Editorial: Special issue SOCO 2020

The thirteen papers included in this special issue represent a selection of extended contributions presented at the 15th International Conference on Soft Computing Models in Industrial and Environmental Applications, SOCO, 2020 held in Gijón, Spain, 11–13 September 2020, and organized by the BISITE group and the University of Oviedo.

SOCO 2020 international conference represents a collection or set of computational techniques in machine learning, computer science and some engineering disciplines which investigate, simulate, and analyse very complex issues and phenomena. SOCO Series of Conferences is mainly focused on industrial applications and provides an interesting opportunity to present and discuss the latest theoretical advances and real-world applications in this multidisciplinary research field.

The contributions are organized as follows.

In the first contribution, Ilin *et al.* propose a hybrid algorithm, called GA-TCTIA-LBSA to address traveling salesman problem (TSP). In this hybrid algorithm, a genetic algorithm (GA), tour construction and tour improvement algorithms (TCTIAs) and a list-based simulated annealing (LBSA) algorithm are used. The TCTIAs are introduced to generate a first population, and after that, a search is continued with the GA. The problem of premature convergence of the GA to local optimum is tackled by a method called social disaster technique. Afterwards, the LBSA is applied to generate a new population based on one of two proposed operators called packing and judgment day. The proposed algorithm is implemented in the MATLAB environment, and its two variants, called GATCTIA-LBSA packing and GA-TCTIA-LBSA judgment day, are tested on symmetric and asymmetric instances from TSPLIB. The overall results demonstrate that the proposed GA-TCTIA-LBSAs offer promising results, particularly for small-sized instances.

The next contribution by Škrabánek *et al.* presents a pocket-sized densely connected convolutional network (DenseNet) directed to classification of size-normalized colour images according to varieties of grapes captured in those images. The authors compare the DenseNet with three established small-sized networks in terms of performance, inference time and model size. A data augmentation used in training the networks is proposed. The networks on in-field images are trained and evaluated. The trained networks distinguish between seven grapevine varieties and background, where four and three varieties are of red and green grapes, respectively. Compared to the established networks, the DenseNet is characterized by near state-of-the-art performance, short inference time and minimal model size. All these aspects qualify the network for real-time, mobile and edge-computing applications.

In the third contribution, which is by Teso-Fz-Betoño *et al.*, an artificial neural network (ANN) is developed to estimate the relative rotation and translation of the autonomous mobile robot (AMR). The ANN will work as an iterative closed point, which is commonly used with the singular value decomposition algorithm. This development provides better resolution for a relative positioning technique that is essential for the AMR localization. The ANN requires a specific architecture, although in the current work a neural architecture search is adapted to select the best ANN for estimating the relative motion. Finally, these ANNs are compared with conventional algorithms to check the good performance of adopting an intelligent method for relative positioning estimation.

The subsequent contribution, by Porras *et al.*, deals with the prediction of the energy generated in a small wind turbine placed in a bioclimatic house located on the north west region of Spain. This includes an analysis of the characteristics of the atmospheric variables registered during the turbine operation for a period of 1 year and an exploratory examination of a range of regression techniques in order to assess the suitability of using the registered information to predict the installation's power

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generation levels on the short term. The study detailed in this work proves that this objective is an attainable one with a good degree of accuracy.

In the following paper, by Zamora-Hernandez *et al.*, a novel structured language aimed to describe the required actions to manufacture a product in industrial assembly environments is presented. The main contribution is to provide a formal language to feed automatic systems that can verify through visual control whether the actions performed by the operator are carried out following the standard described by this language. In general, the use of this formal language will allow to minimize the negative impact of errors during assembly and to reduce waste in many forms in the industry.

The main aim of the sixth research paper, by Lara-Benítez *et al.*, is to assess the performance of different types of deep learning architectures for data streaming classification using asynchronous dual-pipeline deep learning framework. The authors evaluate models such as multi-layer perceptrons, recurrent, convolutional and temporal convolutional neural networks over several time series data sets that are simulated as streams at different speeds. In addition, they evaluate how the different architectures react to concept drifts typically found in evolving data streams. The obtained results indicate that convolutional architectures not only achieve a higher performance in terms of accuracy and efficiency but also are the most sensitive to concept drifts.

