RANDOM PROCESSES AND TIME SERIES CONFERENCE: THEORY AND APPLICATIONS
October 21-23, 2016

TITLES AND ABSTRACTS OF TALKS

All talks, except possibly for those by Robert Engle and Catherine Constable will be in the Natural Sciences Building (NSB) Auditorium at UC San Diego.
(For directions to the Natural Sciences Building go to
http://physicalsciences.ucsd.edu/about/map.html.
The auditorium is on the ground floor.)

FRIDAY, OCTOBER 21, 2016

1-1.30PM: Registration checkin

1.30 PM: OPENING

1.45-2.30 PM: Magda Peligrad, University of Cincinnati
Random fields, spectral density and empirical spectral distribution

The talk will be concerned with stationary random fields, their spectral density and limiting behavior. The theory of stationary random fields is shedding light on the limiting spectral theory of large random matrices, i.e. the distribution of the eigenvalues as the size of the matrix goes to infinity. We shall point out a relationship between the limiting spectral distribution of random matrices with entries selected from a stationary random field and its spectral density. The talk will be based on joint papers with M. Banna, F. Merlevède, M. Lifshits and C. Peligrad.

2.30-3.15 PM: Richard Bradley, Indiana University
On mixing properties of some INAR models

In time series analysis of (nonnegative integer-valued) ``count data'', one sometimes uses ``integer-valued autoregressive'' (INAR) models, a variant of the original autoregressive models of classical time series analysis. The INAR models of order 1 with ``Poisson innovations'' satisfy (with exponential mixing rate) the ``interlaced rho-mixing'' condition (the stronger variant of the usual rho-mixing condition in which the two index sets are allowed to be ``interlaced'' instead of being restricted to ``past'' and ``future''). That was shown in R.C. Bradley, Zapiski Nauchnyh Seminarov POMI 441 (2015) 56-72, and will be explained in this talk. Earlier, S. Schweer and C.H. Weiss, Comput. Statist. Data Anal. 77 (2014) 267-284, had already shown that those models (as well as some other closely related ones) satisfy absolute regularity with exponential mixing rate.

3.15-4 PM: Posters and coffee break (NSB Atrium)

4-4.45 PM: Murad Taqqu, Boston University
Properties and numerical evaluation of the Rosenblatt distribution

We study various distributional properties of the Rosenblatt distribution. We show how its expansion using centered chi-squared random variables allows us to compute cumulants, moments, the coefficients of the expansion and the density and cumulative distribution functions of the Rosenblatt distribution with a high degree of precision.
This is joint work with Mark Veillette.

5-6.15 PM:
Murray and Adylin Rosenblatt Endowed Lecture in Applied Mathematics
Speaker: Robert Engle, New York University
Title: *Dynamic Conditional Beta*

Abstract:
Dynamic Conditional Beta (DCB) is an approach to estimating regressions with time varying parameters. The conditional covariance matrices of the exogenous and dependent variable for each time period are used to formulate the dynamic beta. Joint estimation of the covariance matrices and other regression parameters is developed. Tests of the hypothesis that betas are constant are non-nested tests and several approaches are developed including a novel nested model. The methodology is applied to industry multifactor asset pricing and to global systemic risk estimation with non-synchronous prices.

Reception to follow with poster session.

SATURDAY, OCTOBER 22, 2016

9.30-10.15 AM: Philip Stark, University of California, Berkeley
Simple Random Sampling is not that Simple

A simple random sample (SRS) of size k from a population of size n is a sample drawn at random in such a way that every subset of k of the n items is equally likely to be selected. The theory of inference from SRSs is fundamental in statistics; many techniques and formulae assume that the data are an SRS, including parametric and nonparametric methods, such as permutation tests. True SRSs are rare; in practice, samples are drawn using pseudo-random number generators (PRNGs) and algorithms that map a set of pseudo-random numbers into a subset of the population. Most statisticians take for granted that their software package "does the right thing," producing samples that can be treated as if they are SRSs. In fact, the PRNG algorithm and the algorithm for drawing samples using the PRNG matter enormously. Some widely used methods are particularly bad. Even for modest values of n and k, the methods cannot generate all subsets of size k; the subsets they do generate may not have equal frequencies; and they are numerically inefficient. For instance, the method used by R does not even have equal first-order selection probabilities; for "big data" with n=10^9, the chance that a single item will be in the sample can vary by about 25% across items. Relying on common algorithms for generating SRSs from standard PRNGs introduces bias into otherwise unbiased estimators and makes the usual uncertainty calculations invalid. The situation for sampling with replacement--the foundation for the bootstrap--is worse still.
This is joint work with Kellie Ottoboni, UC Berkeley, and Ronald L. Rivest, MIT.

