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Preface to the Special Issue on "Advances in Uncertainty Theories and its Applications"

As a matter of fact, there are many formalities of uncertainty and inevitably many uncertainty theories. Even for a specific uncertainty, there are always many different theories to handle it. For example, randomness is one of the basic uncertain forms, however, there have been developed at least four theoretical branches facilitating the modelling of random uncertainty: probability measure theory, Dempster-Shafer theory, imprecise probability theory, capacity theory, and others. As to another basic uncertainty, fuzziness, there are at least two theoretical foundations, for example, Zadeh's membership initiated possibility measure framework and Liu's axiomatic credibility measure foundation. The diversified formalities of uncertainty are merely a revelation of the complexity of the real world around us and also the reflection of diversified human knowledge extracting and processing the information being fed from surrounding world. In such a sense, freedom to work with any theory that an individual researcher prefer to is critical to a scientific journal. There should not be any predefined academic political criterion for a journal editor to select or to reject a seriously submitted paper. *Journal of Uncertain Systems* is just providing a free and unbiased environment for researchers working with different forms of uncertainty, or different theoretical treatments with respect to the same form of uncertainty. In this sense, we have reached our goal of this special issue.

There are seven papers selected for this issue. The first paper is "Monkey Algorithm for Global Numerical Optimization" by R.Q. Zhao and W.S. Tang. Monkey algorithm (MA) is designed to solve global numerical optimization problems with continuous variables. The algorithm mainly consists of climb process, watch-jump process, and somersault process in which the climb process is employed to search the local optimal solution, the watch-jump process to look for other points whose objective values exceed those of the current solutions so as to accelerate the monkeys' search courses, and the somersault process to make the monkeys transfer to new search domains rapidly. The proposed algorithm is applied to effectively solve the benchmark problems of global optimization with 30, 1000 or even 10000 dimensions. The computational results show that the MA can find optimal or near-optimal solutions to the problems with a large dimensions and very large numbers of local optima.

The second paper is "Scalar Fuzzy Regression Models" by R. Guo, D. Guo and C. Thiart. In this paper, authors propose a scalar variable formation of fuzzy regression model based on the axiomatic credibility measure foundation. The fuzzy estimation for fuzzy regression coefficients is investigated. A general M-estimation criterion is developed under Maximum Fuzzy Uncertainty Principle, which resulted in weighted Normal equation with adjusted term for M-estimator of the regression coefficients. Finally, authors explore the fuzzy one-way classification model and the M-estimation in general and the concept of estimable function with respect to the one-way model.

The third paper is "Foundations of Fuzzy Bayesian Inference" by R. Viertl. Professor Rienhard Viertl has long working on the theory of statistical inferences on vague data. It is a very nice chance to have his latest research idea to include in this special issue. In this paper, author argues that in Bayesian inference exercises, it is often facing data available and a-priori information are not precise numbers and not standard probability distributions on the parameter space, but more or less vague. Therefore suitable descriptions of data are so-called non-precise numbers which are more general than fuzzy numbers, and so-called fuzzy probability distributions on the parameter space. Based on these observations, author generalizes Bayes' theorem to model imprecise data, which keeps the sequential nature of the Bayesian updating procedure when samples are split. Moreover generalized predictive distributions are explained.

The fourth paper is "Generating Correlation Matrices for Normal Random Vectors in NORTA Algorithm Using Artificial Neural Networks" by S.T.A. Niaki and B. Abbasi. Authors point out that the generation of random vectors is a crucial in the analysis of multivariate systems. The normal-to-anything (NORTA) algorithm, in which generating the correlation matrices of normal random vectors is the most important task, is one of the most efficient methods in this area. In this paper authors proposed Perception algorithm established in artificial neural networks to solve the problem of correlation matrices. Using three simulation experiments, the applicability of the proposed methodology is described and the results obtained from the proposed method to the ones from solving the equations numerically are compared. The results of the simulation experiments demonstrate that the proposed method works well.

The fifth paper is "Defining and Modeling Uncertainty" by E.v. Collani. Professor Elart von Collani is the founder of a new and alternative prediction theory, termed by "stochastics". Author argued philosophically that uncertainty about the future development constitutes the central problem of mankind. In order to solve the related difficulties many methods have been developed: divination, astrology, probability theory, statistics, possibility theory and more

recently fuzzy logic, artificial intelligence and others. Each of these approaches claims to deal with uncertainty and to solve problems related to uncertainty. In this paper an alternative approach called stochastics, i.e., science of prediction, is introduced, which enables reliable and at the same time accurate predictions in real world situations by taking into account uncertainty about the future development.

The sixth paper is "An Algorithm for Discovery of Fuzzy Inclusion Dependencies in Fuzzy Databases" by A.K. Sharma, A. Goswami, and D.K. Gupta. In the paper, authors state that fuzzy inclusion dependencies $(FID_\alpha s, \alpha \in [0,1])$ express subset-relationships between fuzzy databases and are thus important indicators for redundancies between fuzzy databases. In general, the discovery of $FID_\alpha s$ will be beneficial in any effort to integrate unknown fuzzy databases. The problem of searching $FID_\alpha s$ between two fuzzy relations is NP-hard. Therefore, authors proposed to map the $FID_\alpha s$ searching problem to a weighted hypergraph to reduce it to a clique finding problem in a collection of *k*-hypergraphs. Correctness and complexity of the algorithm are also discussed. By reducing the problem to a weighted hypergraph problem, a significant improvement in performance over the naıve algorithm is achieved. The new algorithm uses an NP complete graph algorithm (clique-finding), but a test implementation shows that most of the real world problems can be solved by this approach.

The last paper is "Modelling Uncertainty in Refutation Selection - A POMDP Based Approach" by G.S. Mahalakshmi and T.V. Geetha. This paper explains the methodology behind modeling uncertainty during refutation selection in a procedural argumentation setting. The goal of argument scenario is to share valid knowledge between knowledge volunteers. The process of knowledge sharing is adapted from Indian philosophy. The exchange of arguments (or moves and counter-moves) is modeled into a Partially Observable Markov Decision Process. In this work, a new real-time belief search algorithm for selection of effective refutations and calculation of rewards is proposed and the optimal playing of arguing entities is analyzed in a conversational setting.

We would like to thank most sincerely all the authors contributing to the special issue as well as the anonymous reviewers.

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