Large-scale Detection of Differential Sparsity Structure

报告人：邹长亮 教授　南开大学

摘要： Two-sample multiple testing has a wide range of applications. Most of the literature considers simultaneous tests of equality of parameters. This work takes a different perspective and investigates the null hypotheses that the two support sets are equal. This formulation of the testing problem is motivated by the fact that in many applications where the two parameter vectors being compared are both sparse, we might be more concerned about the detection of differential sparsity structures rather than the difference in parameter magnitudes. A general approach to problems of this type is developed via a novel double thresholding (DT) filter. The DT filter first constructs a sequence of pairs of ranking statistics that fulfill global symmetry properties, and then chooses two data-driven thresholds along the ranking to simultaneously control the false discovery rate (FDR) and maximize the number of rejections. Several applications of the methodology are given, including tests for large-scale correlation matrices, high-dimensional linear models and Gaussian graphical models.

分会场邀请报告（20.1.1）：Multi-Consensus Decentralized Primal-dual Fixed Point Algorithm for Distributed Learning

报告人：刘卫东　　上海交通大学

摘要： Decentralized distributed learning has recently attracted significant attention in many applications in machine learning and signal processing. To solve a decentralized optimization with regularization, we propose a Multi-consensus Decentralized Primal-Dual Fixed Point (MD-PDFP) algorithm. We apply multiple consensus steps with the gradient tracking technique to extend the primal-dual fixed point method over a network. The communication complexities of our procedure are given under certain conditions. Moreover, we show that our algorithm is consistent under general conditions and it enjoys global linear convergence under strong convexity. With some particular choices of regularizations, our algorithm can be applied to decentralized machine learning applications. Finally, several numerical experiments and real data analyses are conducted to demonstrate the effectiveness of the proposed algorithm.

分会场报告（20.1.2）：Communication-efficient Distributed Estimation of Partially Linear Additive Models for Large-scale Data

报告人：王磊　　南开大学

摘要： Distributed estimation for parametric models has drawn attention in modern statistical learning, but few studies focus on semiparametric models. In this paper, we propose two communication-efficient distributed estimators for partially linear additive models with high-dimensional covariates. The commonly used B-spline basis functions are first applied to approximate the nonparametric functions and then we construct a profiled communication-efficient surrogate loss function with Lasso penalty based on one local machine solving the final optimization problem. Further, to reduce the effect of local machines and improve the stability of the algorithm, a profiled gradient-enhanced loss estimator is derived. The resulting two estimators and their theoretical convergence rates for both parametric and nonparametric components are established. The finite-sample performance of the proposed estimators is studied through simulations and an application to appliances energy prediction data set is also presented.

分会场报告（20.1.3）: A Two-Stage Optimal Subsampling Estimation for Missing Data Problems with Large-Scale Data

报告人：苏苗苗　　北京邮电大学

摘要： Subsampling is useful to downsize data volumes and speed up calculations for large-scale data and is well studied with completely observed data. In the presence of missing data, computation is more challenging and subsampling becomes more crucial and complex. However, there is still a lack of studies on subsampling for missing data problems. This paper fills the gap by studying the subsampling method for a widely used missing data estimator, the augmented inverse probability weighting (AIPW) estimator. The response mean estimation problem with missing responses is discussed for illustration. A two-stage subsampling method is proposed via Poisson sampling framework. A small subsample of expected size n1 is used in the first stage to estimate the parameters in the propensity score and the outcome regression models, while a larger subsample of expected size n2 is used in the computationally simple second stage to calculate the final estimator. An attractive property of the resulting estimator is that its convergence rate is n_{2}^{−1/2} rather than n_{1}^{−1/2} when

both the propensity score and the outcome regression functions are correctly specified. The rate n_{2}^{−1/2} is still attainable for some important cases if only one of the two functions is correctly specified. This indicates that using a small subsample in the computationally complex first stage can reduce the computational burden with little impact on the statistical accuracy. The asymptotic normality of the resulting estimator is established and the optimal subsampling probability is derived by minimizing the asymptotic variance of the resulting estimator. Simulations and a real data analysis were conducted to demonstrate the empirical performance of the resulting estimator.

分会场报告（20.1.4）：Estimation and Inference for Ultra-high Dimensional Quasi-likelihood Models Based on Data Splitting

报告人：蒋学军 南方科技大学

摘要： In this article, we develop a valid weighted estimation and inference framework for ultra-high dimensional quasi-likelihood models. The weighted estimator is obtained by minimizing the variance function. We split the full data into two subsets, conduct the model selection on one subset and compute the maximum quasi-likelihood estimator on the other subset. Then we aggregate the two estimators with the optimal weighted matrixes to form the final weighted estimator. With the weighted estimator, we construct the confidence intervals for the group components of the regression vector, and the Wald test for the linear structure of the group components. Theoretically, we establish the asymptotic normality of the weighted estimator, and the asymptotic χ^2-distribution of the corresponding Wald test without assuming model selection consistency. Advantages of the proposed tests are highlighted via theoretical and empirical comparison to some competitive tests, which guarantees that our proposed estimation and inference framework is locally optimal. In addition, when the selection consistency is achieved, we prove that the proposed Wald test is asymptotically identically distributed as the oracle tests in the sense that it knows the support of regression vector. Extensive simulations demonstrate more favorable finite sample performance of the proposed tests. An application to the breast cancer data illustrates the use of our proposed methodology.

分会场邀请报告（20.2.1）：Model-free Test and Measure for Partial Mean Dependence

报告人：钟威 厦门大学

摘要：It is of importance to investigate the significance of a subset of covariates W for the response Y given covariates Z in regression modeling. To this end, we propose a significance test for partial mean independence based on deep neural networks and data splitting. The test statistic converges to the standard chi-squared distribution under the null hypothesis while it converges to a normal distribution under the alternative hypothesis. We suggest a powerful ensemble algorithm based on multiple data splitting to enhance the testing power. If the null hypothesis is rejected, we propose a partial Generalized Measure of Correlation (pGMC) to measure the partial mean dependence of Y given W after controlling for the nonlinear effect of Z. We present the theoretical properties of the pGMC and establish the asymptotic normality of its estimator with the optimal root-N converge rate. Furthermore, the valid confidence interval for the pGMC is also derived. As an important special case when there is no conditional covariates Z, we consider a new test of overall significance of covariates for the response in a model-free setting. Numerical studies and real data analysis are conducted to compare with existing approaches and to illustrate the validity of our procedures.

