Semester: Winter 2007
Location: Haag Hall, Room 313 (Unless otherwise noted)
Day & Time: Wednesdays, 12:30-1:15 pm (Unless otherwise noted)
Campus Map for Talks (PDF Format)

Organizer: Dr. Eric Hall, 235-5852
Email: halle@umkc.edu

Dates, Titles, Speakers (with Abstracts as available)

Wednesday Jan. 24
Linear Resolutions of Graded Modules
Liana Sega, Department of Mathematics and Statistics, UMKC.

Over a polynomial ring in several variables over a field, the field can be resolved by a very simple free resolution, called the Koszul complex. This resolution has the property that each differential can be represented by a matrix whose coefficients are linear terms (monomials of degree one). Such resolutions are called linear. In general, a quotient of a polynomial ring over a field is said to be a Koszul ring if the residue field has a linear resolution over the ring. Since being introduced, these rings have received a lot of attention in Algebra and Algebraic Geometry. We will consider graded modules over Koszul rings and investigate whether their resolutions are, in general, linear. Several answers will be provided over a certain class of Koszul rings.

Wednesday Jan. 31
Introduction to the Department Web Site: A Rich Source of Information
[All GTAs are required to attend; Adjunct Lecturers and full-time Faculty are urged to attend.]
Richard Delaware, Department of Mathematics and Statistics, UMKC

Wednesday Mar. 21
High breakdown inference for the Constrained Multiple Autoregressive models
Mark Gamalo, Department of Mathematics and Statistics, UMKC.

The proliferation of many clinical studies obtaining multiple biophysical signals from several individuals generates a growth in statistical models that analyze cross-sectional time series data. One of them is the class of constrained multiple autoregressive models (C-MARX) that try to explain intra-individual dynamics of the response and its relation to some covariates and offers an easy way of aggregating estimates consistently in a group. In this talk, I will discuss bounded influence estimation as a technique that controls the effect of each observation on the estimate. I will also derive the asymptotic normality of the bounded influence estimates and consequently develop a score-type test statistic, in the sense of Heretier and Ronchetti (JASA, 89:897-904), to test the null hypothesis that a set of linearly estimable functions of the vector parameters are zero.

Wednesday Apr. 11
Google Matrix, PageRank, and Spectral Perturbation
Jiu Ding, Department of Mathematics, University of Southern Mississippi.

Web information retrieval (IR) is more challenging than the traditional IR because of the huge number of webpages. In 1998 Google co-founders Sergey Brin and Larry Page introduced the Google matrix for the computation of the PageRank which is the heart of Google's software. In this talk we introduce the Google matrix and the concept of PageRank, and we also present a spectral analysis for the Google matrix and more generally perturbed matrices.

Semester: Fall 2007
Location: Royall Hall, Room 213 (Unless otherwise noted)
Day & Time: Wednesdays, 2:00-2:50 pm (Unless otherwise noted)
Campus Map for Talks (PDF Format)

Organizer: Dr. Yong Zeng, 235-5850
Email: zengy@umkc.edu

Dates, Titles, Speakers (with Abstracts as available)

Wednesday Sept. 5
An Empirical Study of Volatility Estimation and Price Prediction through Hidden Markov Filtering
Allanus Tsoi, Mathematics Department, Univeristy of Missouri--Columbia.

This work provides a development of economic insight on the behavior of stock markets through hidden Markov Modeling(HMM) and its corresponding data analysis. We consider a price return dynamics where both the drift and volatility of the return process are driven by certain hidden underlying economic force, and evolves as a finite-state, time-homogeneous Markov chain.

The Hidden Markov EM algorithm enables us to estimate certain important functionals of the hidden chain, such as the transition matrix, the state space of the drift as well as that of the volatility. Through these estimates we can perform smoothing of the parameters involved and predicting future security prices.

On an empirical level, we implement HMM on various data sets of historical prices including some major indices, bonds, mutual funds, common stocks, and ETFs to back-test the predictability of the model. Moreover, we compare the applicability of HMM with the well established GARCH(1,1) model. As far as prediction performance is concerned, our results indicate HMM outperforms GARCH(1,1).

Finally, we consider similar analysis in the case of hidden weak Markov filtering with memory order $k > 1$. We come up with a recursive equation governing the dynamics of the conditional mean square error. The linear convergence matrix of the corresponding EM algorithm will be presented.

Wednesday Sept. 19

Large Deviation for Markov Processes and related variational problems

Jin Feng, Mathematics Department, Univeristy of Kansas.

I will describe a systematic approach to large deviation of Markov processes through the use of convergence for nonlinear partial differential equations. Such problem has a deep connection with variational problems of the Hamilton-Jacobi type.

Examples will be shown where intuitions from statistical physics become very helpful in verifying structural assumptions of the general theorems. An on-going effort is made to apply such methodology to statistical characterization of turbulence (for large time coherent structure). I will describe one special problem along such direction.

Wednesday Oct. 3

Asymptotic behavior of some weighted p-variations variations of the fractional Brownian motion

David Nualart, Mathematics Department, Univeristy of Kansas.

