

Advances in computational intelligence

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In the present issue of Soft-Computing, it is a pleasure to present you a selection of 11 extended versions of selected papers from the eleventh edition of the International Work-Conference on Artificial Neural Networks (IWANN'2011) held in Torremolinos (Spain) during June 8–10, 2011. IWANN is a biennial conference that seeks to provide a discussion forum for scientists, engineers, educators and students about the latest ideas and realizations in the foundations, theory, models and applications of hybrid systems inspired on nature (neural networks, fuzzy logic and evolutionary systems) as well as in emerging areas related to the above items. As in previous editions of IWANN, it also aims to create a friendly environment that could lead to the establishment of scientific collaborations and exchanges among attendees.

Since the first edition in Granada (LNCS 540, 1991), the conference has evolved and matured. The list of topics in the successive call for papers has also evolved, resulting in the following list for the edition of IWANN'2011: (a) Mathematical and theoretical methods in computational intelligence; (b) Neuro-computational formulations;

(c) Learning and adaptation; (d) Emulation of cognitive functions; (e) Bio-inspired systems and neuro-engineering; (f) Hybrid Intelligent Systems; and (g) Applications.

At the end of the submission process of IWANN 2011, 202 papers were submitted under the above topics. After a careful peer review and evaluation process (each submission was reviewed by at least 2 and, on average, 2.4 program committee members or additional reviewers), 154 papers were accepted for oral or poster presentation, according to the recommendations of the reviewers' and the authors' preferences.

A number of authors were invited to submit an extended version of their conference paper to be considered for special publication in this issue of Soft-Computing. These authors were selected after the recommendation of the reviewers of the conference papers, the opinion of the chairs of the different sessions and the guest editors. At least three independent and anonymous experts again carefully reviewed the extended versions and the accepted papers, after this new review process, are presented in this issue.

The first paper, “A Multiobjective Approach based on Artificial Bee Colony for the Static Routing and Wavelength Assignment Problem” by Alvaro Rubio-Largo, Miguel A. Vega-Rodríguez, Juan A. Gómez-Pulido and Juan M. Sánchez-Pérez proposes a new multiobjective approach of the artificial bee colony algorithm (MO-ABC) for solving the Static Routing and Wavelength Assignment (RWA) problem in Wavelength Division Multiplexing networks, that due to its complexity (NP-hard problem), it is very suitable for being solved by using evolutionary computation. In order to analyze the effectiveness of the proposed methodology, several comparisons with diverse algorithms published in the literature were carried out. The authors have used two real-world network topologies: the Nippon Telegraph and Telephone

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network (NTT, Japan) and the Pan European Optical Network (COST239); and six datasets per topology, showing that the results obtained significantly improve those published in previous researches.

The paper “Evolutionary Optimization of Multi-parametric Kernel ε -SVMr for Forecasting Problems”, by J. Gascón-Moreno, E. G. Ortiz-García, S. Salcedo-Sanz, L. Carro-Calvo and A. Portilla-Figueras proposes a novel multi-parametric kernel Support Vector Regression algorithm (SVMr) optimized with an evolutionary technique, especially well-suited for forecasting problems. In this paper, SVMr hyper-parameters’ search space is reduced due to the definition of new bounds (lower and upper bounds) for the multi-parametric kernel considered. The authors have tested the proposed approach in different regression problems, including databases from well-known public repositories and a real application of temperature forecasting at Barcelona’s airport, obtaining good performance of the multi-parametric kernel approach against the standard SVMr with Grid Search, from the point of view of accuracy and computation time.

The paper “On the use of Evolutionary Feature Selection for Improving Fuzzy Rough Set Based Prototype Selection” by J. Derrac, N. Verbiest, S. García, C. Cornelis and F. Herrera presents a fuzzy rough set method for prototype selection, focused on optimizing the behavior of the k-nearest neighbors classifier. The hybridization with an evolutionary feature selection method is analyzed to further improve its performance, in terms of accuracy and computational complexity, obtaining a competent data reduction algorithm for the 1-nearest neighbor’s classifier. The proposed methodology offers the best results among all the related techniques selected for the comparison. This conclusion has been contrasted through nonparametric statistical tests.

In the paper entitled “A Differential Inclusion Approach for Modeling and Analysis of Dynamical Systems under Uncertainty. Application to Dengue Disease Transmission” by Jorge Barrios, Alain Piétrus, Gonzalo Joya, Aymée Marrero and Héctor de Arazoza, the application of differential inclusions to modeling nonlinear dynamical systems under uncertainty in parameters is analyzed, presenting a new algorithm for obtaining the reachable sets of a class of nonlinear differential inclusions. This algorithm is a practical version for a set-valued version of the Heun’s method that aims at handling the required memory in a controlled fashion during all iterations. As a practical application, the authors formulate a differential inclusion to model an epidemic outbreak of dengue fever under Cuban conditions, obtaining good performance of the proposed methodology.

