Soft Computing: Theory Innovations and Problem Solving Benefits Minitrack

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The term Soft Computing is used in reference to a family of several preexisting techniques (fuzzy logic, neuro-computing, probabilistic reasoning, evolutionary computation, etc.) able to work in a cooperative way, taking profit from the main advantages of each individual technique, in order to solve lots of complex real-world problems: those for which more conventional methods have not yielded low cost, analytic, and complete solutions. Earlier computational approaches could model and precisely analyze only relatively simple systems. However, more complex systems arising in biology, health, economy, digital world, and similar fields, often remained intractable to conventional mathematical and analytical methods. Therefore, the advances in soft computing techniques play an important role in analyzing and modeling more complex systems. Soft computing deals with imprecision, uncertainty, partial truth, and approximation to achieve computability, robustness and low solution cost, which can better deal with large-scale, fast and unstructured changes that will occur as part of the digital world.

The objective of this minitrack is to attract researchers with an interest in the research area described above. Specifically, not only contributions on theory innovations are welcome, but also those describing different problem-solving benefits by using soft computing-based methodologies, in particular, in the fields of digital world, digital coaching, digital health, digital economy, and cognitive computing. In such a way, we are interested in the contributions where the applied/defined methodologies used are either analysis- or systems-oriented. They may have an experimental or empirical focus. Innovative studies are favored, which combine innovative theoretical results with a careful empirical verification, or good empirical problem solving, planning or decision making with innovative theory building. A common denominator for all studies is the building and use of soft computing-based models.

The first paper of this minitrack, “Machine Learning for Software Engineering: A Bibliometric Analysis from 2015 to 2019”, provides a comprehensive overview of the research published for

the last five years on machine learning techniques applied to software engineering. To do so, the authors examines 1,312 records gathered from Elsevier Scopus. In particular, the authors identify the most productive authors and their collaboration networks, the countries and institutions leading research, the journals publishing most papers, and the most important research themes and the highest impacted articles for those themes.

The second paper of this minitrack, “UJA Human Activity Recognition Multi-Occupancy Dataset”, provides the SaMO-UJA dataset, which contains single and multi-occupancy activities collected in the UJAml Smart Lab of the University of Jaén (Spain). It includes a new generation of sensors as a source of information (acceleration of the inhabitant, intelligent floor for location, proximity and binary-sensors) to provide a new point of view on the multi-occupancy problem. In such a way, it is able to evaluate activity recognition systems, which try to improve the quality of human life, both from an individual and collective perspective.

The third paper of this minitrack, “A Distribution of Information Granularity to Deal with Inconsistency in Multi-Criteria and Heterogeneous Group Decision Making”, presents a new group decision making model dealing with inconsistency in decision processes carried out in multi-criteria and heterogeneous settings. To handle the inconsistency, a distribution of information granularity is injected into the fuzzy preference relations to allow a flexibility degree that is used to decrease the inconsistency associated with the fuzzy preference relations. Furthermore, and unlike the existing models based on a distribution of information granularity, this new model has the ability to support group decision making processes where more than one criterion is kept in mind to evaluate the alternatives and in which the heterogeneity is considered from two points of view: the preferences communicated by a decision maker have a distinct weight of importance for every criterion, and the criteria considered to evaluate the alternatives have different importance weights.

Finally, the fourth paper of this minitrack, “A Preliminary Study of a Citizen Participation System Based on Consensus for Decision-Making Processes”, presents a novel approach to a citizen participation system based on consensus reaching processes in the context of smart cities. As one of the characteristics of the smart cities is to involve citizens in the community’s decision making, the system proposed here allows government representatives to raise proposals to the citizen and allow them to give their opinions about the proposed problems. As a novelty, this system allows citizens to express their opinions by means of different preference structures to make more flexible it and to close the opinion expression domains to the knowledge degree of the users. In addition, it incorporates a consensus reaching process supporting to achieve a minimum level of agreement before making the decision. In such a way, the final decision will be better accepted by citizens. Functional and non-functional system requirements along with a few use cases are also presented according to the classical development of software engineering.