分会场报告（20.2.2）：Estimation and Order Selection for Multivariate Exponential Power Mixture Models

报告人：冯峥晖 哈尔滨工业大学（深圳）

摘要：For multivariate non-Gaussian density estimation and approximation, in this paper, we consider to use multivariate exponential power mixture models. We use the penalized-likelihood method with generalized EM algorithm to estimate locations, scale matrices, shape parameters and mixing probabilities. Order selection is achieved simultaneously. Properties of the estimated order have been derived. Although we mainly focus on the unconstrained scale matrix type in multivariate exponential power mixture models, three more parsimonious type of scale matrix have also been considered. Performance based on simulation and real data analysis imply the parsimony of the exponential power mixture models, and verify the properties on order selection.

分会场报告（20.2.3）: Tensor t-distribution and Tensor Response Regression

报告人: 王宁 北京师范大学

摘 要： In recent years, promising statistical modeling approaches to tensor data analysis have been rapidly developed. Traditional multivariate analysis tools, such as multivariate regression and discriminant analysis, are now generalized from modeling random vectors and matrices to higher-order random tensors (a.k.a. array-valued random objects). Equipped with tensor algebra and high-dimensional computation techniques, concise and interpretable statistical models and estimation procedures prevail in many applications. One of the biggest challenges to statistical tensor models is the non-Gaussian nature of many real-world data. Unfortunately, existing approaches are either restricted to normality or implicitly using least squares type objective functions that are computationally efficient but sensitive to data contamination. Motivated by this, we propose a simple tensor t-distribution that is, unlike existing matrix t-distributions, compatible with tensor operators and reshaping of the data. We then study the tensor response regression with tensor t-error, and develop penalized estimation and hypothesis testing under this t-modeling approach. A novel one-step estimation algorithm is developed for penalized non-convex optimization and is proven to converge to the global optimum. We study the asymptotic relative efficiency of various estimators under this model and establish the oracle properties in variable selection and near-optimal asymptotic efficiency. Extensive numerical studies show the encouraging performance of the one-step estimator.

分会场报告（20.2.4）: A Weighted Iterative Projection Estimation Procedure for Robust Tensor Factor Model with Tucker Decomposition

报告人: 胡雪梅 重庆工商大学

摘 要： Tensor Factor Models(TFM) have been proposed as appealing dimension reduction tools for tensor-valued time series. In this paper we construct a robust TFM with Tucker decomposition by replacing the least square loss by the modified Huber loss whose tail function substituted by an exponential squared loss, propose a robust weighted iterative projection estimation procedure for loading matrices, latent dynamic tensor factors and signal parts, and develop their asymptotic consistent properties and faster convergence rates. Both two simulation experiment examples

and a real example show that the proposed robust procedure outperforms the existing methods in terms of robust estimation and tensor reconstruction.

分会场邀请报告（20.3.1）：High Dimensional (Mean) Independence Tests Based on Rank Indices in the Presence of Heterogeneity

报告人：朱利平 中国人民大学

摘 要： In the big data era, how to deal with heterogeneous observations is an inevitable and important issue. We consider testing (mean) independence in the presence of heterogeneity. To be precise, in the first part of the talk, we consider testing for the effects of high-dimensional covariates on the response. In the second part of the talk, we propose three tests to test independence between two high-dimensional random vectors based on the rank-based indices. To simultaneously accommodate such heteroscedasticity and high dimensionality, we propose novel tests based on aggregations, requiring no prior information on the specific form of models. Our proposed test statistics are scale-invariance, tuning-free and convenient to implement. We further study the asymptotic relative efficiency of our proposed test with respect to the state-of-art universal tests.

分会场报告（20.3.2）：Score Function-based Tests for Ultrahigh-Dimensional Linear Models

报告人：郭旭 北京师范大学

摘要：To sufficiently exploit the model structure under the null hypothesis such that the conditions on the whole model can be mild, this paper investigates score function-based tests to check the significance of an ultrahigh-dimensional sub-vector of the model coefficients when the nuisance parameter vector is also ultrahigh-dimensional in linear models. We first reanalyze and extend a recently proposed score function-based test to derive, under weaker conditions, its limiting distributions under the null and local alternative hypotheses. As it may fail to work when the correlation between testing covariates and nuisance covariates is high, we propose an orthogonalized score function-based test with two merits: debiasing to make the non-degenerate error term degenerate and reducing the asymptotic variance to enhance the power performance. Simulations evaluate the finite-sample performances of the proposed tests, and a real data analysis illustrates its application.

分会场报告（20.3.3）：Detecting communities in attributed networks through bi-direction penalized clustering and its application

报告人：杨虎 中央财经大学

摘 要： How to exploit the heterogeneous information in attributed networks to improve the performance of community detection is a hot research topic. Recently, network embedding methods have been extended to perform community detection on attributed networks, especially state-of-art deep learning methods (such as VGAE-based) translating attributed networks to vectorized data and enabling traditional machine learning methods to deal with attributed networks. It have been proven to be an effective strategy. However, previous methods perform community detection with assumptions about the dimension of embedding and the number of communities. It can limit the effectiveness and applicability of a clustering method if the dimension of embedding or the number of communities is assumed incorrectly, the resulting clustering may be suboptimal or even misleading. Thus, this study fuses VGAE-based methods and a bi-direction penalized clustering algorithm (BiPClust) for community detection and addresses the challenges. To the best of our knowledge, this study is the first to combine these techniques with the following advantages: it solves the issues of dimension selection and the number of communities determination through optimizing penalized clustering automatically; it provides both the computational algorithm and the statistical theorems as a proof to show that BiPClust can counteract the effects of redundant embedding, and determine the unknown number of communities; it is applied for community detection on benchmark datasets and syndicated investment networks in China. Our theoretical analysis suggests that BiPClust can effectively address the challenges of dimension selection and determination of the number of clusters. Furthermore, experimental results demonstrate that BiPClust outperforms other methods, further supporting our theoretical analysis.

