Neurocomputing 163 (2015) 1–2

Contents lists available at ScienceDirect

Neurocomputing

journal homepage: www.elsevier.com/locate/neucom

Editorial

Special issue HAIS 2012: Recent advancements in hybrid artificial intelligence systems and its application to real-world problems

The seven papers included in this special issue represent a selection of extended contributions presented at the 7th International Conference on Hybrid Artificial Intelligent Systems, HAIS 2012 held in Salamanca, Spain, March 28–30, 2012, and organized by the BISITE and the GICAP research groups.

The International Conference on Hybrid Artificial Intelligence Systems (HAIS 2012) 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, Charte et al. analyze the imbalanced learning task in the multilabel scenario, aiming to accomplish two different goals. The first one is to present specialized measures directed to assess the imbalance level in multilabel datasets (MLDs). Using these measures are able to conclude which MLDs are imbalanced, and therefore would need an appropriate treatment. The second objective is to propose several algorithms designed to reduce the imbalance in MLDs in a classifier-independent way, by means of resampling techniques. Two different approaches to divide the instances in minority and majority groups are studied. One of them considers each label combination as class identifier, whereas the other one performs an individual evaluation of each label imbalance level. A random undersampling and a random oversampling algorithm is proposed for each approach, giving as result four different algorithms. All of them are experimentally tested and their effectiveness is statistically evaluated. From the results obtained, a set of guidelines directed to show when these methods should be applied is also provided.

The paper by García-Gutiérrez et al. shows a novel contextual classifier based on a Support Vector Machine (SVM) and an Evolutionary Majority Voting (SVM-EMV) to develop thematic maps from LiDAR and imagery data. Subsequently, the performance of SVMEMV is compared to that achieved by a pixel-based SVM as well as to a contextual classified based on SMV and MRF. The classifiers were tested over three different areas of Spain with well-differentiated environmental characteristics. Results show that SVM-EMV statistically outperforms the rest (SVM, SVM-MRF) for the three datasets obtaining a 77%, 91% and 92% of global accuracy for Trabada, Huelva and Alto Tajo, respectively.

In their contribution, Fernández et al. give a self-contained review of Diffusion Maps (DM) and discuss two methods to compute the DM embedding coordinates to new out-of-sample data. Then, they apply them on two meteorological data problems that involve respectively time and spatial compression of numerical weather forecasts and show how DM is capable to, first, greatly reduce the initial dimension while still capturing relevant information in the original data and, also, how the sample-derived DM embedding coordinates can be extended to new patterns.

In the paper by Seung-Hyun et al. the authors propose a modular Bayesian network system to extract context information by cooperative inference of multiple modules, which guarantees reliable inference compared to a monolithic Bayesian network without losing its strength like the easy management of knowledge and scalability. The proposed method preserves inter-module dependencies by virtual linking and has lower computational complexity in complicated environments. The inter-module *d*-separation controls local information to be delivered only to relevant modules. They verify that the proposed modular Bayesian network is enough to keep inter-modular causalities in a time-saving manner. This paper shows a possibility that a contextaware system would be easily constructed by mashing up Bayesian network fractions independently designed or leaned in different domains.

The present study by de Lope et al. focuses on the general problem of coordinating multiple robots, in particular, addresses the problem of the distribution of heterogeneous multitask in a robust and efficient manner. The main interest in these systems is to understand how from simple rules inspired by the division of labor in social insects, a group of robots can perform tasks in an organized and coordinated way.

They take into account a specifically distributed or decentralized approach, and under this approach they speak of multi-task selection instead of multi-task assignment. In this regard, they have established an experimental scenario to solve the corresponding multi-task distribution problem and they propose a solution using different approaches by applying the response threshold models inspired by division of labor in social insects, the application of the reinforcement learning algorithm based on learning automata theory and ant colony optimization-based deterministic algorithms. They have evaluated the robustness of the algorithms, perturbing the number of pending loads to simulate the robot's error in estimating the real number of pending tasks and also the dynamic generation of loads through time. The paper ends with a critical discussion of experimental results.

In their contribution, Griol et al. propose a framework to model the user's intention during the dialog and adapt the dialog model dynamically to the user needs and preferences, thus developing more efficient, adapted, and usable spoken dialog systems. Their framework employs statistical models based on neural networks that take into account the history of the dialog up to the current dialog state in order to predict the user's intention and the next

http://dx.doi.org/10.1016/j.neucom.2015.02.077

system response. They describe their proposal and detail its application in the Let's Go spoken dialog system.

The final paper, by Agüero et al. proposes two abstractions that provide the developer with a new way of modeling reactive agent capabilities in dynamic environments. The first abstraction focuses on how to process the environmental stimuli as events; the second abstraction specifies how to launch tasks in response to events, which is an approach that is based on event–condition–action rules. Moreover, they present an example that is based on a call center Case-Based–Reasoning-based application, and a performance evaluation of the proposal is also provided.

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.

Acknowledgments

This research is partially supported by the "Programa Universidade de Sao Paulo (USP)/Universidad de Salamanca (USAL) para la Promoción de la Cooperacción Bilateral en Materia de Investigación" under the project RACE.

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