The next study, by Fister *et al.*, is focused on mechanisms to avoid this undesired phenomenon by introducing parallel self-adapted differential evolution that decomposes a monolithic population into more variable-sized sub-populations and combining this with the characteristics of evolutionary multi-agent systems into a hybrid algorithm. The proposed hybrid algorithm operates with individuals having some characteristics of agents, for example, they act autonomously by selecting actions, with which they affect the state of the environment. Additionally, this algorithm incorporates two additional mechanisms, aging and adaptive population growth, which help the individuals by decision making. The proposed parallel differential evolution was applied to the CEC'18 benchmark function suite, while the produced results were compared with some traditional stochastic nature-inspired population-based and state-of-the-art algorithms.

The following work, by Moscoso-López *et al.*, aims to forecast the Air Quality Index (AQI) in Algeciras (Spain) eight hours in advance. The AQI is calculated indirectly through the predicted concentrations of five pollutants (O3, NO2, CO, SO2 and PM10) to achieve this goal. Artificial neural networks (ANNs), sequence-to-sequence long short-term memory networks (LSTMs) and a newly proposed method combing a rolling window with the latter ($LSTM_{NA}$) are used as the forecasting techniques. Besides, two input approaches are evaluated: using only the data from the own time series of the pollutant in the first case or adding exogenous variables in the second one. Results show how the proposed exogenous approach increases the performance of the prediction models. Besides, the newly proposed method $LSTM_{NA}$ provides the best performances in most of the cases evaluated.

The ninth paper, by Marek *et al.*, studies the convergence properties of nonlinear regression in 17 models designed for growth modeling. The authors' studies are performed mainly concerning the quality of the obtained estimates, which are closely related to the intrinsic curvature of the model according to Bates and Watts. The primary goal is to design a methodology for selecting a growth model. The authors demonstrate fruitfulness of their methodology on the weight measurements of 10 calves younger than 25 months of age from cowsheds in the village Záluží in the Czech Republic.

The next paper, by Aguilar-Moreno and Graña, introduces a hybrid approach combining two well-established registration techniques, the iterative closest point algorithm and the normal distributions transform, which achieves good performance on the simultaneous localization and mapping task over a dataset based on affordable light detection and ranging (LiDAR) sensors.

The main goal of 11th paper, by Avram *et al.*, is to study the variations of the predictions in case of different levels of noise and missing context data in practical scenarios for predicting soil moisture. The research has been performed on two locations from the Transylvanian Plain, Romania, and two locations from Canada. The values predicted for the soil moisture were compared in mixed scenarios that vary the quantity of noise and missing context data. The studied behavior was performed using deep learning, decision tree and gradient-boosted tree machine learning algorithms. It has been shown that, when using the air temperature as context for predicting soil moisture, variations of noise and missing data do not influence the results proportionally with the levels of noise and missing data applied. Moreover, gradient-boosted tree algorithm proves to be the best algorithm from the ones studied, to be considered when predicting soil moisture with the CADM approach.

In the following paper by García-Gonzalo *et al.*, the forecasting of the spot prices of copper from the New York Commodities Exchange is studied using a machine learning method, support vector regression coupled with different model schemas (recursive, direct and hybrid multi-step). Using these techniques, three different time series analyses are built, and their performance compared. The numerical results show that the hybrid direct-recursive obtains the best results.

In the final contribution, by Zayas-Gato *et al.*, a hybrid model based on intelligent techniques is developed to predict the active power generated in a bioclimatic house by a low power wind turbine. Contrary to others researches that predict the generated power taking into account the speed and the direction of the wind, the model developed in this paper only uses the speed of the wind, measured mainly in a weather station from the government meteorological agency (MeteoGalicia). The wind speed is measured at different heights, against the usual measurements in other researches, that uses the wind speed and the direction measured in a weather station on the wind turbine nacelle. The main objective is to allow the building management system to optimize the uses of energy taking into account the predicted amount of energy that will be produced and the energy consumed in the house.

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