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Editorial

Interval/Probabilistic Uncertainty: Editorial

The main topic of this special issue is *Interval/Probabilistic Uncertainty*. Most of the papers from this issue were selected from the presentations made at the International Workshop on Interval/Probabilistic Uncertainty and Non-classical Logics – UncLog'08 (Japan Advanced Institute of Science and Technology, March 25–28, 2008). For this special issue, we also solicited relevant papers from other researchers.

All submitted papers were reviewed in accordance with the journal's guidelines. Based on the peer-reviewing reports, the following five papers were accepted for publication.

The first paper, "*Inconsistency as qualified truth: A probability logic approach*," by J.B. Paris, D. Picado Muiño, and M. Rosefield, addresses a frequent problem in practical applications of reasoning – that knowledge bases are often inconsistent. In traditional logic, an inconsistency means that we can derive any statement S and its negation $\neg S$. To avoid this situation, the authors assume that all the statements are only valid with a certain probability η, and limit themselves only to conclusions which are valid with probability $\geqslant \xi$ for some threshold ξ. It turns out that if we select appropriate values of ξ and η, the inconsistencies disappear – in the sense that it is no longer possible to conclude both S and $\neg S$. The authors then analyze the properties of the corresponding conclusion relation ${}^{\eta}\!\lhd_{\xi}$.

The second paper, "*Trade-off between sample size and accuracy: Case of measurements under interval uncertainty*," by H.T. Nguyen, O. Kosheleva, V. Kreinovich, and S. Ferson, addresses the question of what is an appropriate trade-off between the sample size and the accuracy in measurements under interval uncertainty. This question is important because in many practical situations, we do not know the exact distributions of all the measurement errors; we only know the upper bound on the corresponding measurement (or estimation) errors. In this case, after the measurements, we only know the interval of possible values of the quantity of interest. The authors first show that in such situations, the traditional probability-based engineering approach to selecting the sample size can sometimes be misleading; so for interval uncertainty, new techniques are needed. Then, they describe proper techniques for achieving the optimal trade-off between sample size and accuracy under interval uncertainty.

In the third paper, "*Linguistic modelling and information coarsening based on prototype theory and label semantics*," Y. Tang and J. Lawry propose new information-coarsening techniques for linguistic modelling. Based on these techniques, they develop a new method for extracting linguistic rules from data. Specifically, they propose a new *prototype* semantic interpretation for vague concepts, in which each basic linguistic label L has the form '*about P*', where P is a set of prototypes of L, The size of the neighborhood of the underlying concept is described by the word '*about*', which is represented by a probability density function δ on $[0,\infty)$. For linguistic modelling, the authors use IF–THEN rules of the type "IF X is *about P* THEN Y is *about p*", where P is the prototype set of the rule antecedent and p is the prototype of the rule consequence. They develop a new method for extracting such linguistic rules from training data. They illustrate the efficiency and potential of the new linguistic modelling method on the example of the two benchmark time series prediction problems: Mackey–Glass time series prediction problem and sunspots prediction problem.

The fourth paper, "*Variable-precision dominance-based rough set approach and attribute reduction*," by M. Inuiguchi, Y. Yoshioka, and Y. Kusunoki deals with the uncertainty with which we know the values of ordinal attributes in decision information systems. To deal with this uncertainty, the authors introduce the ideas of Ziarko's variable-precision (VP) rough set model into the framework of the dominance-based rough set approach (DRSA). They also analyze how the existing attribute-reduction techniques can be extended to this combined VP–DRSA approach. Specifically, they introduce several reasonable types of reducts, and analyze the relationship between these types.

In the last paper, "*A granularity-based framework of deduction, induction, and abduction*," Y. Kudo, T. Murai, and S. Akama combine Ziarko's variable-precision rough set model with a measure-based semantics for modal logic into a unified framework for deduction, induction, and abduction reasoning. Within this framework, they characterize deduction, induction, and abduction as reasoning processes based on *typical* scenarios (="worlds") in which a proposition holds – rather than by considering the set of *all possible scenarios* (as in the classical logic). If we restrict ourselves to such typical situations, then both

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deduction and abduction become valid reasoning processes, and induction becomes a valid reasoning process of generalization based on observations.

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We hope that the readers will enjoy reading the papers in this special issue.

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