10.15-11 AM: Wei Biao Wu, University of Chicago
A unified asymptotic theory for stationary processes

Motivated by Rosenblatt (1960), we present a systematic asymptotic theory for statistics of stationary time series. In particular, we consider properties of sample means, sample covariance functions, covariance matrix estimates, periodograms, spectral density estimates, kernel density and regression estimates of linear and nonlinear processes. The asymptotic theory is built upon functional and predictive dependence measures, a new measure of dependence which is based on nonlinear system theory. Our dependence measures are particularly useful for dealing with complicated statistics of time series such as eigenvalues of sample covariance matrices and maximum deviations of nonparametric curve estimates, generalizing the seminal work Bickel and Rosenblatt (1973).

11-11.30 AM: Coffee Break

11.30-12.15: Keh-Shin Lii, University of California, Riverside
Modeling and predicting non-stationary point processes

We consider a class of point processes with periodic or almost periodic intensity functions. These models deal with the occurrence of events which are unequally spaced and have a pattern of periodicity or almost periodicity, such as stock transactions and accidents. We model the rate of occurrence of such models as a sum of sinusoidal functions plus a baseline. Problems of consistent estimations of the frequencies, phases and amplitudes are discussed. Issue of prediction are explored. Poisson and non-Poisson cases are considered. Simulation and real data examples are used to illustrate the results.

SATURDAY AFTERNOON, OCTOBER 22, 2016

12.15-1.45 PM: LUNCH ON YOUR OWN

1.45-3 PM:
Murray and Adylin Rosenblatt Endowed Lecture in Applied Mathematics
Speaker: Catherine Constable, Institute of Geophysics and Planetary Physics
Scripps Institution of Oceanography, University of California, San Diego
Title: *Earth's Magnetic Field: Random Reversals, Stochastic Models, and Physical Interpretations*

Direct observations of the modern geomagnetic field enable us to understand its role in protecting us from the depredations of the solar wind and associated space weather, while paleomagnetic studies provide geological evidence that the field is intimately linked with the history and thermal evolution of our planet. In the past the magnetic field has reversed polarity many times: such reversals occur when its overall strength decays, and there are departures from the usual spatial structure which at Earth's surface predominantly resembles that of an axially aligned dipole. Reversals are one element of a continuum of geomagnetic field behavior which also includes geomagnetic excursions (often viewed as unsuccessful reversals), and paleosecular variation. The fragmentary and noisy nature of the geological record combined with distance from the field's source in Earth's liquid outer core provide a limited view, but one that has been partially characterized by time series analysis, and development of stochastic models describing the variability. Analyses of changes in the dipole moment have revealed distinct statistical characteristics associated with growth and decay of field strength in some frequency ranges. Paleomagnetic studies are complemented by computationally challenging numerical simulations of geomagnetic field variations. Access to details within the numerical model allow the evolution of large scale physical processes to be studied directly, and it is of great interest to determine whether these computational results have Earth-like properties. The parameter regime accessible to these simulations is far from ideal, but their adequacy can be assessed and future development guided by comparisons of their statistical properties with robust results from paleomagnetic observations. Progress in geomagnetic studies has been greatly facilitated by the application of statistical methods related to stochastic processes and time series analysis, and there remains significant scope for continued improvement in our understanding. This is likely to prove particularly important for understanding the scenarios that can lead to geomagnetic reversals.

3-3.30 PM: Coffee Break

(SEE NEXT PAGE FOR TWO MORE AFTERNOON TALKS)

SATURDAY, OCTOBER 22, 2016 (CONTINUED)

3.30-4.15 PM: Richard Olshen, Stanford University
Murray Rosenblatt, UCSD, and Clonality

My presentation has three somewhat distinct parts, with the first two, Murray Rosenblatt and UCSD, more closely related than either is to the third: my current studies with others of the estimation of functionals of a probability vector that summarizes frequencies of so-called V(D)J rearrangements of particular types of B cells and T cells of the adaptive human immune system. Data come from assumed independent and in one sense identically distributed `replicates,' and consist of counts. One important component of the human immune system is the sum of squares of entries of the probability vector that is termed `clonality.' The ``why'' and the ``how'' will be explained.

