Journal of Universal Computer Science, vol. 23, no. 7 (2017), 586-588
submitted: 16/7/17, accepted: 26/7/17, appeared: 28/7/17 © J.UCS

Theory and Application of Bio-inspired Intelligence and Methods

J.UCS Special Issue

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The environment adaptation capability of biological entities and systems unfolds solutions to challenging problems. Evolution constantly refines and perfects the solutions to be optimal. Computer scientists look into the phenomenon as guiding metaphors for problem solving; henceforth the Bio-inspired computing (BIC) comes into picture. BIC focuses on the designs and developments of computer algorithms and models based on biological mechanisms and living phenomena. It is now a major subfield of natural computation that leverages on the recent advances in computer science, biology and mathematics. The ideas provide abundant inspiration to construct high-performance computing models and intelligent algorithms, thus enabling powerful methods to solve real-life problems.

The special issue aims to cover the recent models, methods and algorithms that are developed and introduced in the field of bio-inspired computing. The objective is to provide a comprehensive and latest collection of research and experiment works in the field. The special issue endeavours to tackle the bio-inspired computing from a slightly different aspect. Besides the conventional topics in the field of AI and Machine learning, we would like to have topics of some unconventional ones, e.g., membrane computing.

Initially 23 submissions were received, each of which went through two rounds of double-blind reviews with 3 experts in the related fields. 7 papers were eventually selected based on the quality of their work, reviewers' comments and editorial judgement. The geographical distribution of the authorship is quite balanced. The authors of the accepted papers submitted their work from United States, China, Spain, Romania, South Africa, Singapore and Malaysia. We summarised each contribution as follows.

A novel application of Spiking Neural P systems in Stochastic Computing is presented in the first paper entitled "Stochastic Computing with Spiking Neural P Systems" by Mingming Wong and Dennis Wong. A new computational framework is proposed to address the challenges in deeply scaled technologies by implementing stochastic computing (SC) using the SN P Systems. The work endeavour to provide some insights to future IC design development.

The second paper described a new Improved Double Regularization Support Vector Machine (IDRSVM) whose Parameters are selected based on Chaotic Particle Swarm Optimization Algorithm. The paper entitled "Selecting Parameters of an Improved Doubly Regularized Support Vector Machine based on Chaotic Particle Swarm Optimization Algorithm" is written by Chuandong Qin, Zhenxia Xue and et al.

The third contribution entitled "A Hybrid Social Spider Optimization Algorithm with DifferentialEvolution for Global Optimization" by Jianfeng Qiu, Xie Juan and et al. An improved Social Spider Optimization algorithm named wDESSO is proposed for global optimization, which effectively balances exploration and exploitation. The new improved algorithm is tested in solving complex numerical optimization problems.

The forth paper is entitled "Multi-Objective Evolutionary Algorithm Based on Decomposition for Energy-aware Scheduling in Heterogeneous Computing Systems" by Sisi Yuan, Gaoshan Deng and et al. To address the requirement of green IT and reduce the energy consumption of computer system, a multi-objective scheduling algorithm based on decomposition for scheduling of the system workflow is developed and elaborated.

"An Adaptive Membrane Evolutionary Algorithm for Solving Constrained Engineering Optimization Problems" is the fifth paper by Jianhua Xiao, Ying Liu and et al. The researchers present an adaptive membrane evolutionary algorithm (AMEA) that combines a dynamic membrane structure and a differential evolution with the adaptive mutation factor. The results of the experimental indicate that the proposed algorithm outperforms other evolutionary algorithms on five well-known constrained engineering optimization problems.

The title of sixth manuscript is "Adaptive Sharing Scheme based Sub-swarm Multi-objective PSO" by Yanxia Sun and Zhenghui Wang. A new sub-swarm method with adaptive sharing scheme is developed to improve the optimization performance of multi-objective particle swarm optimization. The results show that the proposed method can achieve better optimization performance comparing with some existing methods.

The last paper is "Reversibility in Parallel Rewriting Systems" by Bogdan Aman and Gabriel Ciobanu. Their conducted a study on reversibility in parallel rewriting systems over multisets and emphasizes the controlled reversibility for a particular

case of parallel rewriting systems given by membrane systems, a formalism inspired by the cell activity.

To summarised the content of the special issue, we can see that paper 1, 5 and 7 are in the field of membrane computing and related area; paper 2, 3,4 and 6 are in more traditional AI and machine learning area, e.g. Swan intelligence and multi-objective optimisation.

We sincerely appreciate J.UCS to give us this opportunity to organise this special issue, special thanks to the managing editor Prof. Christian Gütl and the assistant editor Ms. Dana Kaiser for their patience and assistance, without which we can't make this special issue successful. Last but not least, we are really grateful to all members of our editorial board and reviewers for their time and effort to make this happen.