分会场报告（20.3.4）：New Tests for High-Dimensional Two-sample Mean Problems with Consideration of Correlation Structure

报告人：杨松山 中国人民大学

摘要： This paper proposes a test statistic for two sample mean testing problems for high dimensional data by assuming the linear structure on high dimensional precision

matrices. A new precision matrix estimation method considering its linear structure is first proposed, and the regularization method is implemented to select the true basis matrices that can further reduce the approximation error. Then the test statistic is constructed by imposing the estimation of the precision matrix. The proposed test is valid for both the low dimensional setting and high dimensional setting even if the dimension of the data is greater than the sample size. The limiting null distributions of the proposed test statistic under both null distribution and alternative distribution are derived. Extensive simulations are conducted for estimating the precision matrix and testing difference of the high dimensional mean vector. Simulation results show that the proposed estimation method enjoy low estimation error for the precision matrix and the regularization method is able to efficiently select the important basis matrix. The testing method performs well compared with the existing methods especially when the elements of the vector have unequal variances. A real data example is then provided to demonstrate the potential of the proposed method in real world applications.

分会场邀请报告（20.1.5）：深度非线性降维

报告人：於州 华东师范大学

摘要：充分降维方法在过去三十年间得到了长足的发展。以切片逆回归、切片平均方差估计为代表的线性充分降维方法计算便捷应用广泛。我们在此将讨论如何基于深度神经网络将线性充分降维推广至非线性充分降维，并探究充分降维中心域估计的无偏性和收敛性以及收敛速度。我们将通过模拟试验和实际数据验证新方法的有效性。

分会场邀请报告（20.1.6）：Regulation-incorporated Network-based Heterogeneity Analysis

报告人：张庆昭 厦门大学

摘要： Gene expression-based heterogeneity analysis has been extensively conducted. In recent studies, it has been shown that network-based analysis, which takes a system perspective and accommodates the interconnections among genes, can be more informative than that based on simpler statistics. Gene expressions are highly regulated. Incorporating regulations in analysis can better delineate the ``sources'' of gene expression effects. Although conditional network analysis can somewhat serve

this purpose, it does render enough attention to the regulation relationships. In this article, significantly advancing from the existing heterogeneity analyses based only on gene expression networks, conditional gene expression network analyses, and regression-based heterogeneity analyses, we propose heterogeneity analysis based on gene expression networks (after accounting for or ``removing'' regulation effects) as well as regulations of gene expressions. A high-dimensional penalized fusion approach is proposed, which can determine the number of sample groups and parameter values (for all sample groups) in a single step. An effective computational algorithm is proposed. It is rigorously proved that the proposed approach enjoys the estimation, selection, and grouping consistency properties under high-dimensional settings. Extensive simulations demonstrate practical superiority of the proposed approach over closely related alternatives. In the analysis of two breast cancer datasets, the proposed approach identifies heterogeneity and gene network structures different from the alternatives and with sound biological implications.

分会场报告（20.1.7）：非线性期望与统计机器学习

报告人：严晓东 山东大学

摘要：山东大学非线性期望团队在风险研究领域已取得了一批原创性的、具有世界一流水平的研究成果，特别是 G-期望理论成为新一代金融风险研究工具。最近，山东大学非线性期望团队团队基于 G-期望理论研究了双臂及多臂机器人策略博弈行为并建立了非线性极限理论，在国际上产生了很大的影响。本报告考虑这一原创理论成果的统计科学问题以及提出新的统计机器学习方法，其中包括（1）双臂老虎机下的最优分布和悖论；（2）针对大数据下的双样本检验；（3）提出序贯 bootstrap 方法进行相似性假设检验和单样本检验的一般框架；（4）最后为了考虑一般化的模型，我们提出了基于随机梯度下降法的参数检验。值得注意的是，新的统计机器学习方法充分结合“知识”属于知识推理与数据驱动的统计学习方法，并且新的方法解决的假设检验问题与传统方法相比获得了更高的势。

分会场报告（20.1.8）：Robust Transfer Learning in High-dimensional GLM via γ-divergence

报告人：徐福芝 厦门大学

摘要：Outlying observations and even data contamination is often occurred in practice

due to high-dimensional sparsity. Robustness against outliers and contamination based on the divergence has been widely adopted. With the rapid growth in the volumes of high-dimensional data, learning from multiple sources of evidence is desired. Transfer learning can improve the performance of target models by transferring information from source datasets. Yet, multiple sources of information, introducing outlying observations and even contamination, may lead to biased estimation and misleading inference. In this study, we propose a robust transfer learning approach based on the minimum γ-divergence under a generalized linear model(GLM) framework for high-dimensional data. Using an algorithm-free transferable source detection scheme, the proposed approach identifies informative sources and avoids negative transfer of learning. We rigorously establish the consistency properties and estimation bounds under high dimensionality. Computational algorithm is developed based on proximal gradient descent for transferring and debiasing steps. Simulation demonstrates superior and competitive performance of the proposed approach in selection and prediction/classification. Analysis of genetic data on breast cancer and glioblastoma confirms its practical usefulness.

分会场邀请报告（20.2.5）：Tensor Model Averaging

报告人：张新雨 中国科学院

摘要： Tensor has a wide range of applications in neuroimaging, data mining, digital marketing, etc. It is difficult to perform simple linear regression directly on tensor data due to its large number of parameters. CANDECOMP/PARAFAC (CP) decomposition can represent a tensor as a sum of several rank-1 tensors, thus effectively reducing the number of parameters. However, we do not know which rank to use for regression in practice, because it is an NP-complete problem to solve the rank of a given tensor. In this article, we develop a model averaging method on CP tensor regression to solve this problem by weighting the estimators from models of different ranks. Simulations and empirical applications show that the proposed method has a promising performance.

