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Guest-editorial

Feature and algorithm selection with Hybrid Intelligent Techniques

Teresa B. Ludermir*, Ricardo B.C. Prudêncio and Cleber Zanchettin
Federal University of Pernambuco, Recife, Brazil

There are many ad hoc feature and algorithm selection techniques, but there also are more methodical approaches. From a theoretical perspective, it can be shown that optimal feature and algorithm selection require an exhaustive search of all possible subsets of features/algorithms. If a large number of features/algorithms are available, this is impractical. In machine learning, the search is often done for a satisfactory set of features/algorithm instead of an optimal set. Feature and algorithm selection have become the focus of some research in hybrid intelligent systems, for which many algorithms and datasets, with tens or hundreds of thousands of variables, are available. Hybrid Intelligent Systems gather researchers who see the need for synergy between various intelligent techniques in solving real problems.

In order to minimize the above difficulty, machine-learning algorithms may be used to automatically acquire knowledge for algorithm selection, leading to a reduced need for experts and a potential improvement of performance. That is, the algorithm selection problem can be treated via meta-learning approaches. Several meta-learning approaches have been developed for the problem of algorithm selection. In the first article of this special issue, Kanda et al. select algorithms to solve traveling salesman problem using meta-learning. Meta-learning provides a suitable technique for the selection of the most promising optimization algorithm for a specific instance of the traveling salesman problem. Several experiments illustrate the performance of the meta-learning based approach proposed.

*Corresponding author. E-mail: tbl@cin.ufpe.br.

There are many potential benefits of variable and feature selection: facilitating data visualization and data understanding, reducing the measurement and storage requirements, reducing training and utilization times, defying the curse of dimensionality to improve prediction performance. Various Hybrid Intelligent Systems have been developed for variable selection, which improves the prediction performance of the predictors, provides faster and more cost-effective predictors, and a better understanding of the underlying process that generated the data. Time-series forecasting has been used in several real world problems in order to eliminate losses resultant from uncertainty, as well as to support the decision-making process. In the second article of this special issue, Valença et al. select features to improve time series forecasting using hybrid intelligent techniques. The authors propose three hybrid systems using harmony search, neural network and temporal memory search with application to time series forecasting. The systems proposed selects the input variables of the time series. The performance of the techniques is investigated through an empirical evaluation on twenty real-world time series.

Decision making process is generally based on checking and combination of individual opinions from several experts through some thought process to reach a final decision that is presumably the most informed one. This strategy, more widely known as Ensemble Based Systems, is receiving increasing attention in recent research due to being a powerful tool, especially when facing complex problems. The design of Ensemble Based System involves choosing the parameters as the model, the number of predictors, the combination

schema and the learning algorithm. Recently, there has been an increase in the use of hybrid intelligent techniques for the optimization of problem solving, including the automated design of ensemble. In the third paper of this special issue, two optimization techniques select attributes for individual classifiers of the ensemble system. Canuto et al. compare the performance of single classification methods and classifier ensembles in both original and transformed biometric space. The performance of the systems is investigated on some fingerprint data set and modified version of non-invertible transformation.

Evolution Strategies are heuristic, stochastic methods based on populations made up of individuals with specific behavior similar to biological ones; they are robust and efficient at exploring an entire solution space of optimization problems. Evolution Strategies are normally used with the purpose of finding a set of classifiers as diversified as possible, and for adjusting some decision combination schema during the search process. The evaluation function, the representation of the solution, the dimension of the search space, and/or the constraints of the problem may change during the process, and new approaches using Hybrid Intelligent Techniques are to be developed to enhance the performance of the Evolution Strategies. In the last paper of this special issue, evolution strategy with self-adaptation of the mutation distribution is proposed for dynamic optimization problems. In this paper, Tinós and Yang investigated the use of q-Gaussian mutation in evolution strategy applied to dynamic optimization problems. Two sets of experiments are carried out to evaluate the performance of the q-Gaussian mutation. In the first set of experiments, the Moving Peaks generator is employed to create dynamic optimization problems. In the second set of experiments, evolutionary robots are simulated in dynamic environments.

This special issue comprising of four papers is focused on hybrid intelligent approaches and their applications. The papers were selected among the contributions to the XI Brazilian Symposium on Neural Networks (XI SBRN) dealing with Hybrid Intelligent Systems techniques. Papers were selected on the basis of fundamental ideas/concepts rather than the thoroughness of techniques deployed. The XI SBRN took place in São Bernardo do Campo, Brazil, from October 23 to October 28 2010. The Symposium covered topics related to Computational Intelligence, including Artificial Neural Networks, Evolutionary Computation, Fuzzy Systems and other Computational Intelligence approaches. XI SBRN received papers on theoretical and practical aspects of Computational Intelligence. SBRN is a known international conference, an international program committee composed by well known researchers from all over the world, and proceedings published by the IEEE Computer Society.

The XI SBRN received submissions from different countries and less than 50% were accepted for oral presentation. The authors of the papers dealing with Hybrid Intelligent Systems with the best reviews were invited to submit an extended and updated version for this special issue. The selection process emphasized three main aspects: originality, relevance and technical contribution. The new versions were submitted to a rigorous peer review process conducted by international reviewers. Only the papers recommended by the reviewers were accepted for this special issue. At the end of this new review process, 4 papers were selected. We believe that this issue presents a set of very high quality papers. As a result, this edition will provide the readers a rich material of current research on Hybrid Intelligent System and related issues.

We would like to thank all the authors for their effort to submit high quality papers and the referees for their meticulous and useful reviews with relevant comments and suggestions that help improve the quality of this special issue. We would also like to thank the IJHIS Editors-in-Chief, Ajith Abraham, Lakhmi C. Jain and Vasile Palade, and the Journal Editorial Board for this opportunity and for efficiently handling the publication of this special issue.

Teresa B. Ludermir
Ricardo B. C. Prudêncio
Cleber Zanchettin