CrossMark

Preface

Aurora Pozo[1] · Heloisa de Arruda Camargo[2]

Over the course of the last 20 years, research in intelligent techniques has seen a substantial increase in interest, attracting original contributions from various disciplines. These techniques support a wide range of applications, from medical decision making, bioinformatics, web-usage mining, to text and image recognition, and others.

This special issue includes papers selected from the 5th Brazilian Conference on Intelligent Systems (BRACIS 2016), which took place in Recife, Brazil, from October 9th to 12th, 2016. BRACIS has been originated from the combination of the two most important scientific events of Artificial Intelligence and Computational Intelligence in Brazil: the Brazilian Symposium on Artificial Intelligence—SBIA (21 editions), and the Brazilian Symposium on Neural Networks—SBRN (12 editions).

BRACIS is the most important event in Brazil for researchers in the field of Artificial and Computational intelligence (AI/CI). The domain of the conference includes traditional and original topics of both areas and it aims to promote theories and novel applications dealing with the use and analysis of AI/CI techniques in various related fields. BRACIS covered topics related to Computational Intelligence, including Artificial Neural Networks, Artificial Intelligence, Evolutionary Computation, Fuzzy Systems and other Computational Intelligence approaches. Further, BRACIS aims for the promotion of international level research by exchanging scientific ideas among researchers, practitioners, scientists and engineers.

BRACIS 2016 received 176 submissions and after a rigorous reviewing process, 86 papers were accepted to the conference and included in the proceedings. All papers were reviewed by, at least, three independent specialized reviewers. Selected papers 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 papers selected from BRACIS 2016 are listed in the references. The new versions were submitted to a rigorous peer review process. 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 Computation Intelligence and related issues.

Paper 1, titled *A Pattern-Driven Solution for Designing Multi-Objective Evolutionary Algorithms*, addresses the use of Design Patterns (DPs) to improve the design of Multi-Objective Evolutionary Algorithms (MOEAs), which have been widely studied in the literature. With the emergence of several frameworks and techniques to implement MOEAs, the reusability, scalability and maintainability became fundamental concerns in the development of such algorithms. As stated by the authors, DPs are reusable solutions for common design problems, which can be applied to almost any context. Despite their advantages to decreasing coupling, increasing flexibility, and allowing an easier design extension, DPs have been underexplored for MOEA design. In order to contribute to this research topic, the authors of this paper propose a pattern driven solution for the design of MOEAs. The MOEA designed with their solution is compared to another MOEA designed without it. Obtained results show that the use of this DP driven solution allows the reuse of MOEA components, without decreasing the quality, in terms of hyper volume. This means that the developer can extend the algorithms to include other components using only object-oriented mechanisms in an easier way, while maintaining the expected results. To this end, the use of Design Patterns (DPs) can benefit, ease and improve the design of MOEAs.

Paper 2, *A novel context-free grammar for the generation of PSO algorithms,* describes a research on automatically generating and improving algorithms by means of genetic programming. The study proposes a novel context-free grammar for Grammar-Guided Genetic Programming (GGGP) algorithms to guide the creation of Particle Swarm Optimizers (PSO). Four aspects of the PSO algorithm that

✉ Aurora Pozo
  auroratrinidad@gmail.com

  Heloisa de Arruda Camargo
  heloisa@dc.ufscar.br

[1] UFPR, Curitiba, Brazil

[2] UFSCar, São Carlos, Brazil

strongly impact on its search ability: swarm initialization, neighborhood topology, velocity update equation and mutation operator. Experiments were made with 32 unconstrained continuous optimization problems. In the experiments, the designs produced using the novel grammar were compared with the designs generated by GGGP with other grammars defined in the literature. The PSO algorithms produced by adopting the novel grammar achieved better results than those generated by the counterparts. Further, the results achieved by the algorithms produced through the novel grammar were compared with results achieved by the competition algorithms considering the same set of 32 optimization problems. The results have shown that the algorithms produced from the grammar achieved competitive results.