分会场邀请报告（20.2.6）：Introducing the Specificity Score: Measuring the Credibility of Causal Associations

报告人：苗旺 北京大学

摘 要： Most applied science is concerned with uncovering causal relationships. Observational studies offer an important source of data for causal inference. A major challenge for observational studies is the unmeasured confounding. A variety of methods have been proposed for adjustment for unmeasured confounding, including instrumental variable and proximal inference. However, these auxiliary variables approaches often rely on complete and exact knowledge about the exclusion of certain causal effects, which is sometimes problematic and the difficulty is amplified when multiple treatments and outcomes are concerned because multiple auxiliary variables are necessitated. In this paper, I establish a framework for specificity analysis of causal effects in observational studies in the presence of unmeasured confounding, including a score measuring the specificity and credibility of causal associations, a test of the null hypothesis of no causal effects with controlled type I error, and an identification and estimation method of causal effects. While only requiring a rough idea on the extent of the causal associations in view, the specificity analyses do not invoke exact knowledge about which causal associations are active or null. The specificity analyses admit joint causal discovery with multiple treatments and multiple outcomes, which is particularly desirable in gene expressions studies, EHR studies, etc. This framework extends previous auxiliary variables approaches and has potential application in Mendelian randomization and selection bias adjustment. Simulations are used for illustration and an application to a mouse obesity dataset detects potential active effects of genes on clinical traits that are relevant to metabolic syndrome.

分会场报告（20.2.7）: Rank-based Greedy Model Averaging for High-dimensional Survival Data

报告人：贺百花 中国科学技术大学

摘要： Model averaging is an effective way to enhance prediction accuracy. However, most previous works focus on parametric models in low-dimensional settings with completely observed responses. To attain an accurate prediction for the risk effect of survival data with highdimensional predictors, we propose a novel method: rank-based nonparametric greedy (RNG) model averaging. Specifically, adopting the

nonparametric transformation model with splitting predictors as working models, we doubly utilize the smooth concordance index function to derive the candidate predictions and optimal model weights. The final prediction is achieved by weighted averaging all the candidates. Our approach is flexible, computationally efficient, and robust against model misspecification, as it neither requires the correctness of a joint model nor involves nonparametric estimation. We further adopt the greedy algorithm for high dimensions. Theoretically, we derive an asymptotic error bound for the optimal weights under some mild conditions. In addition, the summation of weights assigned to the correct candidate submodels is proven to approach one in probability when there are correct models included among the candidate submodels. Extensive numerical studies are carried out using both simulated and real datasets to show the proposed approach's robust performance compared to the existing regularization approaches.

分会场报告（20.2.8）：Time-varying Complete Subset Averaging in a Data-rich Environment

报告人：李海奇 湖南大学

摘要：This study proposes a novel time-varying complete subset averaging (TVCSA) method in a data-rich environment. The dimension of regressors is allowed to diverge with an increase in sample size. The optimal time-varying subset size is obtained by minimizing the local leave-one-out cross-validation (LOOCV) criterion. The proposed TVCSA estimator is consistent and asymptotically follows a normal distribution. Moreover, it is asymptotically optimal in terms of minimizing the local squared error loss and associated risk criterion. In particular, the proposed uniform-weighting TVCSA estimator is shown to be superior to the optimal-weighting averaging estimator. Monte Carlo simulations show favorable evidence for the proposed TVCSA method relative to other popular alternatives. The applications on U.S. equity premium and inflation rate forecasting demonstrate that our method has better forecasting performance than competing alternatives.

分会场邀请报告（20.3.5）：Statistical Inferences for Complex Dependence of Multimodal Imaging Data

报告人：常晋源 西南财经大学、中国科学院数学与系统科学研究院

摘要：Statistical analysis of multimodal imaging data is a challenging task, since the data involves high-dimensionality, strong spatial correlations and complex data structures. In this article, we propose rigorous statistical testing procedures for making inferences on the complex dependence of multimodal imaging data. Motivated by the analysis of multi-task fMRI data in the Human Connectome Project (HCP) study, we particularly address three hypothesis testing problems: (a) testing independence among imaging modalities over brain regions, (b) testing independence between brain regions within imaging modalities, and (c) testing independence between brain regions across different modalities. Considering a general form for all the three tests, we develop a global testing procedure and a multiple testing procedure controlling the false discovery rate. We study theoretical properties of the proposed tests and develop a computationally efficient distributed algorithm. The proposed methods and theory are general and relevant for many statistical problems of testing independence structure among the components of high-dimensional random vectors with arbitrary dependence structures. We also illustrate our proposed methods via extensive simulations and analysis of five task fMRI contrast maps in the HCP study.

分会场邀请报告（20.3.6）: The Aggregation-Heterogeneity Trade-off in Federated Learning

报告人：林伟 北京大学

摘要：Conventional wisdom in machine learning holds that the more data you train your model on, the better the model can perform. Accordingly, a plethora of federated learning methods have been developed to aggregate as many local samples as possible. Contrary to this belief, this paper shows that aggregation of more data is not necessarily beneficial in the presence of heterogeneity, and reveals a fundamental trade-off between aggregation and heterogeneity in federated learning. We consider a general family of weighted M-estimators that interpolate between FedAvg and the local estimator, in which an aggregation rule is determined by the weights of local samples. We derive an upper bound for the estimation error of the weighted M-estimators, which decomposes into a bias term induced by heterogeneity and a

variance term influenced by aggregation. A measure of heterogeneity, the federated smoothness β, is introduced to simplify the general result. As an important consequence, the optimal aggregation rule for each local device is to aggregate only its $\lfloor K^{2\beta/(2\beta+1)}/(n/\sigma^2)^{1/(2\beta+1)}\rfloor\vee 1$ closest neighbors among the K devices, where n is the local sample size and σ^2 is the noise variance. Moreover, we show that our estimator, termed FedKNN, attains the minimax optimal rate over a certain parameter space characterized by β. This optimal procedure depends crucially on the neighboring structure among devices in terms of the proximity of local parameters. Finally, we prove that without such prior knowledge no estimator can achieve a convergence rate faster than $O(\sigma^2/n)$ and hence adaptation is impossible.

分会场报告（20.3.7）: Sequential Data Integration under Dataset Shift

报告人: 盛赢 中国科学院数学与系统科学研究院

摘 要： With the rapidly increasing availability of large-scale and high-velocity streaming data, efficient algorithms that can process data in batches without requiring expensive storage and computation resources have drawn considerable attention. An emerging challenge in developing efficient batch processing techniques is dataset shift, where the joint distribution of the collected data varies across batches. If not recognized and addressed properly, dataset shift often leads to erroneous statistical inferences when integrating data from different batches. In this paper, two shift-adjusted estimation procedures are developed for updated estimation of the parameter in the presence of dataset shift. Under prior probability shift, we can obtain parameter estimation and assess the degree of dataset shift simultaneously. We study the asymptotic properties of the proposed estimators and evaluate their performance in numerical studies. This is a joint work with Jing Qin and Chiung-Yu Huang.

