香港浸會大學
HONG KONG BAPTIST UNIVERSITY

理學院
FACULTY OF SCIENCE

數學系
Department of Mathematics

SRCC Workshop on Statistical Learning with Medical Applications

Date : 27 July 2023 (Thursday)

Time : 14:00–18:30

Venue : FSC1217, Fong Shu Chuen Library
Ho Sin Hang Campus
Hong Kong Baptist University

Cheng WANG (School of Mathematical Sciences, Shanghai Jiao Tong University), **14:00-14:30**

Title: HiQR: An Efficient Algorithm for High-dimensional Quadratic Regression with Penalties

Abstract: This paper investigates the efficient solution of penalized quadratic regressions in high-dimensional settings. We propose a novel and efficient algorithm for ridge-penalized quadratic regression that leverages the matrix structures of the regression with interactions. Building on this formulation, we develop an alternating direction method of multipliers (ADMM) framework for penalized quadratic regression with general penalties, including both single and hybrid penalty functions. Our approach greatly simplifies the calculations to basic matrix-based operations, making it appealing in terms of both memory storage and computational complexity.

Xuehu ZHU (School of Mathematics and Statistics, Xi'an Jiaotong University), **14:30-15:00**

Title: Subspace Change Point Detection and Clustering

Abstract: This paper develops a method to detect model structural changes by applying a Corrected Kernel Principal Component Analysis (CKPCA) to construct the so-called central distribution deviation subspaces. This approach can efficiently identify the mean and distribution changes in these dimension reduction subspaces. We derive that the locations and number changes in the dimension reduction data subspaces are identical to those in the original data spaces. Meanwhile, we also explain the necessity of using CKPCA as the classical KPCA fails to identify the central distribution deviation subspaces in these problems. Additionally, we extend this approach to clustering by embedding the original data with nonlinear lower dimensional spaces, providing enhanced capabilities for clustering analysis. The numerical studies on synthetic and real data sets suggest that the dimension reduction versions of existing methods for change point detection and clustering significantly improve the performances of existing approaches in finite sample scenarios.

Wenwu WANG (School of Statistics and Data Science, Qufu Normal University), **15:00-15:30**

Title: Kernel Learning in Regression Discontinuity Designs

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Abstract: Regression discontinuity designs (RDDs) for causal inference become more and more popular in observational studies, and the local linear estimator has become the standard in the RDDs literature. However, it should not always dominate other local polynomial estimators in empirical studies, whose performance depends on the data generating processes. In this paper, we propose a theoretical framework for estimating treatment effect by one-side polynomial regression. Under equidistant designs, we derive the accurate estimation variance and bias, which provides a benchmark for empirical research. Moreover, the one-side kernel (weight) functions are derived. It is found that the kernel functions become increasingly erratic as the polynomial order increases, which explains the Runge phenomenon. Furthermore, we propose a data-driven procedure to guide the choice of polynomial order and bandwidth. Finally, the finite sample performance of our proposed method is demonstrated by simulation studies and real data examples.

Wenlin DAI (Institute of Statistics and Big Data, Renmin University of China), **15:30-16:00**

Title: Exploratory Functional Data Analysis

Abstract: In this talk, we will discuss the latest developments in exploratory functional data analysis (EFDA). With the increasing frequency of functional data being recorded, it is important to adapt to the demands of real-world applications. We will begin by exploring robust statistics for functional data. We will then move on to visualization tools such as the rainbow plot and functional boxplot, which have been developed to handle more general types of functional data with irregular coordinate grids or multiple components. We will also review outlier detection technologies, which are often combined with visualization tools. Finally, we will briefly touch on future directions for EFDA.

Break Time: 16:00-16:20

Binyan JIANG (Department of Applied Mathematics, Hong Kong Polytechnic University), **16:20-16:50**

Title: A Two-way Heterogeneity Model for Dynamic Networks

Abstract: Analysis of networks that evolve dynamically requires the joint modelling of individual snapshots and time dynamics. This paper proposes a new flexible two-way heterogeneity model towards this goal. The new model equips each node of the network with two heterogeneity parameters, one to characterize the propensity to form ties with other nodes statically and the other to differentiate the tendency to retain existing ties over time. With n observed networks each having p nodes, we develop a new asymptotic theory for the maximum likelihood estimation of 2p parameters when np goes to 1. We overcome the global non-convexity of the negative log-likelihood function by the virtue of its local convexity, and propose a novel method of moment estimator as the initial value for a simple algorithm that leads to the consistent local maximum likelihood estimator (MLE). To establish the upper bounds for the estimation error of the MLE, we derive a new uniform deviation bound, which is of independent interest. The theory of the model and its usefulness are further supported by extensive simulation and a data analysis examining social interactions of ants.

Weiguang LI (Center for Evidence-Based and Translational Medicine, Wuhan University), **16:50-17:20**

Title: Brain-X: Brain-Inspired Computing and Brain-Inspired Intelligence

Abstract: Brain-X (ISSN: 2835-3153, published by Wiley publishing) is a newly interdisciplinary journal. It is committed to publish cutting-edge discoveries and technologies, and determined to enhance the visibility of interdisciplinary research in the field of brain, neuroscience and neurology. Brain-inspired computing and brain-inspired intelligence are very important parts of interdisciplinary brain. Brain-inspired computing is also known as neuromorphic computing. It is a method of computer engineering in which elements of a computer are modeled after systems in the human brain and nervous system. Brain-inspired intelligence refers to the field of the complex and efficient computational capabilities of the brain, the purpose is to perform tasks in a way similar to the human brain.

Yue LIU (Xiyuan Hospital of China Academy of Chinese Medical Sciences, Beijing), **17:20-17:50**

Title: Interdisciplinary Science Contributes to the Study of Panvascular Disease

Abstract: Interdisciplinary research has become the main source of scientific and technological innovation and an irreplaceable research paradigm in the scientific era. The continuous development of medicine from focusing on the individual to focusing on the whole indicates the complexity of research, and it is urgent to introduce new interdisciplinary disciplines including mathematics and bioinformatics. Taking panvascular disease as an example, we introduce the research progress and achievements of interdisciplinary knowledge application, in order to provide reference for developing interdisciplinary cooperation.

Yanfei LIU (Xiyuan Hospital of China Academy of Chinese Medical Sciences, Beijing), **17:50-18:20**

Title: Blood Stasis and Vascular Aging

Abstract: Blood stasis and vascular aging are mutual cause and effect, and vascular aging caused by blood stasis is more and more common, so that it is worth exploring. Blood stasis can lead to pulse sluggish, affect the normal physiological function of the human and cause vascular aging, consequently to premature aging. Vascular aging is the beginning of body aging and the common pathogenesis of a variety of age-related diseases. Controlling vascular aging to delay the occurrence of age-related diseases is of great significance to human health. We reviewed the researches on slowing aging and preventing premature aging with Chinese medicine of activating blood circulation, in order to provide reference for the follow-up research.

-- All interested are most welcome! --