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Preface

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As a branch of meta-heuristic algorithms, swarm intelligence is concerned with the collective behavior of decentralized, self-organized and populated systems. Inspired by the complex behavior of biological populations, researchers have proposed many distributed models or algorithms for problem-solving in complex environments by means of observing, abstracting, modeling, and simulating the collaborative behavior in nature biological populations. Usually, the optimization process of a swarm intelligence algorithm is a heuristic and iterative search process by constantly generating, updating, and selecting solutions. The research objective of swarm intelligence algorithm is to design optimization algorithms with the ability of problem-solving by taking inspiration from the intelligent behavior exhibited in biological communities and understanding the characteristics of the interaction mechanism in a swarm. Exploring the wisdom of collective behavior swarm intelligence algorithms have achieved great success in many practical problems, such as path planning, task scheduling, multi-robot systems, data mining and so on. Currently, swarm intelligence algorithms and their applications are widely studied.

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One of the most popular swarm intelligence algorithms is the Particle Swarm Optimization (PSO), which is inspired by the social behavior of bird flocking and has been widely used in real-parameter optimization problems. Very recently, many nature-inspired algorithms have been proposed, such as the fireworks algorithm which is inspired by the fireworks explosions in the air. Besides the research on improvements of algorithms, a number of important applications of swarm intelligence algorithms, including PSO, have been reported in a variety of fields. The International Conference on Swarm Intelligence (ICSI) is an important forum for researchers and practitioners to exchange latest advances in theories, technologies, and applications of swarm intelligence and related areas. The Sixth International Conference on Swarm Intelligence and the Second BRICS Congress on Computational Intelligence (ICSI-CCI'2015) were successfully held from June 26 to 29, 2015 in Beijing, China, with the goal of prompting a combination of the swarm intelligence and computational intelligence studies in BRICS countries. The theme of the ICSI-CCI'2015 was "Serving our society and life with intelligence". With the help of the technical committee of this joint event, some high-quality papers from the ICSI-CCI'2015 reflecting the latest advances in swarm intelligence algorithms and their applications were recommended for this special issue.

This special issue aims at promoting research on swarm intelligence and its applications by publishing some of the important advances in current research. A number of active researchers responded enthusiastically to our call for contributions. As the outcome of a thorough reviewing process, eight papers were chosen for this special issue.

The first paper "Memetic Electromagnetism Algorithm for Surface Reconstruction with Rational Bivariate Bernstein Basis Functions" by Andrés Iglesias and Akemi

Gálvez addresses the surface reconstruction problem by using rational Bézier surfaces in terms of a memetic approach which is combining a powerful metaheuristic method for global optimization, i.e., the electromagnetism algorithm, with a local search method electromagnetism algorithm. This method has been applied to a benchmark of five illustrative examples exhibiting challenging features. In the meantime, the authors dealt with data points subjected to measurement noise and irregular sampling, replicating the usual conditions of real-world applications. It turns out by their experimental results that the proposed method is able to recover the underlying shape of surfaces with very good accuracy.

The second paper is "Cultural Particle Swarm Optimization Algorithms for Uncertain Multi-Objective Problems with Interval Parameters" by Yi-nan Guo, Zhen Yang, Chun Wang and Dunwei Gong. A novel multi-objective cultural particle optimization algorithm is proposed for uncertain multiobjective optimization problems with interval parameters, with a good balance between exploration and exploitation during its convergence process. The characteristic features of this algorithm are: the possibility degree is introduced to construct a novel dominant comparison relationship so as to rationally measure the uncertainty of particles, the grid s coverage degree is defined based on topological knowledge and used to measure the uniformity of non-dominant solutions in objective space instead of the crowding distance, and the key flight parameters are adaptively adjusted and the local or global best are selected in terms of the knowledge. Experimental results in this paper demonstrate that the obtained solutions are more close to the true Pareto front uniformly and the uncertainty of non-dominant solutions is lower.

The third paper "A Multi-objective Optimization Method based on Discrete Bacterial Algorithm for Environmental/Economic Power Dispatch" by Lijing Tan, Hong Wang, Chen Yang, and Ben Niu presents a new multi-objective optimization method based on a discrete bacterial algorithm to address the multi-objective economic-environmental dispatch (EED) problem with nonlinear, non-convex, and complexity constraints. In the proposed algorithm, the existence of bacteria complies with a fitness survival mechanism, in which a health sorting approach is operated to control the chances of reproduction as well as elimination. To speed up the convergence rate and avoid local minima, a comprehensive learning strategy is embedded to enable the communication exchanges between the bacteria and external archive. The effectiveness of the method is verified by experiments via providing similar or superior solutions to environmental/economic power dispatch issues with the various constraints.