分会场报告（20.3.8）: Federated Survival Analysis via Data Augmentation Using Multi-task Variational Autoencoder

报告人: 王洪 中南大学

摘 要： Survival models finds vast applications in biomedical studies. However, survival data used to train these models are usually distributed, censored and facing a growing concern for data privacy. In addition to these issues, it is less commonly

recognized that survival times are usually tailed. In this study, we attempt to tackle such challenges via a novel federated learning scheme. The proposed scheme aims to mitigate the censoring and tailed data problems via data augmentation using multi-task variational autoencoder(MVAE). Experimental results from extensive simulated and real world survival datasets have demonstrated the effectiveness of the proposed methodology with possible deployments at the server or the clients.

分会场邀请报告（21.1.1）：Feature Screening for Clustering Analysis

报告人：席瑞斌 北京大学

摘要： We consider feature screening for ultrahigh dimensional clustering analyses. Based on the observation that the marginal distribution of any given feature is a mixture of its conditional distributions in different clusters, we propose to screen clustering features by independently evaluating the homogeneity of each feature's mixture distribution. Important clustering-relevant features have heterogeneous components in their mixture distributions and unimportant features have homogeneous components. The well-known EM-test statistic is used to evaluate the homogeneity. Under general parametric settings, we establish the tail probability bounds of the EM-test statistic for the homogeneous and heterogeneous features, and further show that the proposed screening procedure can achieve the sure independent screening and even the consistency in selection properties. Limiting distribution of the EM-test statistic is also obtained for general parametric distributions. The proposed method is computationally efficient, can accurately screen for important clustering-relevant features and help to significantly improve clustering, as demonstrated in our extensive simulation and real data analyses.

分会场报告（21.1.2）：Generalization Ability of Wide Neural Networks

报告人：赖建发 清华大学

摘要： We perform a study on the generalization ability of the wide two-layer ReLU neural network over $\mathbb{R}$. We first establish some spectral properties of the neural tangent kernel (NTK): $a)$ K_{d}, the NTK defined on $\mathbb{R}^{d}$, is positive definite; $b)$ $\lambda_{i}(K_{1})$, the i-th largest eigenvalue of K_{1}, is proportional to i^{-2}. We then show that: $i)$ when the width $m\rightarrow\infty$, the neural network kernel (NNK) uniformly converges to the

NTK; $ii)$ the minimax rate of regression over the RKHS associated to K_{1} is $n^{-2/3}$; $iii)$ if one adopts the early stopping strategy in training a wide neural network, the resulting neural network achieves the minimax rate; $iv)$ if one trains the neural network till overfitted, the resulting neural network can not generalize well. Finally, we provide an explanation to reconcile our theory and the widely observed `benign overfitting phenomenon'.

分会场报告（21.1.3）: Citation Counts Prediction of Statistical Publications Based on Multi-Layer Academic Networks via Neural Network Model

报告人：潘蕊 中央财经大学

摘要： Citation counts is a crucial factor for evaluating the quality of a research paper. Therefore, it is of vital importance to accurately predict citation counts and to explore the mechanism underlying citations. In this paper, we mainly focus on the prediction of citation counts in the field of statistics. We collect 55,024 academic papers published in 43 statistics journals from 2001 to 2018. Our main contributions are as follows. First, we invest considerable effort in collecting and cleaning a high-quality dataset. Second, multi-layer networks are constructed from different perspectives, including journal network, author citation network, co-citation network, co-authorship network, and keyword co-occurrence network. In addition, we extract 77 factors for citation counts prediction, including 22 traditional factors and 55 network-related factors. Third, to address the issues of zero-inflated and over-dispersed citation counts, a neural network model is designed to achieve high prediction accuracy. Furthermore, we adopt a leave-one-feature-out approach to investigate the importance of factors. The results show that our neural network model outperforms the other methods. This study provides a useful guide for researchers to predict citation counts and can be easily extended to other research fields.

分会场报告（21.1.4）: Dimension Reduction for Covariates in Network Data

报告人：赵俊龙 北京师范大学

摘要： A problem of major interest in network data analysis is to explain the strength of connections using context information. To achieve this, we introduce a novel approach, called network supervised dimension reduction, in which covariates are projected onto low-dimensional spaces to reveal the linkage pattern without assuming

a model. We propose a new loss function for estimating the parameters in the resulting linear projection, based on the notion that closer proximity in the low-dimension projection corresponds to stronger connections. Interestingly, the convergence rate of our estimator is found to depend on a network effect factor, which is the smallest number that can partition a graph in a manner similar to the graph colouring problem. Our method has interesting connections to principal component analysis and linear discriminant analysis, which we exploit for clustering and community detection. The proposed approach is further illustrated by numerical experiments and analysis of a pulsar candidates dataset from astronomy.

分会场邀请报告（21.2.1）：Tuning-parameter-free Propensity Score Matching Approach for Causal Inference Under Shape Restriction

报告人：刘玉坤 华东师范大学

摘要： Propensity score matching (PSM) is a pseudo-experimental method that uses statistical techniques to construct an artificial control group by matching each treated unit with one or more untreated units of similar characteristics. To date, the problem of determining the optimal number of matches per unit, which plays an important role in PSM, has not been adequately addressed. We propose a tuning-parameter-free PSM method based on the nonparametric maximum-likelihood estimation of the propensity score under the monotonicity constraint. The estimated propensity score is piecewise constant, and therefore automatically groups data. Hence, our proposal is free of tuning parameters. The proposed estimator is asymptotically semiparametric efficient when the covariate is univariate or the outcome and the propensity score depend on the covariate in the same direction. We conclude that matching methods based on the propensity score alone cannot, in general, be efficient.

