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Preface

Special issue: Advances in Stochastic processes and Applications

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The publication of this special issue of the journal Mathematical Biosciences and Engineering is a matter of a great pleasure for me. It contains 7 refereed research papers on recent developments in stochastic processes. There is particular focus on applications of stochastic processes as models of dynamic phenomena in several research fields, such as financial mathematics, economics, biology and health. A milestone on this topic is [1] in which very broad coverage of the most applicable aspects of stochastic processes is featured.

The stochastic processes treated in this volume range within quite wide areas, such as diffusions, stochastic volatility models, non linear autoregressive processes, neural networks and Markov chains. Statistical methods, including both parametric and non-parametric schemes, are also investigated to infer properties of the considered systems.

Within the framework of financial portfolio optimization, [2] analyze the relationships between the condition of arbitrage and the utility maximization in the presence of insider information. In this context it is shown that the value of the insider information may be bounded while the arbitrage condition holds. The authors also provide an example in which the insider information does not imply arbitrage for the insider. Remaining in a financial context, by looking at data from $S\&P$ 500, in [3] alternative forecast combinations across estimation windows for directly dealing with possible structural breaks in the observed time series are compared in the framework of GARCH-type models.

In [4] a wide class of diffusion process, obtained from the generalized Weibull diffusion process and useful in the context of cell growth phenomena, is considered. The maximum likelihood estimation (MLE) of the parameters is provided. An application to quantitative polymerase chain reaction shows the capability of the considered process for fitting the fluorescence levels associated with the amplification of amplicons of DNA.

In [5] a novel nonlinear autoregressive sieve bootstrap scheme based on the use of Extreme Learning Machines is proposed and discussed. The procedure is fully nonparametric and the use of Extreme Learning Machines dramatically reduces the computational burden of the bootstrap procedure. By means of a Monte Carlo experiment, the authors shows that the distributions of the bootstrap variance estimators is consistent, delivering good results both in terms of accuracy and bias, for either linear and nonlinear statistics and smooth functions of means.

The risk of lung carcinogenesis from cigarette smoking among current and former smokers is treated in [6], in which a stochastic three-stage model to fit the data of Surveillance, Epidemiology, and End Results (SEER) program besides the data set of smoking derived from the Nurses' Health Study cohort of females (NHS) and the Health Professionals Follow up Study cohort of men (HPFS). Authors' findings are very interesting insight in understanding relation between smoking and mutations in cells.

A non-homogeneous Ornstein-Uhlembeck (OU) process is discussed in [7] as a model for the membrane potential activity of a single neuron. It is assumed that, in the absence of stimuli, the neuron activity is described via a time-homogeneous OU. The authors provide a statistical procedure to fit the constant parameters and the time-dependent functions involved in the model. The proposed methodology is based on two steps: the first one is able to estimate the constant parameters, while the second one fits the non-homogeneous terms of the process. Remaing in the context of neuronal activity, in [8] a two-state point process corresponding the two states of the neuronal cell is provided. The model presumes state-dependent excitatory stimuli amplitudes and decay rates of membrane potential. The state switches at each stimulus time. The neural firing time distribution and the mean firing time are analysed, by means of Laplace transform technique.

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