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Editorial: Special Issue on Swarm Intelligence Algorithms and Applications

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Swarm intelligence (SI) is generally to study the collective behaviour in a decentralized system which is made up by a population of simple individuals interacting locally with one another and with their environment. Such systems are often be found in nature, including bird flocking, ant colonies, particles in cloud, fish schooling, bacteria foraging, animal herding, honey bees, spiders, and sharks, just to name a few. Inspired by those biological systems and natural phenomena, people have developed a number of swarm-based algorithms, such as particle swarm optimization (PSO), ant colony optimization (ACO), bacterial foraging optimization (BFO), artificial immune system(AIS), bees algorithms, fish schooling search (FSS), fireworks algorithms (FWA), etc. In the meantime, they are widely used in many real world applications in the range from scientific research to engineering tasks. Recently, those SI algorithms are sharply emerged,received extensive attention from researchers and practitioners from all over the world, and become one of the hottest topics in the artificial intelligence community.

This special issue includes fourteen papers selected from The First International Conference on Swarm Intelligence (ICSI'2010) successfully held on June 12-15, 2010 in Beijing, China, after a vigorous reviewing process conducted by the program committee members and technical committee chairs of ICSI' 2010 as well as some other reviewers. These papers deal with either somenovel SI algorithms andtheir improvements and parallel implementation or some extended applications in the fields of multi-objective optimization, combinatorial optimization, evolving neural networks, image segmentation, medical information processing, etc.

The first and second papers address artificialimmune algorithms based on particle swarm optimization and memory coevolution. The first paper by Ruochen Liu, Manchun Niu, Lina Tang, and Licheng Jiao introducean adaptive particle swarm optimization into artificial immune network algorithm (AIN) as anew mutation operation, called Adaptive PSO based ArtificialImmune Network Classification algorithm (APAINC) which can increase in classification accuracy in comparison with artificial immune network classification algorithms based on both random mutation and PSO.Tao Liu andZhifeng Hu proposeMemory Coevolution Immune Algorithm (MCIA) by introduced a strategy of memory coevolution and defined the distanceconcentration and affinity function. The experimental results show that the adoption of memory coevolution mechanism is able to enhance the search capabilities of the MCIA greatly.

The third and fourth papers deal with BFO algorithms. The third paper by Ben Niu, Yan Fan, Hong Wang, Li Li, and Yujuan Chai suggest two modifications on the bacterial foraging optimizer by introducing a linear variation and a nonlinear variation of chemotaxis step for improving the speed of

convergence and finely tuning the search in a multidimensional space. Experimental results indicate that they outperform the classical BFO and GA in all the benchmark functions. The fourth paper presented by Hanning Chen, Yunlong Zhu, Kunyuan Hu, and Tao Ku make use of a self-adaptive BFO algorithmfor optimizing the reader-to-reader interference and tag coverage problems in RFID reader networks.

The following two papers describe two new quantum particle swarm optimizers (QPSOs). Bin Jiaoand Shaobin Yan put forward a novel intelligent algorithm by mixed simulated annealing, cooperative co-evolution mechanism, quantum-behaved theory and particle swarm optimization algorithm together, which not only enhance the capacity of searching the best solution but also strengthen the ability of global search for Job Shop Scheduling Problem. The paper by Nikola Kasabov and HazaNuzlyAbdullHamedproposea dynamic quantum–inspired particle swarm optimization method which is used to the problem of feature and parameter optimisation of evolving spiking neural network models. Their method results in the design of faster and more accurate classification models than the ones optimised with the use of standard evolutionary optimisation algorithms.

The seventh paper by Ying Li, Jiaxi Liang propose a novel hybrid cooperative particle swarm optimization (CPSO) algorithm whichembodies two particle swarmsto alleviate the premature convergence problem happened in PSOalgorithm. The underlying idea of the CPSO is to utilize random mutation, multi-swarms, and thehybrid of many heuristic optimization methods for improving the quality of solution and the convergence.

Next two papers deal with multi-objective optimization problems in terms of a special parallel particle swarm optimization and multi-objective genetic algorithm. You Zhou and Ying Tan design and implement a parallel multi-objective particle swarm optimization (MOPSO) based on graphic processing unit (GPU). Compared with the corresponding CPU based MOPSO algorithm, the GPU based MOPSO reached a speedup of about 7, while maintaining the same optimizing performance. A large swarm size was more powerful in searching the Pareto solutions, and the larger the swarm size was, the bigger the speedup of GPU based MOPSO could be. However, the paper by Jinliang Hou, Haiqi Wang, and Yujie Liu present a method of integrating spatial information into multi-objective genetic algorithm to solve spatial optimal location problem based on GIS. This method is able to converge to the Pareto-optimal set and is also a feasible way of solving multi-objective spatial optimal location problem.