分会场报告（21.2.2）：Novel Statistical Methods for High-dimensional Microbiome Data Analysis

报告人：占翔 北京大学

摘要： Advancement in next generation high-throughput sequencing technologies —such as genomics, transcriptomics, proteomics, metabolomics and metagenomi cs—allows characterization of the human omics profile at an extraordinarily det ailed molecular level. Among the fields of omics studies, a very popular mode

of analysis is the association analysis, which tries to establish associative relationships between omics features and disease outcomes as the first step to study the underlying biological omics mechanism of the disease. Despite its popularity, the field of omics association studies, however, has not yet reached enough maturity for making the leap from omics survey to rational omics-based personalized therapeutics. One primary limitation to leverage this large body of omics sequencing data is computational and statistical challenges, including high-dimensionality, sparse data structure, relatively small effect size or sample size and complex dependence/correlation structure among omics features. Taking microbiome and metagenomics data as examples, in this talk, we discuss some recent statistical methods to combat these challenges in microbiome association analysis. Our proposed methods are both powerful and robust, while maintaining both statistical rigor and biological relevance. Using comprehensive numerical simulation studies, we will show that the proposed methods are superior than existing counterparts in literature. We will also demonstrate the potential usefulness of our methods by applications to several real data sets.

分会场报告（21.2.3）: High-dimensional Response Growth Curve Modeling for Longitudinal Neuroimaging Analysis

报告人: 王璐 中南大学

摘 要： There is increasing interest in modeling high-dimensional longitudinal outcomes in applications such as developmental neuroimaging research. Growth curve model offers a useful tool to capture both dynamic changes of outcomes over time within each individual, as well as the mean growth pattern across individuals. However, when the number of outcomes is large, it becomes challenging and often infeasible to tackle the large covariance matrix of the random effects involved in the model. In this article, we propose a high-dimensional response growth curve model, with three novel components: a low-rank factor model structure that substantially reduces the number of parameters in the large covariance matrix, a re-parameterization formulation coupled with a sparsity penalty that selects important fixed and random effect terms, and a computational trick that turns the inversion of a large matrix into the inversion of a stack of small matrices and thus considerably speeds up the computation. We develop an efficient expectation-maximization type estimation algorithm, and demonstrate the competitive performance of the proposed method through both simulations and a longitudinal study of brain structural

connectivity in association with human immunodeficiency virus.

分会场报告（21.2.4）: Generalized Liquid Association Analysis for Multimodal Data Integration

报告人：曾靖 中国科学技术大学

摘要： Multimodal data are now prevailing in scientific research. One of the central questions in multimodal integrative analysis is to understand how two data modalities associate and interact with each other given another modality or demographic variables. The problem can be formulated as studying the associations among three sets of random variables, a question that has received relatively less attention in the literature. In this article, we propose a novel generalized liquid association analysis method, which offers a new and unique angle to this important class of problems of studying three-way associations. We extend the notion of liquid association from the univariate setting to the sparse, multivariate, and high-dimensional setting. We establish a population dimension reduction model, transform the problem to sparse Tucker decomposition of a three-way tensor, and develop a higher-order orthogonal iteration algorithm for parameter estimation. We derive the nonasymptotic error bound and asymptotic consistency of the proposed estimator, while allowing the variable dimensions to be larger than and diverge with the sample size. We demonstrate the efficacy of the method through both simulations and a multimodal neuroimaging application for Alzheimer's disease research. Supplementary materials for this article are available online.

分会场邀请报告（21.3.1）: Group-orthogonal Subsampling for Big Data Linear Mixed Models

报告人：孙法省 东北师范大学

摘要： Linear mixed model is a popular and common modeling method in statistical analysis. It is computationally difficult to obtain parameter estimates in linear mixed model for big data. The current subsampling methods are mainly aimed at the situation where the data is independent, without considering the correlation within the data. We provide some theoretical results on information matrix for linear mixed model. Based on these findings, an optimal subsampling method for linear mixed model is proposed, which maximizes the determinant of the variance-covariance

matrix of the subsampling estimator. Besides, the proposed subsampling procedure is also optimal under A-optimality criterion, which minimizes the trace of the variance-covariance matrix of the subsampling estimator. Furthermore, asymptotic property of the subsampling estimator is established. Numerical examples based on both simulated and real data are provided to illustrate the proposed subsampling method.

分会场报告（21.3.2）: Debiased and Thresholded Ridge Regression for Linear Models with Heteroskedastic and Correlated Errors

报告人：张云翼 香港中文大学（深圳）

摘 要： High-dimensional linear models with independent errors have been well-studied. However, statistical inference on a high-dimensional linear model with heteroskedastic, dependent (and possibly non-stationary) errors is still a novel topic. Under such complex assumptions, the paper at hand introduces a debiased and thresholded ridge regression estimator that is consistent, and is able to recover the model sparsity. Moreover, we derive a Gaussian approximation theorem for the estimator, and apply a dependent wild bootstrap algorithm to construct simultaneous confidence interval and hypothesis tests for linear combinations of parameters. Numerical experiments with both real and simulated data show that the proposed estimator has good finite sample performance. Of independent interest is the development of a new class of heteroscedastic, (weakly) dependent, and non-stationary random variables that can be used as a general model for regression errors.

分会场报告（21.3.3）: Sketched Ridgeless Linear Regression: The Statistical Role of Sketching

报告人：曾奕程 深圳市大数据研究院

摘要: Overparametrization often helps improve the generalization performance. We propose a dual view of overparametrization suggesting that sketching, as a popular technique of reducing effective sample size, may also help generalize. Motivated by this dual view, we characterize two out-of-sample prediction risks of the sketched ridgeless least square estimator in the proportional regime with comparable m, n and p, where m is the sketching size, n the sample size, and p the feature dimensionality. Our

results reveal the statistical role of sketching. Specifically, sketching does not always hurt the generalization performance, and may actually help improve it in some cases. We identify the optimal sketching sizes that minimize the out-of-sample prediction risks, and find that the optimally sketched estimator has stabler risk curves that eliminates the peaks of those for the full-sample estimator. We then propose a practical procedure to empirically identify the optimal sketching size. Numerical studies strongly support our theory.

分会场报告（21.3.4）：Classified Generalized Linear Mixed Model Prediction Incorporating Pseudo-prior Information

报告人：马海强 江西财经大学

摘 要： We develop a method of classified mixed model prediction based on generalized linear mixed models that incorporate pseudo-prior information to improve prediction accuracy. We establish consistency of the proposed method both in terms of prediction of the true mixed effect of interest and in terms of correctly identifying the potential class corresponding to the new observations if such a class matching one of the training data classes exists. Empirical results, including simulation studies and real-data validation, fully support the theoretical findings.