4.15-5 PM: Anthony Gamst, University of California, San Diego
Model Selection and Adaptive Estimation

Murray Rosenblatt made fundamental contributions to the theory of non-parametric curve estimation, starting with his seminal 1956 paper on density estimation, which showed that unbiased density estimates do not exist and inspired much of the subsequent work in non-parametric estimation. These and related techniques have become the workhorses of modern machine learning. Striking the proper balance between approximation and estimation error -- bias and variance -- is the key to producing optimal estimators. Achieving this balance is model selection's goal. One is faced with choices concerning which variables to include in the model, the extent of local averaging to use, and the degree of interaction to allow between the included variables, among others. And one would like to have a technique which makes the best choices for -- that is, adapts to -- the problem at hand, not just the best choices, on average, for a class of problems. All machine learning algorithms, including relatively impenetrable tools like deep neural networks, have parameters which control some or all of these features -- controlling the extent to which a given model fits the training data more or less closely than optimal. We will discuss some recent work in selecting models which are adaptive and finite-sample optimal.

5.30 PM: Dinner, Faculty Club, UC San Diego
(advance purchase of dinner tickets is required)
MC: Karen Messer, Division of Biostatistics and Bioinformatics, UC San Diego

SUNDAY, OCTOBER 23, 2016

9.30-10.15 AM: Richard Davis, Columbia University
Noncausal Vector AR Processes with Application to Economic Time Series

Following up on Rosenblatt's extensive work on non-minimum phase modeling (see Rosenblatt (2000), "Gaussian and Non-Gaussian Linear Time Series and Random Fields", Springer), we consider inference procedures for possibly noncasual vector autoregressions (AR). Inference procedures for noncausal autoregressive univariate models have been well studied and applied in a variety of applications from environmental to financial. For such processes, the observations at time t may depend on both past and future shocks in the system. In this talk, we will consider extensions of the univariate noncausal AR models to the vector AR (VAR) case. The extension presents several interesting challenges since even a first-order VAR can possess both causal and noncausal components. Assuming a non-Gaussian distribution for the noise, we show how to compute an approximation to the likelihood function. Under suitable conditions, it is shown that the maximum likelihood estimator (MLE) of the vector of AR parameters is asymptotically normal. The estimation procedure is illustrated with a simulation study for a VAR(1) process and with two macro-economic time series. Semiparametric attempts at estimation for these models will also be mentioned.
This is joint work with Li Song and Jing Zhang.

10.15-11 AM: Dimitris Politis, University of California, San Diego
From Nonparametrics to Model-Free: a time series time line

11-11.30 AM: Coffee Break

11.30 AM-12.15 PM: Larry Goldstein, University of Southern California
Normal Approximation for Recovery of Structured Unknowns in High Dimension: Steining the Steiner formula
(See next page for abstract)

Normal approximation for recovery of structured unknowns in high dimension: Steining the Steiner formula

Larry Goldstein, University of Southern California

Abstract

Intrinsic volumes of convex sets are natural geometric quantities that also play important roles in applications. In particular, the discrete probability distribution $\mathcal{L}(V_C)$ given by the sequence $v_0, \ldots, v_d$ of conic intrinsic volumes of a closed convex cone C in $\mathbb{R}^d$ summarizes key information about the success of convex programs used to solve for sparse vectors, and other structured unknowns such as low rank matrices, in high dimensional regularized inverse problems. Concentration of V_C about its mean implies the existence of phase transitions for the probability of recovery of the structured unknown as a function of the number of observations. Additional information about the probability of recovery success is provided by a normal approximation for V_C. Such central limit theorems can be shown by first considering the squared length G_C of the projection of a standard Gaussian vector on the cone C. Applying a second order Poincaré inequality, proved using Stein's method, then produces a non-asymptotic total variation bound to the normal for $\mathcal{L}(G_C)$. A conic version of the classical Steiner formula in convex geometry translates finite sample bounds and a normal limit for G_C to that for V_C.

Joint with Ivan Nourdin and Giovanni Peccati. `http://arxiv.org/abs/1411.6265`