The paper “A Pareto-based Multi-objective Evolutionary Algorithm for Automatic Rule Generation in Network

Intrusion Detection Systems” by J. Gómez, C. Gil, R. Baños, A. L. Márquez, F. G. Montoya and M. G. Montoya presents a novel Pareto-based multi-objective evolutionary algorithm to optimize the automatic rule generation of a signature-based in the problem of intrusion detection system. The proposed multi-objective approach has been evaluated using a benchmark dataset and real traffic of a Spanish university, showing its advantages.

The paper “Hebbian and Error-Correction Learning for Complex-Valued Neurons” by Igor Aizenberg analyzes some important aspects of Hebbian and error-correction learning rules for complex-valued neurons, showing how Hebbian learning can be correctly used for multi-valued neurons with a periodic activation function. In the experimental results, the author showed that the Hebbian weights are better starting weights for the error-correction learning algorithm, which converges faster starting from the Hebbian weights rather than from random ones.

The paper “Memetic Pareto differential evolutionary neural network used to solve an unbalanced liver transplantation problem” by M. Cruz-Ramírez, C. Hervás-Martínez, P. A. Gutiérrez, M. Pérez-Ortiz, J. Briceño and M. de la Mata presents a multi-objective evolutionary algorithm to obtain artificial neural network models to aid decision making in the field of donor-recipient matching when treating liver transplantation. Furthermore, various techniques to select individuals from the Pareto front are proposed and a combination of two pre-processing methods has been applied to the dataset to offset the existing imbalance.

In the paper by A. R. Badillo, J. J. Ruiz, C. Cotta and A. J. Fernández-Leiva, entitled “On User-Centric Memetic Algorithms”, a study on the deployment of interactive capabilities in a memetic algorithm, with application to two complex NP-hard problems has been presented. The results obtained by the authors indicate that these techniques are capable of taking advantage from good-quality human feedback that can drive/focus the algorithm toward specific regions of the search space. The use of some simple models of proactive behavior has also yielded encouraging results of the proposed methodology.

The paper “Using genetic algorithms to generate test sequences for complex timed systems” by A. Núñez, M. G. Merayo, R. M. Hierons and M. Núñez, presents a methodology that addresses the generation of test data for state-based specifications, from the point of view of an optimization problem. The authors defined the problem of finding transition sequences that are likely to be feasible, and to satisfy some temporal criteria as a search problem. They defined a computationally efficient fitness function that is used to guide the proposed genetic algorithm. The results were obtained from two different case studies: a communication protocol and the scientific application BIPS3D.

In the paper “Brain-Computer Interfacing: More than the sum of its parts”, by R. Scherer, J. Faller, D. Balderas, E. V. C. Friedrich, M. Pröll, B. Allison and G. Müller-Putz, the problem of Brain-Computer Interfacing (BCI) is analyzed presenting relevant research carried out in the lab, that addresses several important issues for BCIs based on the detection of transient changes in oscillatory electroencephalogram (EEG) activity. First, the authors present results on the long-term stability and robustness of detection of oscillatory EEG components modulated by distinct mental tasks. They subsequently present Restricted Boltzmann Machines (RBMs) as promising tools for the recognition of oscillatory EEG patterns and finally present the basic framework of the context-aware hybrid Graz-BCI that allows interacting with the massive multiplayer online role-playing a video game.

Finally, the last selected paper entitled “Human Activity Recognition based on a Sensor Weighting Hierarchical Classifier”, by O. Banos, M. Damas, H. Pomares, F. Rojas, B. Delgado-Marquez and O. Valenzuela, presents a fusion classification methodology which takes into account the

potential of the individual decisions yielded at both activity and sensor classification levels. The proposed methodology was analyzed on a wearable sensors-based system, reinforcing the idea that some parts of the body (i.e., sensors) may be especially informative for the recognition of different human activities, and therefore supporting the ranking of the decisions provided by each associated sensor decision entity. The results obtained by the proposed methodology outperform traditional multiclass models.

The Guest Editors would like to express their gratitude to all the contributing authors for their submissions and to the anonymous reviewers for their comments and useful suggestions in order to improve the quality of the papers. They would also like to express their gratitude to Antonio Di Nola, Editor-in-Chief of *Soft Computing*, *A Fusion of Foundations, Methodologies, and Applications*, for providing us with the opportunity to publish this set of selected papers in the present issue.

It is a pleasure for us to invite all authors and interested readers of this issue to future IWANN conferences, which will be announced at <http://www.iwann-conference.es>.