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Recent Advances in Bio-Inspired Computing: Theory and Applications

J.UCS Special Issue

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This special issue of the Journal of Universal Computer Science (J.UCS) is devoted to selected contributions from BIC-TA 2010, the annual International Conference on Bio-Inspired Computing: Theories and Applications that in 2010 took place in Liverpool. As the name indicates, this conference is interdisciplinary in character and brings together scientists from a wide range of fields for brainstorming on advances in computing techniques and the humbling variety, adaptability, as well as sophistication of the nature around us for inspiration and applications based on such techniques and algorithms. Another special issue of the Natural Computing (NaCo) journal was also produced as a result of this conference and the first guest editor feels privileged and honoured for being able to produced two very high quality special issue volumes of two very highly regarded journals.

Bio-Inspired Computing: Theories and Applications (BIC-TA) has established itself as one of the flagship conferences bringing together the world's leading academics and scientists from different branches of Natural Computing. Since 2006 the conference has taken place at Wuhan (2006), Zhengzhou (2007), Adelaide (2008) and Beijing (2009) and has attracted wide ranging interest amongst researchers with different backgrounds. The fifth in the series of the BIC-TA conferences was held at Liverpool and it was the privilege for the Department of Mathematics and Computer Science at Liverpool Hope University to play host for the BIC-TA 2010 from 8th to 10th September. With the growing trend in Emergent Complex Systems theme, BIC-TA 2010 saw, for the first time in the series, the inclusion of two closely related fields, namely Complex Systems, and Computational Neuroscience. BIC-TA 2010 was graced with the keynote speeches delivered by Prof. Steve Furber (The University of Manchester, UK) and Prof. D.G. Thomas (Madras Christian College, Chennai, India). The conference series is going from strength to strength with the BIC-TA 2011 hosted at the Universiti Sains Malaysia, Penang (Malaysia) and future 2012 and 2013 editions planned to be held at Gwalior (India) and Anhui (China), respectively.

From a wide spectrum of interesting research papers on various aspects of Bio-Inspired Computing, with a diverse range of simulation applications, theories, and techniques within the domain, the editors carefully selected, for this special issue of the J.UCS, 15 papers (out of over 80 papers) which were presented at the conference. An open Call for Paper was also issued for this special issue and the editors received 15 submissions as a result of this open call. The authors of the selected papers were invited to substantially extend and submit them for a complete new peer-review for consideration in this special issue. The final decision for the inclusion 8 papers, brief summary of these is given in the paragraph to follow, in this special issue has been strictly based on the outcome of the rigorous peer-review process.

The first three papers in this special issue are devoted to very interesting applications of Membrane Computing theme. Elias et al. report an insightful application of distributed P-Systems suitable for real-time optimisation in a dynamic and distributed environment. They propose the design of a variant of the Distributed P system by augmenting it with new features enabling centralised monitoring and communication with all the other components of the distributed system. Another Membrane Computing application is in Niu et al. who implement a variant P system with shuffle operation on string-language objects and obtain comparison results demonstrating the power of shuffle operation enlarged in the framework of P systems. They illustrate how to generate picture languages by using this kind of devices in the context of Catalytic-Like Rules. In yet another theoretical development, properties of the Array P System with Shuffle on Trajectories are studied, using examples, by Venkatesan et al. They present a new concept of trajectory array P system which consists of a membrane structure in which the objects are arrays and the evolutionary rules are given in terms of trajectories. Although, the next three articles are on the theme of Particle Swarm Optimisation (PSO), amongst these the paper by Zhang et al. is on a membrane algorithm, called HPSOPS, which combines membrane systems and a hybrid particle swarm optimisation with wavelet mutation (HPSOWM) as they present this hybrid algorithm for solving certain broadcasting problems. Deep and Bansal tackle certain class of Economic Dispatch Problems, which are non-linear continuous optimisation problems, using original PSO and two of its improved variants (namely, Laplace Crossover PSO (LXPSO) and Quadratic Approximation PSO (qPSO)), and obtain improved results than reported in the literature. In-depth theoretical analysis is presented in Ali et al. as they use Differential Evolution with some very interesting examples. Their analysis shows the effect of two local searches (namely, Trigonometric Local Search (TLS) and Interpolated Local Search (ILS)) on the working of basic Differential Evolution (DE). A very interesting Genetic Algorithm application is reported by Singh Baicher in the context of real-time implementation of a class of optimised multirate quadrature mirror filter bank. In the final paper, Bhattacharya et al. report a very interesting work on the theme of Neural Computing comprising of study assessing Thalamo-cortical Circuitry Model and they describe the effects of variation of synaptic connectivity using a neural mass model.

The objective of this special issue has been to make available recent results and report in-progress research in the field and we much hope that this publication will become an important reference source to many students, researchers, and academics in their educational, research, and professional activities.

As guest editors, we would like to express our deep thanks to the Editor-in-Chief, Prof. Christian Gütl, for providing us with the opportunity to host this special issue in J.UCS. We are much indebted to Mag. Dana Kaiser (assistant editor) for her continued support and helpful guidance throughout all the stages of preparing the special issue. We also thank the authors for their contributions, including those whose papers were not included. Last but not least, we express our sincere gratitude for the thoughtful work of the reviewers who provided invaluable evaluations and recommendations that have helped maintain the quality and clarity of presentation of the papers.

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