Colloquium 2018-2019

Spring 2019

February 4, 4:40 pm (This is a Monday and a different starting time)
Speaker: **Fangfang Wang** (University of Wisconsin at Madison)
Topic: Statistical Modelling of Multivariate Time Series of Counts

Abstract: In this presentation, I will talk about a new parameter-driven model for non-stationary multivariate time series of counts. The mean process is foPace will pick up now. rmulated as the product of modulating factors and unobserved stationary processes. The former characterizes the long-run movement in the data, while the latter is responsible for rapid fluctuations and other unknown or unavailable covariates. The unobserved stationary vector process is expressed as a linear combination of possibly low-dimensional factors that govern the contemporaneous and serial correlation within and across the count series. Regression coefficients in the modulating factors are estimated via pseudo maximum likelihood estimation, and identification of common factor(s) is carried out through eigen-analysis on a positive definite matrix that aggregates the autocovariances of the count series at nonzero lags. The two-step procedure is fast to compute and easy to implement. Appropriateness of the estimation procedure is theoretically justified, and simulation results corroborate the theoretical findings in finite samples. The model is applied to time series data consisting of the numbers of National Science Foundation funding awarded to seven research universities from January 2001 to December 2012. The estimated parsimonious and easy-to-interpret factor model provides a useful framework for analyzing the interdependencies across the seven institutions.

February 7, 4:00 pm (Please note the earlier time)
Speaker: **Yue Zhao** (University Leuven)
Topic: The normal scores estimator for the high-dimensional Gaussian copula model

Abstract: The (semiparametric) Gaussian copula model consists of distributions that have dependence structure described by Gaussian copulas but that have arbitrary marginals. A Gaussian copula is in turn determined by an Euclidean parameter R called the copula correlation matrix. In this talk we study the normal scores (rank correlation coefficient) estimator, also known as the van der Waerden coefficient, of R in high dimensions. It is well known that in fixed dimensions, the normal scores estimator is the optimal estimator of R, i.e., it has the smallest asymptotic covariance. Curiously though, in high dimensions, nowadays the preferred estimators of R are usually based on Kendall's tau or Spearman's rho. We show that the normal scores estimator in fact remains the optimal estimator of R in high dimensions. More specifically, we show that the approximate linearity of the normal scores estimator in the efficient influence function, which in fixed dimensions implies the optimality of this estimator, holds in high dimensions as well.

February 8, 4:15pm (This is a Friday)
Speaker: **Hai Shu** (University of Texas MD Anderson Cancer Center)
Topic: Extracting Common and Distinctive Signals from High-dimensional Datasets

Abstract: Modern biomedical studies often collect large-scale multi-source/-modal datasets on a common set of objects. A typical approach to the joint analysis of such high-dimensional datasets is to decompose each data matrix into three parts: a low-rank common matrix that captures the shared information across datasets, a low-rank distinctive matrix that characterizes the individual information within the single dataset, and an additive noise matrix. Existing decomposition methods often focus on the orthogonality between the common and distinctive matrices, but inadequately consider a more necessary orthogonal relationship among the distinctive matrices. The latter guarantees that no more shared information is extractable from the distinctive matrices. We propose decomposition-based canonical correlation analysis (D-CCA), a novel decomposition method that defines the common and distinctive matrices from the L2 space of random variables rather than the conventionally used Euclidean space, with a carefully designed orthogonal relationship among the distinctive matrices. The associated estimators of common and distinctive signal matrices are asymptotically consistent and have reasonably better performance than state-of-the-art methods in both simulated data and the analyses of breast cancer genomic datasets from The Cancer Genome Atlas and motor-task functional MRI data from the Human Connectome Project.

February 13, 4:15 pm (This is a Wednesday)
Speaker: **Guifang Fu** (Utah State University)
Topic: A New Statistical Framework to Identify Influential Genetic and Environmental Variables Associated with Shape Variation