In this talk we will present some recent results on the asymptotic behavior of some weighted p-variations of the fractional Brownian motion with Hurst paramter H. In the particular case $p=2$, the weighted quadratic variations converge in mean squaren with a suitable normalization, if $H<1/4$. On the other hand, for $1/4<H<3/4$, they converge in distribution, with a different normalization, to a stochastic integral with respect to an independent Brownian motion. We will provide an outline of the proof of this result, which is based on the techniques of Mallliavin calculus. This is a joint work with Ivan Nourdin.

Wednesday Oct. 17
Room: Haag Hall 301. *(Note: Not the usual room.)*
Self-Rao-Blackwellization:
Bringing the Best Out of Bad Data or Bad Procedures
Xiao-Li Meng, Statistics Department, Harvard University.

A common frustration in statistical inference and, more generally, information recovery is when data are missing, incomplete or irregularly spaced (e.g., as with wavelets). Self-Rao-Blackwellization is a full-blown off-spring of the notion of self-consistency, introduced by Efron in 1967 in his reformulation of the Kaplan-Meier estimator. It is designed to handle such bad data problems in parametric, semi-parametric, and non-parametric estimation and under an arbitrary loss function. It also provides a theoretical criterion to regulate and improve estimation procedures even when there is no missing data. Indeed, efficient estimation procedures, such as maximum likelihood estimation, are automatically self-Rao-Blackwellized (asymptotically under square-loss). Conceptually, Self-Rao-Blackwellization is extremely appealing; it is essentially a mathematical formalization of the iteration of common-sense trial-and-error methods until no more improvement is possible.

Mathematically it is elegant, with one fixed-point equation to solve and a general projection theorem to establish optimality. Practically, it is straightforward to program because it directly uses the regular/complete-data method for each iteration, much like the EM algorithm, which can be viewed as a version of Self-Rao-Blackwellization for maximum likelihood estimation. Its major disadvantage is that it can be computationally intensive. However, increasingly efficient (approximate) implementations are being discovered, such as for wavelet de-noising with hard and soft thresholding. This talk summarizes those points, based on joint work with Thomas Lee on wavelet applications and with Zhan Li on the theoretical foundation of Self-Rao-Blackwellization.

Wednesday Oct. 31
Mutual Information and Estimation
Tyrone Duncan, Mathematics Department, Univeristy of Kansas.

Mutual information provides a numerical measure of the relation between two random variables or two stochastic processes. It has some properties that justify it as a measure of information and it plays an important role in information theory. In this talk the mutual information is determined between a stochastic process (the signal) and this signal plus noise. It is shown that this mutual information can be explicitly expressed in terms of an estimation error that arises from an estimation problem with a quadratic mean error criterion. In a second computation, the rate of change of the mutual information with respect to a scalar parameter multiplying the signal is expressed in terms of another estimation error. The noise in both cases is assumed to be a fractional Gaussian noise with the Hurst parameter, H, in the interval (1/2,1). These results generalize some known results for white Gaussian noise (H = 1/2) and they provide more evidence of a relation between mutual information and estimation.

Wednesday Nov. 14

Subgradient Optimization, Duality, and Computer Communication Network Design Problems

Deep Medhi, CS & EE Departments, UMKC

Subgradient optimization arises when we face the situation of optimizing a function that is continuous but is not differentiable everywhere. Thus, instead of gradient-based approaches, subgradient based approaches are required. In this talk, we will first briefly present an overview on subgradient optimization.

Many optimization problems are computational tractable if the dual problem is considered. A particular type of duality approach, known as Rockafeller dual, leads the dual problem to a continuous function but not differentiable everywhere. Thus, we will next discuss how this duality is used with subgradient optimization.

Finally, we will discuss a particular class of computer communication network design problems, which is combinatorial in nature. We will discuss how this problem can be tackled efficiently using duality and subgradient optimization.

Wednesday Nov. 28

Objective Bayesian Analysis for the Multivariate Normal Model

Dongchu Sun, Statistics Department, Univeristy of Missouri-Columbia.

Objective Bayesian inference for the multivariate normal distribution is illustrated, using different types of formal objective priors (Jeffreys, invariant, reference and matching), different modes of inference (Bayesian and frequentist), and different criteria involved in selecting optimal objective priors (ease of computation, frequentist performance, marginalization paradoxes, and decision-theoretic evaluation).

In the course of the investigation of the bivariate normal model in Berger and Sun (2007), a variety of surprising results were found, including the availability of objective priors that yield exact frequentist inferences for many functions of the bivariate normal parameters, such as the correlation coefficient. Certain of these results are generalized to the multivariate normal situation.

The prior that most frequently yields exact frequentist inference is the right-Haar prior, which unfortunately is not unique. Two natural proposals are studied for dealing with this non-uniqueness: first, mixing over the right-Haar priors; second, choosing the `empirical Bayes' right-Haar prior, that which maximizes the marginal likelihood of the data. Quite surprisingly, we show that neither of these possibilities yields a good solution. This is disturbing and sobering. It is yet another indication that improper priors do not behave as do proper priors, and that it can be dangerous to apply `understandings' from the world of proper priors to the world of improper priors.