Editorial

Recent advancements in hybrid artificial intelligence systems and its application to real-world problems

The eleven papers included in this special issue represent a selection of extended contributions presented at the 8th International Conference on Hybrid Artificial Intelligent Systems, HAIS 2013 held in Salamanca, Spain, September 11th–13th, 2013, and organized by the BISITE and the GICAP research groups.

The International Conference on Hybrid Artificial Intelligence Systems (HAIS 2013) has become a unique, established and broad interdisciplinary forum for researchers and practitioners who are involved in developing and applying symbolic and sub-symbolic techniques aimed at the construction of highly robust and reliable problem-solving techniques to present the most relevant achievements in this field.

The papers are organized as follows.

In the first contribution, Barreto and Barros, introduce a simple and efficient extension of the Extreme Learning Machine (ELM) network. The proposed variant of the ELM, henceforth named Robust ELM (RELM), is designed using M-estimators to compute the output weights instead of the standard ordinary least squares (OLS) method. They evaluate the performance of the RELM using batch and recursive learning rules, and also introduce a model selection strategy based on Particle Swarm Optimization (PSO) to find an optimal architecture for datasets contaminated with non-Gaussian noise and outliers. By means of comprehensive computer simulations using synthetic and real-world data sets, they show that the proposed robust ELM classifiers consistently outperform the original version.

This paper, by Garcia et al., presents a meta-learning recommendation system able to predict the expected performance of noise filters in noisy data identification tasks. For such, a meta-base is created; containing meta-features extracted from several corrupted data sets along with the performance of some noise filters when applied to these data sets. Next, regression models are induced from this meta-base to predict the expected performance of the investigated filters in the identification of noisy data. The experimental results show that meta-learning can provide a good recommendation of the most promising filters to be applied to new classification data sets.

This contribution, by Sáez et al., proposes a new measure to establish the expected behavior of a classifier with noisy data trying to minimize the problems of considering performance and robustness individually: the Equalized Loss of Accuracy (ELA). The advantages of ELA against other robustness metrics are studied and all of them are also compared. Both, the analysis of the distinct measures and the empirical results, show that ELA is able to overcome the

aforementioned problems that the rest of the robustness metrics may produce, having a better behavior when comparing different classifiers over the same data set.

In this paper Martínez-Ballesteros et al., present a study of well-known quality measures with regard to the weights of the measures that appear in a fitness function. In particular, the fitness function of an existing evolutionary algorithm called QARGA has been considered with the purpose of suggesting the values that should be assigned to the weights, depending on the set of measures to be optimized. As initial step, several experiments have been carried out from 35 public datasets in order to show how the weights for confidence, support, amplitude and number of attributes measures included in the fitness function have an influence on different quality measures according to several minimum support thresholds. Second, statistical tests have been conducted for evaluating when the differences in measures of the rules obtained by QARGA are significative, and thus, to provide the best weights to be considered depending of the group of measures to be optimized. Finally, the results obtained when using the recommended weights for two real world applications related to ozone and earthquakes are reported.

In this contribution, Gala et al., apply Support Vector Regression (SVR), Gradient Boosted Regression (GBR), Random Forest Regression (RFR) as well as a hybrid method to combine them to downscale and improve 3-h accumulated radiation forecasts provided by Numerical Weather Prediction (NWP) systems for seven locations in Spain. They use either direct 3-h aggregated radiation forecasts or they build first global accumulated daily predictions and disaggregate them into 3-h values, with both approaches outperforming the base NWP forecasts. They also show how to disaggregate the 3-h forecasts into hourly values using interpolation based in clear sky (CS) theoretical and experimental radiation models, with the disaggregated forecasts again being better than the base NWP ones and where empirical CS interpolation yields the best results. Besides providing ample background on a problem that others many opportunities to the Machine Learning (ML) community, their study shows that ML methods or, more generally, hybrid artificial intelligence systems are quite effective and, hence, relevant for solar radiation prediction.

Next paper, by Palacios et al., suggest that a new extension to vague datasets of the classification algorithm Fuzzy Unordered Rule Induction Algorithm (FURIA) has advantages over other approaches in both the computational effort during the learning stage and the linguistic quality of the induced classification rules. The new approach is benchmarked with different test problems and compared to other artificial intelligence tools for dyslexia diagnosis in the literature.

The paper by Nuñez-Gonzalez et al.[1] discusses trust prediction in Social Networks, proposing and giving validation results on two approaches, (1) a naïve selection of reputation features and (2) a probabilistic model of these features. They report experimental results on trust prediction over publicly available Epinions and Wikipedia adminship voting databases achieving encouraging results.

This paper, by Moreno et al., proposes a complete framework to deal jointly with some of the most important: scalability, sparsity, first rater and cold start problems. Although the framework is addressed to movies' recommendation and validated in this context it can be easily extended to other domains. It manages different predictive models for making recommendations depending on specific situations. These models are induced by data mining algorithms using as input data both product and user attributes structured according to a particular domain ontology.

The present study, by del Val et al., present a set of mechanisms that consider self-organization actions and incentives to adapt the structure of the society to the service demand and to promote a cooperative behavior among agents in open societies.

The next contribution, by Alfonso-Cendón et al., presents architectural patterns to integrate agents on top of an existing context-aware architecture. This allows an additional abstraction layer on top of context-aware systems, where knowledge management is performed by agents. This approach improves the flexibility of Ambient Intelligence systems and facilitates their design. A case study on guiding users in buildings to their meetings illustrates this approach.

In the final paper, Sung-Bae proposes a location recognition and prediction system in smartphone environment, which consists of recognizing location and predicting destination for users. It recognizes user location by combining k-nearest neighbor and decision trees, and predicts user destination using hidden Markov models. To show the usefulness of the proposed system, it has been conducted thorough experiments on real everyday life datasets collected from ten persons for six months, and confirmed that the proposed system yielded above 90% of average location prediction accuracy.

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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[1] This paper was intended for this special issue; however it has accidentally been published as a regular paper. Reference details:
J. David Nuñez-Gonzalez, Manuel Graña and Bruno Apolloni, "Reputation features for trust prediction in social networks". Neurocomputing, 2015, Vol. 166, pp. 1–7

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