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Editorial

Combined special issue SOCO 2012–2013: Recent advancements in soft computing and its application in industrial and environmental problems

The seven papers included in this special issue represent a selection of extended contributions presented at the 7th and 8th International Conference on Soft Computing Models in Industrial and Environmental Applications, held in Ostrava, Czech Republic, September 5th–7th, 2012, and Salamanca, Spain, 11th–13th September 2013, both editions organized by the BISITE and the GICAP research groups.

This special issue is aimed at practitioners, researchers and postgraduate students who are engaged in developing and applying advanced intelligent systems principles to solving real-world problems. The papers are organized as follows.

In the first contribution, Moretti et al. show a hybrid modeling approach which combines Artificial Neural Networks and a simple statistical approach in order to provide a one hour forecast of urban traffic flow rates. Experimentation has been carried out on three different classes of real streets and results show that the proposed approach outperforms the best of the methods it puts together.

In this paper, by Troncoso et al., a kernel for time-series data is introduced so that it can be used for any data-mining task that relies on a similarity or distance metric. The main idea of this kernel is that it should recognize as highly similar time-series that are essentially the same but may be slightly perturbed from each other. Namely, this kernel tries to focus on the shape of the time-series and ignores small perturbations such as misalignments or shifts.

First, a recursive formulation of the kernel directly based on its definition is proposed. Then it is shown how to efficiently compute the kernel using an equivalent matrix-based formulation. To validate the proposed kernel three experiments have been carried out. As an initial step, several synthetic datasets have been generated from UCR time-series repository and the KDD challenge of 2007 with the purpose of validating the kernel-derived distance over shifted time-series. Also, the kernel has been applied to the original UCR time-series to analyze its potential in time-series classification in conjunction with Support Vector Machines.

Finally, two real-world applications related to ozone concentration in atmosphere and electricity demand have been considered.

This contribution, by de Moura Oliveira et al., proposes the gravitational search algorithm to design PID control structures. The controller design is performed considering the objectives of setpoint tracking and disturbance rejection, minimizing the integral of the absolute error criterion. A two-degrees-of-freedom control configuration with a feedforward pre-filter inserted outside the PID feedback loop is used to improve system performance for both design criteria. The pre-filter used is a Posicast controller designed simultaneously with a PID controller. Finally the simulation results are presented which show the proposed technique merit.

This paper, by García-Gutiérrez et al., presents a comparison between the classic MLR (Multiple Linear Regression)-based methodology and regression techniques in machine learning (neural networks, support vector machines, nearest neighbor, ensembles such as random forests) with special emphasis on regression trees. The selected techniques are applied to real Light Detection and Ranging (LiDAR) data from two areas in the province of Lugo (Galizia, Spain). The results confirm that classic MLR is outperformed by machine learning techniques and concretely, our experiments suggest that Support Vector Regression with Gaussian kernels statistically outperforms the rest of techniques.

Next contribution, by Marques et al., proposes a specific architecture, reporting results on a synthetic database build according to Social and Smart (SandS) project current designs. Database synthesis for system tuning and validation is a critical issue, hence the paper details the considerations guiding its design and generation, as well as the validation procedure ensuring the ecological validity of the innovation process simulation. The architecture is composed of a Support Vector Regression (SVR) module for user satisfaction modeling, and an Evolution Strategy (ES) achieving recipe innovation. The paper reports some computational experiments that may guide the real life implementation. The reported results are methodologically sound as far as they are independent of the generation process.

Next paper, by Otero and Sánchez, solves the problem in the stereo vision for 3D data, which is affected by constraints in the position of the cameras, the quality of the optical elements and the numerical algorithms for calibration and matching. Also, there is not a wide agreement on the best procedure for bounding the 3D errors within an uncertainty volume. In this work, this problem is solved by implementing the whole set of computations, including calibration and triangulation, with interval data.

This is in contrast with previous works that rely on Direct Linear Transform (DLT) as a camera model. To keep better with real lens aberrations, a local iterative modification is proposed that provides an on-demand set of calibration parameters for each 3D point, comprising those nearest in 3D space. In this way, the estimated camera parameters are closely related to camera aberrations at the lens area through which that 3D point is imaged. To further reduce the triangulation uncertainty volume, a Soft Computing approach is

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proposed that represents each 3D point uncertainty as a cloud of crisp points compatible with interval-valued calibration data. Real data from previous works in related research areas is used to judge whether the new approach improves the precision and accuracy of other crisp and interval-valued estimations without degrading precision, and it is concluded that the new technique is able to significantly improve the uncertainty volumes.

In the final paper, by González et al., an Information Correlation Coecient (ICC) analysis was carried out followed by a wrapper Feature Selection (FS) method on the reduced input space. Additionally, a novel HAR method is proposed for this specific problem of stroke early diagnosing, comprising an adaptation of the well-known Genetic Fuzzy Finite State Machine (GFFSM) method. The main contributions of this study are the optimization of the sample rate, selection of the best feature subset, and learning of a suitable HAR method based on GFFSM to be applied to the HAR problem.

The guest editors wish to thank Professor Tom Heskes, (Editor-in-Chief of Neurocomputing) for providing the opportunity to edit this special issue. We would also like to thank the referees who have critically evaluated the papers within the short time. Finally, we hope the reader will share our joy and find this special issue very useful.

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