POLITECNICO DI TORINO

June 12-th and 13-th, 2006
Dipartimento di Matematica
Corso Duca degli Abruzzi 24, 10129 Torino

TWO DAYS ON PROBABILITY, STATISTICS AND MATHEMATICAL FINANCE

This year the 43-rd "Riunione Scientifica delle Società Italiana di Statistica" (SIS) will be held in Turin between June 14 and June 16th, 2006; on June 12th and 13th there will be three satellite meetings on the interplay between Statistics and Finance, Insurance, Business and Biomedicine. All these activities at web page http://hal9000.cisi.unito.it/wf/ATTIVITA_C/Associazio/SIS2006/index.htm

This is the reason why the usual annual cycle of seminars of the Probability and Statistics group at Politecnico di Torino advertised in this document will be also condensed in two half-day workshops on June 12 and 3th, 2006 and will be held at times conveniently syncronized with the SIS events.
The activities of our group are at web page http://calvino.polito.it/~probstat/

All these events will make for an interesting Statistics Week in Turin from June 12th to June 16th.
See you there!

The 2006 Seminar Chairman of the Probability and Statistics group at Politecnico di Torino
Franco Pellerey

June 12-th, 2006, at room 1D
10.00-11.00:
Antonio Di Crescenzo, Dipartimento di Matematica e Informatica, Università di Salerno
Alternating Brownian motions: probability laws and simulation.
11.00-12.00:
José Maria Fernández Ponce, Dpto Estadistica e Investigación Operativa, Universidad de Sevilla, Spain.
Multivariate dispersion orderings: an application in influence analysis.

June 12-th, 2006, at room Buzano
14.00-15.00:
Giovanni M. Marchetti Dipartimento di Statistica "G. Parenti", Università di Firenze
Graphical models of marginal independence for categorical data: parameterizations and inference
15.00-16.00:
Etienne Pardoux, Laboratoire d'Analyse, Topologie, Probabilités, Université de Provence
Homogenization of possibly degenerate second order PDEs, a probabilistic approach.
16.00-17.00
Walter Kremers, Mayo Clinic
Etiology and MELD Score as Predictors of Survival in Acute Liver Failure: Cox Regression with Competing Risks

June 13-th, 2006, at room Buzano
9.30-10.30:
Giacomo Scandolo, Dipartimento di Matematica per le Decisioni, Università di Firenze
Assessing the robustness of risk measures
10.30-11.30:
Sabrina Mulinacci, Istituto di Econometria e Matematica per le Decisioni, Università Cattolica
On the inefficiency of the American option contract in incomplete markets
11.30-12.30:
Patrizia Semeraro, Dipartimento di Statistica e Matematica Applicata, Università di Torino
A multivariate time-changed Lévy model for financial applications

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ABSTRACTS

Alternating Brownian motions: probability laws and simulation.

Antonio Di Crescenzo, Dipartimento di Matematica e Informatica, Università di Salerno

We consider a Brownian motion with alternating infinitesimal moments, where the time intervals between consecutive changes of these moments are described by an alternating renewal process. We obtain the probability law of the resulting stochastic process, with explicit expressions in the special case of exponentially distributed inter-renewal times. The first-passage-time problem through a constant boundary is also considered. Bounds to the first-passage-time density and distribution function are obtained, and a simulation procedure to estimate first-passage-time densities is constructed. Examples of applications to problems in environmental sciences and mathematical finance are also provided.

Multivariate dispersion orderings: an application in influence analysis.

José Maria Fernández Ponce, Dpto Estadistica e Investigación Operativa, Universidad de Sevilla, Spain.

Univariate stochastic and dispersive orderings arise in statistical decision theory in the comparison of experiments and estimation problems. Johnson and Geisser (1983) proposed a method of assessing the influence of specified subsets of the data when the goal is to predict future observations using predictive densities. They assumed the prior density for the corresponding parameters in the model, which presume that a little prior information is available relative to that information inherent in the data. Assume the case when a particular subset has been deleted, then the predictive densities based on full and subset deleted data seta, when a particular parameter is unknown, are two multivariate t-distributions. In this case, the problem to detect influential observations is based on compare two multivariate t-distributions. If we only study the comparison in terms o variability, it seems to be logical that if we delete a subset of data then the obtained predictive density will be expected to be more dispersive than the one based on full data. This may be interpreted as the added variability, due to deletion of the corresponding data subset. However it is not true that every subset of data with a fixed size has the same influence. A Dispersion Bayesian Influence in terms of Variability (DBIV) measure can be defined for each particular subset and we will be able to order the subsets from least to most influential according to the magnitude of this measure.

Graphical models of marginal independence for categorical data: parameterizations and inference

Giovanni M. Marchetti , Dipartimento di Statistica "G. Parenti", Università di Firenze

Graphical models are often used to investigate dependencies between categorical variables. Graphs are used to define a precise set of conditional or marginal independencies. The most popular are graphical loglinear models, defined by an undirected graph, and recursive path analysis models, defined by a directed acyclic graph.
In this talk a different class of marginal independence models are presented, defined by a graph with bi-directed edges. These models are called (especially in the Gaussian case) covariance graph models and they define a class of probability distributions that fulfill a set of marginal independencies between variables. There are rules, called Markov properties, that allow the reading of the implied independencies off the graph. Two such properties are the pairwise Markov property and the global Markov property, and for discrete distributions they do not coincide. Two parameterizations of discrete covariance graph models will be proposed in order to accommodate easily the constraints that define the models, under the global Markov property. The second one has the advantage of defining, for some classes of graphs, variation independence parameters. The problem of maximum likelihood estimation will be addressed and some applications will be discussed.

Homogenization of possibly degenerate second order PDEs, a probabilistic approach.