The fourth paper is "Semi-supervised learning for question classification in CQA" by Yiyang Li, Lei Su, Jun Chen, Liwei Yuan. This paper presents a kind of semi-supervised question classification method based on ensemble learning. In this method, first of all, several classifiers are combined as an ensemble classifier which is trained firstly to utilize a small number of labeled question samples. Then, the trained preliminary classifier gives each of the unlabeled question samples a pseudo label. Thirdly, the ensemble classifier is trained again to use the labeled question samples and a large number of unlabeled question samples which have pseudo labels. The experiments on community question answering (CQA) system demonstrate that the proposed method can utilize a large number of unlabeled question samples to improve the question classification accuracy effectively.

The fifth paper "Task-Oriented Hierarchical Control Architecture for Swarm Robotic System" by Yuquan Leng, Cen Yu, Wei Zhang, Yang Zhang, Xu He and Weijia Zhou, proposes a novel system architecture for swarm robotic system, including human–computer interaction layer, planning layer and execution layer, for task-oriented swarm robotic system. Then, a hierarchical organizational model for the system is given for establishing the management relationship between different layers and individuals. Due to the task-oriented characteristics, this paper describes the relationship between tasks for the decomposition and logic of task in details. In addition, a method of behavior generation based on proposition/transition Petri networks is designed to construct combined behavior effectively using simple individual behavior to solve a variety of tasks.

The sixth paper is "A Swarm Intelligence Based (SIB) Method for Optimization in Designs of Experiments" by Frederick Kin Hing Phoa. A new natural heuristic method called Swarm Intelligence Based (SIB) method is proposed for a discrete optimization problem. It includes two new operations, MIX and MOVE, for combining two particles and selecting the best particle, respectively. This technique is ready for the search of both continuous and discrete domains, and its global best particle is guaranteed to move towards the optimum monotonically.

The seventh paper is "A Multi-Objective ACO for Operating Room Scheduling Optimization" by Xiang Wei. A meta-heuristic approach integrating Pareto sets and Ant Colony Optimization (ACO) is proposed to solve the operating room (OR) scheduling problem as a specific multi-objective combinatorial optimization problem. The Pareto sets construction and the modified ant graph model are introduced and two types of pheromone setting and updating strategies are compared to determine a more efficient multi-objective OR scheduling algorithm. Computational results show that the PSACO-MO achieves good results in shortening makespan, reducing nurses 'overtime and balancing resources' utilization in general.

The eighth paper is "Semi-self-adaptive Harmony Search Algorithm" by Xinchao Zhao, Zhaohua Liu, Junling Hao, Rui Li, Xingquan Zuo. In this paper, Zhao et.al. proposes a semi-self-adaptive harmony search algorithm (SSaHS) with the self-adaptive adjustment of the bandwidth and the elitist learning strategy of particle swarm optimization. The SSaHS employs a self-adaptive adjusting strategy for the difference between the maximum and minimum components in the harmony memory and is capable of dynamically adjusting the bandwidth for the specific problem. Comparison results show that the SSaHS can find better solutions than both basic harmony search algorithm and several enhanced harmony search algorithms.

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Guest Editors

List of papers

1. NACO-D-16-00015R1: Memetic Electromagnetism Algorithm for Surface Reconstruction with Rational Bivariate Bernstein Basis Functions, Andrés Iglesias and Akemi Gálvez.
2. NACO-D-15-00169R1: Cultural Particle Swarm Optimization Algorithms for Uncertain Multi-objective Problems with Interval Parameters, Yi-nan Guo, Zhen Yang, Chun Wang and Dunwei Gong
3. NACO-D-16-00144R1: A Multi-objective Optimization Method based on Discrete Bacterial Algorithm for Environmental/Economic Power Dispatch, Lijing Tan, Hong Wang, Chen Yang, and Ben Niu
4. NACO-D-16-00003R1: Semi-Supervised Learning for Question Classification in CQA, Yiyang Li, Lei Su, Jun Chen, Liwei Yuan
5. NACO-D-16-00001R1: Task-Oriented Hierarchical Control Architecture for Swarm Robotic system, Yuquan Leng, Cen Yu, Wei Zhang, Yang Zhang, Xu He and Weijia Zhou
6. NACO-D-15-00073R2: A Swarm Intelligence Based (SIB) Method for Optimization in Designs of Experiments, Frederick Kin Hing Phoa
7. NACO-D-16-00019R2: A Multi-Objective ACO for Operating Room Scheduling Optimization, Xiang Wei.
8. NACO-D-16-00169R1: Semi-self-adaptive Harmony Search Algorithm, Xinchao Zhao.