Sesión Especial 25
Probabilidad y Procesos Estocásticos

Organizador
- José Miguel Angulo Ibáñez (Universidad de Granada)

Descripción
La Probabilidad, cuya fundamentación matemática entronca en la Teoría de la Medida, si bien con un desarrollo diferenciado a partir de los conceptos propios de independencia y condicionamiento, así como epistemológicamente en el contexto de la representación y el tratamiento de la incertidumbre, constituye la raíz en la construcción de los Procesos Estocásticos, así como de la Estadística Matemática, disciplinas con un amplio cuerpo de conocimiento consolidado e implicaciones muy diversificadas en el conjunto de la Ciencia. En esta sesión se exponen los avances recientes en algunas líneas de investigación que actualmente desarrollan grupos representativos de nuestro entorno. Los contenidos abarcan aspectos de carácter fundamental y metodológico, con proyección en diferentes campos de aplicación.

Programa

LUNES, 4 de febrero (mañana)

11:30 – 12:00 Josep Vives (Universitat de Barcelona)
Option Price Decomposition Formulas: Applications to Pricing and Calibration

12:00 – 12:30 Eustasio del Barrio (IMUVA, Universidad de Valladolid)
Smooth Cyclically Monotone Interpolation and Empirical Center-Outward Distribution Functions

12:30 – 13:00 Gerardo Sanz (Universidad de Zaragoza)
Stochastic orders and couplings for nonconservative particle systems

13:00 – 13:30 Javier Villarroel (Universidad de Salamanca)
On some results for escape probabilities for compound Poisson processes with drift
Option Price Decomposition Formulas: Applications to Pricing and Calibration

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Abstract. In [1], a new type of decomposition formula for the plain vanilla option price for the Heston model was obtained. This formula is useful in two directions. One is to obtain approximated closed form option price formulas that allow precise and computationally efficient pricing and the other is model calibration, see [2]. This decomposition formula has been extended to more general stochastic volatility jump-diffusion models in [3] and [4], and other extensions are coming. The purpose of the talk is to present a survey of this technique and some of its applications.

Referencias


Smooth Cyclically Monotone Interpolation and Empirical Center-Outward Distribution Functions

EUSTASIO DEL BARRIO

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Abstract. We consider the smooth interpolation problem under cyclical monotonicity constraint, namely, given $X = \{x_1, \ldots, x_n\}$ and $Y = \{y_1, \ldots, y_n\}$ in $\mathbb{R}^d$ we assume the existence of a unique cyclically monotone bijection $T : X \rightarrow Y$. Our goal is to define continuous, cyclically monotone maps $\overline{T} : \mathbb{R}^d \rightarrow \mathbb{R}^d$ such that $\overline{T}(x_i) = y_i$, $i = 1, \ldots, n$. Our solutions $\overline{T}$ are Lipschitz, and we provide a sharp lower bound for the corresponding Lipschitz constants. The problem is motivated by the concept of empirical center-outward distribution function in $\mathbb{R}^d$ in [2], defined only at sample points. Our interpolation (see [1]) provides a smooth extension, generalizing the traditional left-continuous univariate concept. We provide also a Glivenko-Cantelli result.

Referencias


Joint work with Juan A. Cuesta-Albertos, Marc Hallin and Carlos Matrán
Stochastic orders and couplings for nonconservative particle systems

GERARDO SANZ
Universidad de Zaragoza

Abstract. We find necessary and sufficient conditions for the comparability and attractiveness of general Interacting Particle Systems (IPS). We work with processes allowing births, deaths and migration of elements but migration needs not be conservative. That is, a batch of $k$ elements leaving a site $x$ arrives at $y$ as a batch of $l$ elements.

The proof relies on the construction of an order-preserving coupling based on the theory of network flow. Our results improve currently available results.

Joint work with Raúl Gouet (Univ. of Chile, rgouet@dim.uchile.cl) and F. Javier López (Univ. of Zaragoza, javier.lopez@unizar.es)
Financed by CONYCIT AFB170001 (Chile), Fondecyt grant 1161319 (Chile) and MTM2017-83812-P (Spain). The authors are members of the research group Modelos Estocásticos of DGA (Spain)

On some results for escape probabilities for compound Poisson processes with drift

JAVIER VILLARROEL
Universidad de Salamanca

Abstract. Given a Poisson process $(N_t)_{t \geq t_0}$ we study escape probabilities off the interval $(a, b)$ of general compound Poisson processes with drift: $X_t = x + ct + \sum_{n=0}^{N_t} J_n$.

We formulate integral equations that satisfies $P_x(\tau_b < \tau_a)$ starting from $x \in (a, b)$.

In the case of purely negative jumps $J_n$ we give closed form expressions for this probability. The ruin probability of risk theory is recovered via limits. We draw a parallelism with the “speed function” of diffusion processes.

Referencias


Joint work with Juan Antonio Vega and Miquel Montero
Financed by Agencia Estatal de Investigación under Contract No. FIS2016-78904-C3-2-P.

Some Recent Contributions to the Theory on Two Sex Branching Processes

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Abstract. In the general setting of stochastic modeling, branching process theory provides mathematical models to describe the dynamics of populations whose size evolves over time, due to random births and deaths. In order to describe the evolution of biological populations with sexual reproduction, several classes of two sex branching processes have been investigated. In such classes of processes, the population consists of two types of individuals, females and males, and two biological phases are considered, the mating phase where the couples (female-male) are formed, and the reproduction phase in which each couple produces new individuals according to a probability distribution. In this talk, we provide a survey about the recent advances on two sex branching processes. In particular, we present some results about the class of continuous time two sex branching processes introduced in [1].

Referencias


Joint work with Manuel Mota and Nykolai M. Yanev.
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An ANOVA-Type Procedure for Replicated Spatial and Spatio-Temporal Point Patterns

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Abstract.
Several methods to analyse structural differences among groups of replicated spatial, spatio-temporal and possibly marked point patterns are presented. We calculate a number of functional descriptors of each pattern to investigate departures from completely random patterns, both among subjects and groups. We also develop strategies for analysing the effects of several factors marginally within each factor level, and the effects due to interaction between factors. We consider the $K$-function and its mark-weighted version as particular descriptors of each pattern in our sample, and develop a set of statistics based on classical analysis of variance statistics and their analogues in functional data analysis.

The statistical distributions of our functional descriptors and of our proposed tests are unknown, and thus we use bootstrap and permutation procedures to estimate the null distribution of our statistical test. A simulation study provides evidence of the validity and power of our procedures. Several applications in environmental and engineering problems will be presented.

Joint work with Jonatan González.
Risk Assessment of Random Field Threshold Exceedances

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Abstract. Functionals describing structural aspects of random field threshold exceedance sets provide indicators useful for characterization of extremal behaviour and risk assessment. First-order indicators such as exceedance areas or excess volumes on bounded domains are suitably formalized in terms of compound distribution functions, a framework under which effects of spatial deformation, local change of measure, or specification of non-constant thresholds, among other extensions involving certain forms of heterogeneity, are properly addressed. Model-based conditional simulation, from available space or space-time observations, can be used as a suitable approach to the empirical assessment of the probability distributions of selected indicators, and subsequent implementation of different risk measures [1]. In particular, quantile-based risk measures, which play an important role in the analytical development of the modern theory of risk measures, have a direct loss-related interpretation and can be applied under general system dynamics conditions.

Referencias


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