Special Issue on Innovations in Nature-Inspired Computing and Applications Guest Editor's Preface

Nature-inspired computation is a general term referring to computing inspired by nature. It is an emerging interdisciplinary area in computer science and due to its success in dealing with large, complex, and dynamic problems, it has become a household name for solving real-world problems. The main idea is to mimic the complex phenomena (concepts, principles, and mechanisms) occurring in nature as computational processes in order to enhance the way computation is performed from a problem solving point of view. Some of the key paradigms falling under this umbrella are neurocomputing, evolutionary algorithms, swarm intelligence, artificial immune systems, membrane computing, computing with words, artificial life, hybrid approaches, etc. Articles were selected on the basis of fundamental ideas and concepts rather than the direct usage of well-established techniques. This special issue is aimed at practitioners, researchers, and post-graduate students who are engaged in developing and applying advanced nature-inspired computational techniques from a theoretical point of view and also to solve real-world problems. It constitutes a collection of 15 articles reflecting some of the current technological innovations in the field of nature-inspired computation and its real world applications. The papers are arranged as follows.

In the first article, Veenhuis presents a novel function optimization algorithm inspired from Wikipedia, which uses a collaborative web community of authors to improve the quality of articles. The author introduces a community optimization algorithm by mimicking a collaborative web community, which edits or improves a knowledge base. The knowledge base represents the problem to be solved and the different decision variables represent different topics contained in this knowledge base. The algorithm is tested on eight well-known benchmark problems for lower as well as higher dimensions.

The diffusion of innovation theory explains how new ideas are disseminated among social system members. Sampaio et al. in the second article propose the use of evolutionary algorithms for the simulation of innovation diffusion within organizations. To overcome some of the problems inherent in the conventional evolutionary algorithm a probabilistic approach is also incorporated.

In the sequel, Jha et al. evaluate the performance of a robot by empowering it with a decision-making capability, which uses synthetic emotions. The authors attempted to make the robot perform high-profile tasks rather than menial ones so as to increase its utility.

Biogeography-based optimization is a population-based algorithm that is inspired by biogeography, which describes the immigration and emigration of species between habitats. Goel et al. in the fourth article present a land cover

feature extraction technique based on the extended species abundance model of biogeography and the algorithm has been successfully tested on two different multi-spectral satellite image datasets.

In the fifth paper, Madureira et al. describe the developing issues for ant-colony system-based optimization tools to support decision-making processes and solve the problem of generating a sequence of jobs that minimizes the total weighted tardiness for a set of jobs to be processed in a single machine.

Many real-world optimization problems present themselves in a multi-objective setting (where each of the objectives portrays different aspects of the problem). Ganesan et al. in the sixth article propose the weighted sum scalarization approach using differential evolution, chaotic differential evolution, and gravitational search algorithms to generate the approximate Pareto frontier.

In the sequel, Dutta et al. present a real-coded multi-objective genetic algorithm based K- clustering method, where a genetic algorithm is exploited to search for suitable clusters and centers of clusters so that intra-cluster distance and inter-cluster distances are simultaneously optimized. The authors attempted to simultaneously tackle dimensionality reduction and optimization of objectives using the multi-objective genetic algorithm.

The scheduling problem is considered to be an NP-complete combinatorial optimization problem and during the past few decades, researchers have used different meta-heuristics to solve such complex problems. However, most of these meta-heuristic techniques require extensive parameter tuning, which is again a very hard and time-consuming task to perform. Periera et al. in the eighth article propose a case-based reasoning module to solve the parameter-tuning problem in a multi-agent scheduling system.

Díaz-Parra and Ruiz-Vanoye in the ninth paper propose a vertical transfer algorithm for solving the school bus routing problem. The vertical transfer algorithm uses the clusterization population pre-selection operator, tournament selection, crossover-k operator, and an intelligent mutation operator.

In the tenth paper, Saha et al. propose craziness-based particle swarm optimization for designing digital Infinite Impulse Response (IIR) filters. Experimental results illustrate that apart from gaining better control on cognitive and social components of the conventional particle swarm optimization algorithm, the craziness-based particle swarm optimization offers better performance.

The prisoner's dilemma game has emerged as the most promising mathematical metaphor for studying cooperation. Wang et al. conduct simulations with four different types of neighbourhood structures, and agents update their strategies by probabilistically imitating the strategies of better performing neighbours. During the evolution each agent can modify its own strategy and/or personal feature via a particle swarm optimization approach in order to improve the utility.

Polášek and Uhlár in the twelfth paper propose a method for extracting, identifying, and visualizing topics, code tiers, users, and authors in software projects. The methodology can extract topics and visualize them in 3D graphs and then

developers within and outside the teams can receive and utilize visualized information from the code and apply it to their projects.

Navrat and Sabo present an approach, inspired by honey bees, that allows exploring the World Wide Web by extracting keywords relevant to current news stories. Honey bees cooperate together to select random keywords and carry them from one article to another, landing only on the articles relevant to the keyword.

In the fourteenth article, Raeesi and Kobti introduce the Variable Neighborhood Search (VNS) metaheuristic. VNS is hybridized with Differential Evolution (DE) incorporating explorative evolutionary operators and sub-populations to improve the population diversity. The algorithms are then validated on classical job shop scheduling problems.

In the final paper, Snasel et al. illustrate a growing self-organizing grid method for knowledge discovery and visualization for the analysis of emergency call-taking information systems and their data characteristics. To handle the massive data, the growing grid algorithm is implemented in a parallel environment using compute unified device architecture. Experimental results illustrate that the proposed method is very efficient.

I would like to thank our peer-reviewers for their diligent work and timely efforts. We are also grateful to the Editor-in-Chief of Springer's LNCS Transactions on Computational Science, Prof. Marina Gavrilova, University of Calgary, Canada, for her continued support and for the opportunity to organize this special issue. We hope that the readers will enjoy reading this special issue and find it useful.

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