The tenth paper presented by Beatriz A. Garro, Humberto Sossa, and Roberto A. Vázquez raises an interested question of “Back-Propagation vs Particle Swarm Optimization Algorithm: which Algorithm is better to adjust the Synaptic Weights of a Feed-Forward ANN?” They compared the two ways of training an artificial neural network (ANN), i.e.,PSO algorithm against classical training algorithms such as: back-propagation (BP) and Levenberg Marquardt method by non-linear problems and a real object recognition problem. In the eleventh paper, Honggui Han, Zhaozhao Zhang, andJunfeiQiao introducea novel pruning algorithm to design the single hidden layer feedforward neural network (FNN), which can prune the redundant hidden nodes by calculating the Hessian and removing the lines in the matrix for reconstructing the FNN. Experimental results show that the proposed method is efficient for network structure pruning and it achieves better performance than some of the existing algorithms.

On the other hand, Salabat Khan, Mohsin Bilal, Muhammad Sharif, and Rauf Baigpresent an ACO algorithm for n-Queen problem that is a combinatorial problem. Further, they also develop an intelligent heuristic function that helps in finding the solution very quickly and effectively.

In the thirteen paper, Shafaf Ibrahim, Noor Elaiza Abdul Khalid, Mazani Manaf, and Umi Kalthum Ngah compare the performances of PSO and seed-based region growing (SBRG) approaches in the

segmentation of human brain tissue abnormalities, and find that the proposed PSO and SBRG techniques may provide potential solutions to the current difficulties in detecting abnormalities in human brain tissue area.

The final paper presented by Jin Zhang, Ying Wang, and Rulong Wang uses two nonlinear dynamic indexes, i.e., approximate entropies (ApEn) and Lyapunov Exponents, to extract EEG feature, and uses KIII model invented by Walter J. Freeman to recognize hypoxia EEG as well. Experimental results show that the ApEn and Lyapunov exponents are able to denote the characteristics of EEG effectively, and KIII model has good performance to recognize the nonlinear signals.

We hope that this special issue could stimulate some of new directions and solutions that can lead to both theoretical insight and practical applications in the SI community. We appreciate the Editor-in-Chief Prof. Radu-Emil Precup for giving us this opportunity to make this special issue possible. We express our heartfelt thanks to all reviewers for their timely and in-depth reviews of these papers. Finally, we would like to thank all the authors who worked hard in writing and revising their papers which consist of this special issue with a high quality.

Professor Ying Tanis a full professor and Ph.D. advisor of the Key Laboratory of Machine Perception (Ministry of Education), Peking University, and Department of Machine Intelligence, EECS, Peking University. He is also the head of Computational Intelligence Laboratory (CIL) of Peking University. He received the BS in 1985, the MS in 1988, and the Ph.D degree from Southeast University, in 1997. He became a postdoctoral research fellow then an associate professor with University of Science and Technology of China; he was a full professor, advisor of PhD candidates, and director of the Institute of Intelligent Information Science of his university. He worked with the Chinese University of Hong Kong in 1999 and in2004-2005. He was an electee of 100 talent program of the Chinese Academy of Science in 2005.He has authored or co-authored more than 200 academic publications in refereed journals and conferences and several books and chapters in book. His interests include computational intelligence, swarm intelligence, AIS, intelligent information processing, pattern recognition, statistical learning theory, and their applications. Dr. Tan is Associate Editor of International Journal of Swarm Intelligence Research and IES Journal B, Intelligent Devices and Systems, and Associate Editor-in-Chief of International Journal of Intelligent Information Processing. He is a member of Advisory Board of International Journal on Knowledge Based Intelligent Engineering System, and the Editorial Board of Journal of Computer Science and Systems Biology and Applied Mathematical and Computational Sciences. He is also the Editor of Springer Lecture Notes on Computer Science, LNCS 5263, 5264, 6145, and 6146, and the Guest Editors of several referred journals. He was the general chair of International Conference on Swarm Intelligence (ICSI'2010,ICSI'2011) and program committee chair of ISNN'2008. He has honoured the National Natural Science Award of China in 2009. He is a senior member of the IEEE. More information of Prof. Y. Tan can be found at http://www.cil.pku.edu.cn.

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