分会场邀请报告（21.1.5）：广义离群随机矩阵的极限理论、统计推断和交叉应用

报告人：姜丹丹 西安交通大学

摘要：从构建基础极限理论、创新统计推断方法、拓展交叉领域应用三方面深入地研究了广义离群随机矩阵。首先，在变量维数和样本容量成比例趋于无穷的条件下，推导了广义离群随机矩阵特征值的一阶和二阶极限理论，即特征值的相变和谱统计量的中心极限定理。其次，基于上述极限理论提出离群特征值的一致估计、噪声方差的修正估计、离群特征值个数检验、以及广义离群模型中部分最小根的相等检验等统计推断新方法。最后，无线通信、电力等领域的数据分析中大多会涉及离群随机矩阵模型，如信道矩阵、电力系统同步相量测量数据矩阵等对应的协方差矩阵。因此我们将统计推断新方法应用于这些领域，解决大规模多输入多输出系统中信道容量的估计问题、大规模电力系统的故障快速检测问题等。实验研究表明，所提出的极限理论和统计推断方法放宽了之前一些对角化或分块对角化假设的严格条件，并在不假设正态性总体的情况下将工作扩展到更广泛的

范围；在交叉领域的应用中所提出的方法与现有方法相比，为无线通信、电力等领域的一些实际问题分析提供了更低耗的统计方法和计算方法，从而达到在实际领域中针对海量数据进行快速分析的目的。

分会场报告（21.1.6）：Weighted Residual Empirical Processes, Martingale Transformations, and Model Checking for Regressions

报告人：谭发龙 湖南大学

摘要：This paper proposes a new methodology for testing the parametric forms of the mean and variance functions based on weighted residual empirical processes and their martingale transformations in regression models. The dimensions of the parameter vectors can be divergent as the sample size goes to infinity. We then study the convergence of weighted residual empirical processes and their martingale transformation under the null and alternative hypotheses in the diverging dimension setting. The proposed tests based on weighted residual empirical processes can detect local alternatives distinct from the null at the fastest possible rate of order n^−1/2 but are not asymptotically distribution-free. While the tests based on martingale transformed weighted residual empirical processes can be asymptotically distribution-free, yet, unexpectedly, can only detect the local alternatives converging to the null at a much slower rate of order n^−1/4 , which is somewhat different from existing asymptoticallydistribution-freetestsbasedonmartingaletransformations.As the tests based on the residual empirical process are not distribution-free, we propose a smooth residual bootstrap and verify the validity of its approximation in diverging dimension settings. Simulation studies and a real data example are conducted to illustrate the effectiveness of our tests.

分会场报告（21.1.7）：Regularized t Distribution: Definition, Properties and Application

报告人：胡宗良 深圳大学

摘要：For gene expression data analysis, an important task is to identify genes that are differentially expressed between two or more groups. Nevertheless, as biological experiments are often measured with a relatively small number of samples, how to accurately estimate the variances of gene expression becomes a challenging issue. To tackle this problem, we introduce a regularized t distribution and derive its statistical

properties including the probability density function and the moment generating function. The noncentral regularized t distribution is also introduced for computing the statistical power of hypothesis testing. For practical applications, we apply the regularized t distribution to establish the null distribution of the regularized t statistic, and then formulate it as a regularized t-test for detecting the differentially expressed genes. Simulation studies and real data analysis show that our regularized t-test performs much better than the Bayesian t-test in the "limma" package, in particular when the sample sizes are small.

分会场报告（21.1.8）: Randomization-based Joint Central Limit Theorem and Efficient Covariate Adjustment in Randomized Block 2K Factorial Experiments

报告人: 杨玥含 中央财经大学

摘 要： Randomized block factorial experiments are widely used in industrial engineering, clinical trials, and social science. Researchers often use a linear model and analysis of covariance to analyze experimental results; however, limited studies have addressed the validity and robustness of the resulting inferences because assumptions for a linear model might not be justified by randomization in randomized block factorial experiments. In this article, we establish a new finite population joint central limit theorem for usual (unadjusted) factorial effect estimators in randomized block 2K factorial experiments. Our theorem is obtained under a randomization-based inference framework, making use of an extension of the vector form of the Wald–Wolfowitz–Hoeffding theorem for a linear rank statistic. It is robust to model misspecification, numbers of blocks, block sizes, and propensity scores across blocks. To improve the estimation and inference efficiency, we propose four covariate adjustment methods. We show that under mild conditions, the resulting covariate-adjusted factorial effect estimators are consistent, jointly asymptotically normal, and generally more efficient than the unadjusted estimator. In addition, we propose Neyman-type conservative estimators for the asymptotic covariances to facilitate valid inferences. Simulation studies and a clinical trial data analysis demonstrate the benefits of the covariate adjustment methods. Supplementary materials for this article are available online.

分会场邀请报告（21.2.5）：One-way or Two-way Factor Model for Matrix Sequences?

报告人：孔新兵 南京审计大学

摘要： In this talk, we investigate the issue of determining the dimensions of row and column factor spaces in matrix-valued data. Exploiting the eigen-gap in the spectrum of sample second moment matrices of the data, we propose a family of randomised tests to check whether a one-way or two-way factor structure exists or not. Our tests do not require any arbitrary thresholding on the eigenvalues, and can be applied with (virtually) no restrictions on the relative rate of divergence of the cross-sections to the sample sizes as they pass to infinity. Although tests are based on a randomization which does not vanish asymptotically, we propose a de-randomized, strong (based on the Law of the Iterated Logarithm) decision rule to choose in favour or against the presence of common factors. We use the proposed tests and decision rule in two ways. We further cast our individual tests in a sequential procedure whose output is an estimate of the number of common factors. Our tests are built on two variants of the sample second moment matrix of the data: one based on a row (or column) flattened version of the matrix-valued sequence, and one based on a projection-based method. Our simulations show that both procedures work well in large samples and, in small samples, the one based on the projection method delivers a superior performance compared to existing methods in virtually all cases considered.

