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Preface

There has recently been a spurt of activity to integrate different computing paradigms such as fuzzy set theory, neural networks, genetic algorithms, and rough set theory, for generating more efficient hybrid systems that can be classified as soft computing methodologies. Here the individual tool acts synergistically, not competitively, for enhancing the application domain of each other. The purpose is to provide flexible information processing systems that can exploit the tolerance for imprecision, uncertainty, approximate reasoning, and partial truth in order to achieve tractability, robustness, low solution cost and close resemblance with human like decision making.

Neuro-fuzzy computing, capturing the merits of fuzzy set theory and artificial neural networks, constitutes one of the best-known visible hybridizations encompassed in soft computing. This integration promises to provide, to a great extent, more intelligent systems (in terms of parallelism, fault tolerance, adaptivity, and uncertainty management) to handle real life ambiguous recognition/decision-making problems.

Case based reasoning (CBR) may be defined as a model of reasoning that incorporates problem solving, understanding and learning, and integrates all of them with memory processes. It involves adapting old solutions to meet new demands, using old cases to explain new situations or to justify new solutions, and reasoning from precedents to interpret a new situation. Cases are nothing but some typical situations, already experienced by the system. A case may be defined as a contextualized piece of knowledge representing an experience that teaches a lesson fundamental to achieving the goals of the system. The system learns as a by-product of its reasoning activity. It becomes more efficient and more competent as a result of storing the experience of the system and referring to them in later reasoning. Systems based on this concept are finding widespread applications in problems like medical diagnosis and law interpretation where the knowledge available is incomplete and/or evidence is sparse.

Research integrating CBR with a soft computing framework for developing efficient methodologies and algorithms for various decision making applications has drawn the attention of scientists. Here soft computing tools become effective in tasks like extracting cases from ambiguous situations and handling uncertainties, adapting new cases, retrieving old cases, discarding faulty cases, finding similarity between cases, maintaining an optimal size of case bases, and in approximating reasoning for justifying a decision. Design of efficient knowledge-based networks in the said paradigm is also being attempted. At present, the results on these investigations, both theory and applications, are being available in different journals and conference proceedings mainly in the fields of computer science, information technology, engineering and mathematics.

The objective of this special issue is to present a cross sectional view of the present status of the said research demonstrating the role of soft computing tools, both individually and in combination, for performing different tasks of CBR with real life applications. Out of the twenty-three submissions, six papers were finally selected which address various methodologies, systems and applications. These are authored by experts from different active groups in the USA, Canada, France, India, Hong Kong, Spain and each of them is reviewed by two to three referees.

The issue begins with a title article written by two editors, Pal and Shiu. It explains the concepts and features of CBR along with the relevance of soft computing. This introductory paper will enable the readers to understand the remaining articles better.

A simultaneous optimization method of a CBR system using a genetic algorithm (GA) for financial forecasting is then explained by Kim. In this study, the GA simultaneously optimizes multiple factors, such as case indexing and representation, of the CBR system. Comparison of the GA approach with other conventional approaches for financial forecasting has also been carried out. The experimental result demonstrates the optimization ability of using GA for building CBR systems.

A model to forecast parameters of a complex and dynamic environment in an unsupervised way is developed in the next article by Fdez-Riverola and Corchado. The system employs a CBR model to wrap a growing cell structures network, a radial basis function network and a set of Sugeno fuzzy models to provide an accurate prediction. Each of these techniques is used at a different stage of the reasoning cycle of the CBR system to retrieve historical data, to adapt it to the present problem and to review the proposed solution. This system has been used to predict the red tides that appear in the costal waters of the north west of the Iberian Peninsula. The article demonstrates a successful hybridization of various soft computing tools for real application.

In the forth article, Park et al. describe an integrated learning framework of neural network and CBR. The main idea is that feature weights for CBR can be evaluated by neural networks. A new method, called memory-based neural reasoning, is proposed which guides the CBR by providing case-specific weights to the learning process. Four data sets have been used during testing. The result shows that neural network is a very useful tool in refining the CBR reasoning process.

Yager in his paper provides some tools, based on soft computing aggregation methods, useful in the two fundamental steps in CBR, namely, matching the target and the cases, and fusing the information provided by the relevant cases. For the first step, a method which uses a hierarchical representation of the target object is used to match the cases. For the second step, an induced ordered weighted averaging operator is used to carry out the aggregation. This approach is particularly useful in situations in which soft matching values are involved, i.e., they are drawn from an ordered linguistic scale.

In their paper Pal et al. describe a rough self-organizing map (RSOM) with fuzzy discretization of feature space. Discernibility reducts obtained using rough set theory are used to extract domain knowledge in an unsupervised framework. Reducts are then used to determine the initial weights of the network, which are further refined using competitive learning. Superiority of this network in terms of quality of clusters, learning time and representation of data is demonstrated quantitatively through experiments over the conventional SOM. The clusters obtained by RSOM are found to be more compact with prominent boundaries i.e., the resulting SOM is sparse with fewer separated winning nodes. Therefore the cases, as represented by the weight vectors of the winning nodes, constitute a compact case base.

Shiu et al. in the last article explain a fuzzy integral based approach to measure the competence of different CBR agents in a collaborative (distributed) CBR environment. They show that a carefully designed query dispatching strategy is important in this regard, and three such policies are developed and compared with some of the existing ones.

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