Paper 3, Population-based Bio-Inspired Algorithms for Cluster Ensembles Optimization, describes a research on cluster ensembles. The combination of different clustering algorithms (cluster ensembles) aims to combine multiple partitions generated by different clustering algorithms into a single clustering solution (consensus partition). Recently, several approaches have been proposed in the literature to optimize or to improve the solutions found by the cluster ensembles. As a contribution to this important subject, this paper presents an investigation of five bio-inspired techniques in the optimization of cluster ensembles (Genetic Algorithms, Particle Swarm Optimization, Ant Colony Optimization, Coral Reefs Optimization and Bee Colony Optimization). In the investigation, unlike most of the existing work, an evaluation methodology for assessing three important aspects of cluster ensembles is presented, assessing robustness, novelty and stability of the consensus partition delivered by different optimization algorithms. The feasibility of the analyzed techniques is evaluated through an empirical analysis using 20 different problems and applying two different indexes to examine its efficiency and feasibility. The findings indicated that the best population-based optimization method was PSO, followed by CRO, AG, BCO and ACO, for providing robust and stable consensus partitions.

In paper 4, *A proposal for tuning the alpha parameter in CC-integrals for application in fuzzy rule-based classification systems*, the authors investigated the concept of an extended Choquet integral generalized by a copula, called CC-integral. In particular, they adopted a CC-integral that uses a copula defined by a parameter, which behavior was tested in a previous work using different fixed values. In this contribution, an extension of this method has been proposed, by learning the best value for the parameter using a genetic algorithm. This new proposal is applied in the fuzzy reasoning method of fuzzy rule-based classification systems in such a way that, for each class, the most suitable value of the parameter is obtained, which can lead to an improvement on the system's performance. In the experimental study, the performance of 4 different so called CC-integrals were tested, comparing the results obtained when using fixed values for the parameter against the results provided by the new evolutionary approach proposed in the paper. From the obtained results, it is possible to conclude that the genetic learning of the parameter is statistically superior to the fixed one for two copulas. Moreover, in general, the accuracy achieved in test is superior to that of the fixed approach in all functions. They also compared the quality of this approach with related approaches, showing that the methodology proposed in this work provides competitive results and can be considered as a good alternative to be used in fuzzy rule-based classification systems.

In paper 5, *Swarm Optimization Clustering Methods for Opinion Mining,* a novel unsupervised clustering approach is proposed for opinion mining. Towards their motivation, the authors argue that supervised machine learning and opinion lexicon, despite been the most frequent approaches for opinion mining, require considerable effort to prepare the training data and to build the opinion lexicon, respectively. In the proposal presented in this paper, three swarm algorithms based on Particle Swarm Optimization are evaluated using three corpora with different levels of complexity with respect to size, number of opinions, domains, languages, and class balancing. K-means and Agglomerative clustering algorithms, as well as, the Artificial Bee Colony and Cuckoo Search swarm-based algorithms were selected for comparison. The proposed swarm-based algorithms achieved better accuracy using the word bigram feature model as the pre-processing technique, the Global Silhouette as optimization function, and on datasets with two classes: positive and negative.

The authors emphasize that, although the swarm-based algorithms obtained lower result for datasets with three classes, they are still competitive considering that neither labeled data, nor opinion lexicons are required for the opinion clustering approach.

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 improved the quality of this special issue. We would also like to thank the Natural Computing Editor-in-Chiefs, the Journal Editorial Board and Elsevier for the opportunity and for efficiently handling the publication procedure.

Aurora Pozo (UFPR)
Heloisa de Arruda Camargo (UFSCar)
Invited editors
List of papers

1. Giovani Guizzo and Silvia R. Vergilio. A Pattern-Driven Solution for Designing Multi-Objective Evolutionary Algorithms.

2. Péricles Miranda and Ricardo Prudencio. A novel context-free grammar for the generation of PSO algorithms.

3. Anne Canuto, Joao Carlos Xavier Junior, Antonino Feitosa Neto, Cephas Barreto and Huliane Silva. Population-based Bio-Inspired Algorithms for Cluster Ensembles Optimization.

4. Giancarlo Lucca, José Antonio Sanz Delgado, Graçaliz Dimuro, Benjamin Bedregal and Humberto Bustince. A proposal for tuning the alpha parameter in CalphaC-integrals for application in fuzzy rule-based classification systems.

5. Ellen Souza, Diego Santos, Gustavo Oliveira, Alisson Silva and Adriano L. I. Oliveira. Swarm Optimization Clustering Methods for Opinion Mining.