Abstract: The tremendous diversity of shape is widespread in nature and embodies both a response to and a source of evolution and natural selection. Genes are reported to have an important role in controlling phenotypic variation in shape, and many species exhibit morphological plasticity which allows their shape to adapt to environmental cues. In this talk, I will introduce a new statistical framework to quantify the relative importance of all explanatory variables in terms of the strength of their association with shape variation. The shape is inputted as an image and then described as a multivariate vector or a high dimensional curve. There are unique challenges in variable selection for high dimensional data. Additional challenges arise when modeling multiple correlated components as one unit rather than isolating them one by one, which greatly decreases the prediction error. I will introduce a novel Bayesian multivariate variable selection (BMVS) approach that investigates a large-scale candidate pool to identify influential variables associated with the multivariate shape vector. We integrate the estimation of covariance-related parameters and all regression parameters into one framework through a rapidly updating MCMC procedure. The BMVS approach has been proven to satisfy the strong selection consistency property under certain conditions. We use three simulations to demonstrate that the BMVS approach is empirically accurate, robust, and computationally viable. Numerical comparison indicates that BMVS outperforms some existing approaches such as canonical correlation analysis and multivariate Lasso. We apply the BMVS approach to two rice-related GWAS datasets: the first with 3,254 SNPs related to rice shape, and the second with 36,901 SNPs related to three flowering-time phenotypes. The presented BMVS approach is flexible and can be employed in a wide variety of applications. At the conclusion of the presentation, I will list several future collaboration opportunities that extend from the shape research.

February 14, 4:15 pm
Speaker: **Steve Ferry** (Binghamton University)
Topic: The “lost tribes” of manifolds (Gromov's joke)

Abstract: This work is joint with John Bryant. In his 1994 ICM talk Shmuel Weinberger, inspired by work of Edwards, Quinn, Cannon, and Bryant-F.-Mio-Weinberger, conjectured the existence of a new collection of spaces with many of the properties of topological manifolds. The authors have constructed spaces in dimensions $n \ge 6$ satisfying many parts of Weinberger's conjecture. Our spaces are finite dimensional and locally contractible. They have the local and global separation properties of topological manifolds, satisfying Alexander duality both locally and globally. They are homogeneous, meaning that for every x and y in a component of one of these spaces there is a homeomorphism carrying x to y. In dimensions ≥ 6, the h- and s-cobordism theorems hold for these topologically exotic manifolds manifolds.

February 28, 4:15 pm, in the Atrium of Old Champlain Hall
Speaker: **Hermann Nicolai** (Max Planck Institute for Gravitational Physics, Potsdam, Germany)
Topic: Symmetry and Unification – can physics be unified into a single formula?

Abstract: Attempts to unify the known laws of Nature have a long history. Since the mid-seventies, these attempts have been reinforced with ongoing efforts to reconcile Quantum Mechanics and Einstein's theory of General Relativity into a single unified theory of quantum gravity. In this talk I will review the motivation as well as some more recent developments at an introductory level and discuss prospects for the future.

April 4, 3:00 pm LH 9. - Peter Hilton Memorial Lecture and Dean's Speaker Series in Geometry, Geometric Analysis, and Topology
Speaker*:* ***Shmuel Weinberger*** *(University of Chicago)*
Title: ***How hard is algebraic topology? Between the constructive and the non.***

Abstract: In algebraic topology one studies geometric problems and problems of constructing and deforming highly nonlinear functions by means of algebra. If one knows that two maps are homotopic (i.e. can be deformed to one another) because a certain calculation says they both lie in the trivial group, then what has one learned? (A striking example of this is Smale's turning the sphere inside out, which now can be seen after much highly nontrivial effort, on youtube.) The question I shall discuss is how hard is it to understand what the algebraic topologists tell us.

April 9, 1:15 pm (SPECIAL DAY, PLACE AND TIME) WH-100E, joint with Combinatorics Seminar
Speaker*:* ***Gregory Warrington*** *(University of Vermont)*
Topic*: Gerrymandering*

Abstract: http://seminars.math.binghamton.edu/ComboSem/abstract.201904war.html

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===== Fall 2018 =====

October 18, 4:15 pm
Speaker*:* ***Jingchen (Monika) Hu*** *(Vassar College)*
Topic*: Teaching Undergraduate Upper Level Statistics Courses through a Shared/Hybrid Model*

Abstract: At liberal arts colleges, with smaller number of students taking statistics, offering advanced level courses can be difficult. Under the Liberal Arts Consortium for Online Learning (LACOL) Upper Level Math Project, I taught an elective course (Bayesian Statistics) through a shared/hybrid model in Fall 2017. Lectures were given in classroom at Vassar with Vassar students present. Each lecture was recorded and shared with both Vassar students and students from other campuses taking the course as an independent study course with a local faculty liaison. I would love to share my experience and thoughts, focusing on 1) what material to move online and how to do so, and 2) how to build up a cross-campus learning community.

December 6, 4:15 pm
Speaker*:* ***C. Sastry Aravinda*** *(Binghamton University)*
Topic*: Harish-Chandra – The Mathematician and the artist*

Abstract: This will be a non-technical talk on the life of Harish-Chandra mainly focussing on his singular evolution as one of the most impactful mathematicians of the last century. The talk should be accessible to a wide audience.

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