分会场报告（21.2.6）：基于结构化随机森林的地震波初至拾取方法

报告人：张春霞 西安交通大学

摘要：初至拾取是地球物理勘探中的重要环节，但随着野外采集技术的发展和进步，尤其是面临十分复杂的地表条件时，获得满意的拾取结果仍是一个挑战。随着人工智能技术的迅速发展，实现地震波初至拾取的智能化是 AI+物探技术领域的一个研究热点。本报告中，我们将介绍基于结构化随机森林的初至拾取方法，该方法考虑了相邻道集数据之间的相关性，并设计了合适的数据正则化技术和拾取结果的后期处理策略，在模拟数据和实际工区数据上的试验结果表明，新方法可达到与人工拾取结果基本相当的自动拾取，从而为智能化初至拾取提供了一种新途径。

分会场报告（21.2.7）：Functional Additive Expectile Regression in the Reproducing Kernel Hilbert Space

报告人：刘育孜 江西财经大学

摘要： In the literature, the functional additive regression model has received much attention. Most studies currently conducted, however, only estimate the mean function, which may not adequately capture the heteroscedasticity and/or asymmetries of the model errors. In light of this, we extend functional additive regression models to their expectile counterparts and obtain an upper bound on the convergence rate of its regularized estimator under mild conditions. To demonstrate its finite sample performance, a few simulation experiments, and a real data example are provided.

分会场报告（21.2.8）：A General Framework to Select Tuning Parameter for Nonparametric Derivative Estimation

报告人：刘思晟 湖南师范大学

摘要： Derivative estimation plays an important role in many practical applications. In this paper, a general framework is proposed to select tuning parameter for the nonparametric derivative estimation. The new framework enlarges the scope of the generalized Cp criterion Charnigo et al. (2011) by replacing the empirical derivative via any other linear nonparametric smoother. The framework is flexible since it can work for any nonparametric derivative estimation that are linear in observed responses. We provide the theoretical support of the proposed tuning parameter selection method and justify it through empirical studies. The simulation results showed that our proposed framework works well for different nonparametric derivative estimation methods. The practical application of the proposed framework is demonstrated in the study of the age effect on hippocampal gray matter volume in healthy adults from the IXI dataset.

分会场邀请报告（21.3.5）：Heterogeneity-aware Clustered Distributed Learning for Multi-source Data Analysis

报告人：方匡南 厦门大学

摘要： In diverse fields ranging from finance to omics, it is increasingly common that

data is distributed and with multiple individual sources (referred to as “clients” in some studies). Integrating raw data, although powerful, is often not feasible, for example, when there are considerations on privacy protection. Distributed learning techniques have been developed to integrate summary statistics as opposed to raw data. In many of the existing distributed learning studies, it is stringently assumed that all the clients have the same model. To accommodate data heterogeneity, some federated learning methods allow for client-specific models. In this article, we consider the scenario that clients form clusters, those in the same cluster have the same model, and different clusters have different models. Further considering the clustering structure can lead to a better understanding of the “interconnections” among clients and reduce the number of parameters. To this end, we develop a novel penalization approach. Specifically, group penalization is imposed for regularized estimation and selection of important variables, and fusion penalization is imposed to automatically cluster clients. An effective ADMM algorithm is developed, and the estimation, selection, and clustering consistency properties are established under mild conditions. Simulation and data analysis further demonstrate the practical utility and superiority of the proposed approach.

分会场报告（20.3.6）：Distribution-free Simultaneous Prediction Bands for Clustered Data with Missing Responses

报告人：唐炎林 华东师范大学

摘要： Prediction plays a crucial role in decision-making across various fields and industries, as it enables us to anticipate future events or outcomes based on observed data and knowledge. However, existing methods often rely on strong modeling assumptions and thus are prone to model misspecification errors. In this work, we construct simultaneous prediction for missing clustered data based on the idea of conformal inference, without any assumptions about the model distribution and within-group dependency structures. These covariate-dependent predictions assess the overall pattern and magnitude of global associations between the responses and covariates, and provide coverage guarantees in finite samples. In particular, compared to alternative methods, our methods yield the smallest prediction regions by converging to the highest density set, and fully adapts to complex error distributions by approximating conditional coverage. Simulations show the excellent finite-sample behavior of our methods in comparison to naive alternatives. The practical use of our methods is demonstrated in two case studies on serum cholesterol and CD4+ cells.

分会场报告（21.3.7）：Renewable Quantile Regression for Streaming Data Sets

报告人：姜荣 上海第二工业大学

摘要： Online updating is an important statistical method for the analysis of big data arriving in streams due to its ability to break the storage barrier and the computational barrier under certain circumstances. The quantile regression, as a widely used regression model in many fields, faces challenges in model fitting and variable selection with big data arriving in streams. Chen et al. (2019, Annals of Statistics) has proposed a quantile regression method for streaming data, but a strong additional condition is required. In this paper, renewable optimized objective functions for regression parameter estimation and variable selection in a quantile regression are proposed. The proposed methods are illustrated using current data and the summary statistics of historical data. Theoretically, the proposed statistics are shown to have the same asymptotic distributions as the standard version computed on an entire data stream with the data batches pooled into one data set, without additional condition. Both simulations and data analysis are conducted to illustrate the finite sample performance of the proposed methods.

分会场报告（20.3.8）：Smooth-threshold GMM Estimation of Higher-order Semiparametric Spatial Autoregressive Model with Increasing Dimension

报告人：杨晶 湖南师范大学

摘要： The generalized method of moments (GMM) is a particularly popular method that has been widely used in econometric modeling, in terms of its computation simplicity and estimation efficiency. In this paper, to capture the spatial dependence as well as heterogeneous effects of the impacts of some regressors, we concentrate on the GMM estimation and variable selection of a higher-order spatial autoregressive model with partially linear varying coefficients and diverging number of parameters. Specifically, with the varying coefficient functions being approximated by some basis functions, the GMM estimation of the considered model is firstly studied and then a novel and convenient smooth-threshold GMM procedure is constructed for variable selection. Under some regularity conditions, we establish the asymptotic normality and oracle property of the resulting estimators. This is not only the first attempting at studying the model based on the series GMM estimation, but also the first considering variable selection based on the smooth-threshold estimating equations. Extensive

numerical simulations are conducted to confirm the theories and to demonstrate the finite sample performance of the proposed method. A real data analysis is followed for application.

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