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Guest Editorial: Soft approaches to information processing: from theory to applications

by

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During last decades we have witnessed a tremendous development of electronic data processing. Huge amounts of data are gathered and processed every day, with the consequent need for efficient and effective methods of information processing. Even if the ever evolving computer technologies alleviate this problem to some extent, still definitely new ideas and techniques are needed to effectively locate information relevant to users' need. There is one dimension of data access effectiveness which requires special attention, namely *consistency with human perception*. Accessing databases and retrieving textual information from document collections is an experience that does not only belong to specialists. In the Information Society virtually everybody is performing this kind of activity more or less often. An average user is neither prepared nor willing to express his or her requirements in the form usually expected by information systems. A very important aspect of man-machine interaction is the difficulty of matching the rigid, binary logic of a computer and the flexible, often vague and imprecise character of natural language, which is the most important way of communication for a human being. Natural language modelling and understanding is a multi-faceted problem. One of the basic problems is the proper account for the different aspects of information imperfection related to the concepts expressed

using natural language. In this special issue, we focus on this problem from different perspectives and contexts by using *Soft Computing* tools. Soft computing approaches are appropriate to deal with imprecision, vagueness, incompleteness, partial truth, and approximation. Using such approaches it is possible to model and process imprecise information more effectively. The papers gathered here deal with various problems related to data modelling and processing by using an important soft computing tool, *Fuzzy Logic*. Fuzzy logic provides a sound mathematical framework for the development of well-founded models, tools and techniques. The support for human consistent data processing is one of its main, generally meant, goals.

In the first paper, entitled *An Improved Recommender System to Avoid the Persistent Information Overload in a University Digital Library*, Porcel, Morales del Castillo, Cobo, Ruíz and Herrera-Viedma propose an extended architecture of a recommender system. The main idea is to maintain a history of recommendations, including also those items, which were not earlier shown to the user due to constraints imposed by him or her. This history may be used for the future recommendations and may contribute to a better delivery of other services by the system. The recommender system considered is to be used in the framework of a university digital library and thus it may provide some additional services, like giving hints as to the formation of teams of faculty members to address a specific research problem. The recommender system proposed employs a fuzzy linguistic approach to model relevance, importance, compatibility and preference degrees of items and other relevant elements, as well as to model the limits on the number of recommended items specified by the users.

The paper *Matrioshka's Soft Approaches to Personalized Web Exploration* by Bordogna and Psaila proposes the use of soft tools to deal with an important problem of efficient Web searching user interface development. The authors adopt the meta-search paradigm and develop some new flexible ways to aggregate the rankings of documents obtained using different search engines as well as provide the user with other means to effectively explore search results. The soft techniques are meant to deal with semantic ambiguity, imprecision and uncertainty of complex web searches.

Furno, Loia, and Veniero in their paper *A computational intelligence approach to cognitive situation awareness for Airport Security* deal with the situation awareness, a crucial aspect of effective decision making. The situation awareness is meant here as the perception of the objects in an environment of an agent over a time frame, the comprehension of their meaning, and the projection of their status in the near future. It requires continuous monitoring and identification of relationships among objects in a dynamic environment. The authors consider the domain of airport security where this aspect has a particular importance. They propose a fuzzy cognitive ontology-based approach to model situation awareness and introduce an agent-based distributed evaluation architecture. The latter involves many task-oriented soft computing agents monitoring the situation.

Qiang, Asmussen, Delafontaine, Stichelbaut, De Tré, De Maeyer and Van de Weghe in their paper *Modelling Imperfect Time Intervals in a Two-Dimensional Space* employ soft techniques to model and process imperfect temporal information. In particular, they use rough set and fuzzy set theories to define two-dimensional rough and fuzzy representations of time intervals. The proposed approaches provide a more compact and clearer representation of imperfect time intervals and relations among them, compared to traditional linear modelling of time intervals. An important advantage of the modelling technique proposed is the ease and intuitiveness of their use in the context of temporal query interfaces implied by the graphical representation used.

In the paper *Supervised Learning for Database Integration through Weighted Means and OWA Operators* by Torra, Navarro-Arribas and Abril, the record linkage problem is considered, basically consisting in checking if two records refer to the same entity. In particular, a supervised approach for linking records with numerical attributes is considered. The soft approach proposed relies on the use of aggregation operators elaborated in the framework of soft computing to define the similarity of records. Those operators, in particular Yager's OWA operators, are parameterized and the search for their specific form is defined as an optimization problem solution.

The papers gathered in this special issue cover well the broad research area of applying fuzzy logic and soft computing in information management. We hope that the reader will find inspiration and motivation for further development of this interesting research field. We warmly invite all interested readers to visit the Web site of the EUSFLAT Working Group on Soft Computing in Database Management and Information Retrieval at `http://scdmir.ugent.be`. This special issue should be seen in part as an effect of the activities of this Working Group. In particular, we encourage the visitors to register and take an active part in the discussion of relevant topics using the forum available at the above mentioned Web site. We hope this will foster the research and discussion in our community. The topics of the papers collected in this special issue, and possibly the papers themselves, may trigger some new threads of the discussion on the forum.

As guest editors of this special issue, we would like to express our gratitude to the authors for their contributions and to the reviewers for their help. We are grateful to Professor Zbigniew Nahorski and Dr Jan W. Owsiński, the Editors, for their support and encouragement, and for their contribution to the preparation of this special issue.

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