Etienne Pardoux, Laboratoire d'Analyse, Topologie, Probabilités, Université de Provence

Our goal is to study, by a probabilistic method, the limit as $\varepsilon \to 0$ of the solution $u^{\varepsilon}(t,x)$ of an elliptic PDE with periodic coefficients in the regular bounded domain $D \subset \mathbb{R}^d$

$$\begin{cases} \mathcal{L}_\varepsilon u^\varepsilon(x) + f\left(x, \frac{x}{\varepsilon}\right) u^\varepsilon(x) = 0,\ x \in D, \\ u^\varepsilon(x) = g(x),\ x \in \partial D, \end{cases}$$

where f is bounded from above, and g is continuous, as well as the limit of $u^{\varepsilon}(t,x)$, the solution of a parabolic PDE with periodic coefficients of the form

$$\begin{cases} \frac{\partial u^\varepsilon(t,x)}{\partial t} = \mathcal{L}_\varepsilon u^\varepsilon(t,x) + \left(\frac{1}{\varepsilon} e(\frac{x}{\varepsilon}) + f(x, \frac{x}{\varepsilon})\right) u^\varepsilon(t,x) \\ u^\varepsilon(0,x) = g(x), x \in \mathbb{R}^{\mathrm{d}}, \end{cases}$$

where

$$\mathcal{L}_\varepsilon = \frac{1}{2} \sum_{i,j=1}^{d} a_{ij}(\frac{x}{\varepsilon}) \frac{\partial^2}{\partial x_i \partial x_j} + \sum_{i=1}^{d} \left(\frac{1}{\varepsilon} b_i(\frac{x}{\varepsilon}) + c_i(\frac{x}{\varepsilon})\right) \frac{\partial}{\partial x_i}.$$

The novelty of our result lies in the fact that we allow the matrix a to degenerate (and even possibly to vanish) in some open subset D of $\mathbb{R}^d$. There is by now quite a vast literature concerning the homogenization of second order elliptic nd parabolic PDEs with a possibly degenerating matrix of second order coefficients a. But, as far as we know, in all the published papers, either the coefficient a is allowed to degenerate in certain directions only, or else it may vanish on sets of measure zero only. It seems that our paper presents the first result where the matrix a is allowed to vanish on an open set.

We will follow the probabilistic approach initiated by Freidlin in the 60's, and exploit recent joint results with A. Veretennikov on the Poisson equation in the degenerate case.

Etiology and MELD Score as Predictors of Survival in Acute Liver Failure: Cox Regression with Competing Risks

Walter Kremers, Mayo Clinic

Here I will describe one study we performed considering the value of the MELD (Model for End-stage Liver Disease) score, specifically in patients with acute liver failure. We will briefly give a brief background of the MELD and acute liver failure. We will present our analysis and results and also comment on the use of competing risks survival analysis with special attention to the handling of ties.

Assessing the robustness of risk measures

Giacomo Scandolo, Dipartimento di Matematica per le Decisioni, Università di Firenze

Motivated by compelling practical issues, a relevant part of the recent literature on risk management has been devoted to ”structural” properties of risk measurement procedures. In this framework the two notions of coherent (Artzner et al., 2000) and convex (F¨ollmer & Schied 2001, Frittelli & Gianin 2002) risk measures have been proposed and well accepted, at least from the theoretical viewpoint. A common assumption is that the underlying probability measure describing market events is known: most risk measures such as Value-at-Risk or Expected Shortfall are defined as functionals of the distribution of the considered payoff. In applications, however, this probability distribution is unknown and should be estimated from (historical) data as part of the risk measurement procedure. Thus, in practice, a risk measurement methodology is a correspondence between the data set DN (of size N) and an estimated value T(DN) for the risk measure.
This quantity is supposed to estimate the abstract risk measure R(F) where F is the "true", but usually unknown distribution function generating the data set. This distinction between R(F) and its estimator(s) T(DN) is in our opinion relevant and naturally raises the following two questions Consistency : does T(DN) converge to R(F) as the size N of the data set increases?
Sensitivity : how sensitive is the result with respect to the data set or with respect to a misspecification of the true probability measure? In our work we would like to examine these issues using tools from robust statistics. Our first aim is to study general robustness properties of a coherent risk measure and its estimators. Then we would like to focus on some specific examples of risk measures: Value at Risk, Expected Shortfall/ AVaR and the class of spectral risk measures introduced by Acerbi in 2001.

On the inefficiency of the American option contract in incomplete markets

Sabrina Mulinacci, Istituto di Econometria e Matematica per le Decisioni, Università Cattolica di Milano

It is well-known that in an incomplete market for any contingent claim a set of arbitrage free prices is defined. In the case of American options, depending on the behaviour of the buyer, the exercise time may be different for different arbitrage-free prices. In the paper, we study what happens in the extreme case in which the seller knows perfectly the stopping time chosen by the buyer for each possible price and we show that, in any situations, such a case is more efficient both for the buyer and the seller. Starting from this argument, it is possible to define a pseudo-American type option contract that allows the buyer to optimize his utility as for the American contract, the seller to reduce his risk and to trade the option at a smaller price.

A multivariate time-changed Lévy model for financial applications

Patrizia Semeraro,Dipartimento di Statistica e Matematica Applicata D. De Castro, Università di Torino

Thee purpose of this work is the definition of a bivariate Lévy process by subordination of a Brownian motion. In particular we investigate a generalization of the bivariate Variance Gamma process proposed by Luciano and Schoutens as a price process. Our main contribution is to introduce a bivariate subordinator with correlated Gamma margins. We characterize the process and study its dependence structure. At the end we also propose an exponential Lévy price model based on our process.