SPECIAL ISSUE
NATURE INSPIRED DISTRIBUTED COMPUTING

PREFACE
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This special issue contains a subset of papers selected from ones presented at the 12th International Workshop on Nature Inspired Distributed Computing (NIDISC 2009). The selected papers are extended versions of those that appeared in the workshop. The workshop was held in conjunction with the 23th IEEE International Parallel and Distributed Processing Symposium (IPDPS'2009) on May 23, 2009, Rome, Italy. The purpose of the workshop is to address recent developments in Nature-inspired optimization and machine learning techniques and their application to solve problems related to new computer and communication technologies. This remains a very active area of research with many open problems.

All submitted papers have been carefully reviewed by three anonymous referees and, on the base of these reviews, 8 papers have been selected for the special issue. All accepted papers present original applications of Nature-inspired optimization techniques in the contemporary research related to distributed computing, and concerning bioinformatics, multiprocessor scheduling and assignment, cooperation issues in mobile ad hoc networks, multi-agent systems, and attacks against authentication protocols. These results present a significant advance in their areas of research, and definitively will stimulate a progress in development of new computer and communication technologies.

The first two papers address problems related to bioinformatics. The paper by Azzedine Boukerche et al. deals with sequence alignment: one of the basic operations in bioinformatics. The authors evaluate their recently proposed parallel exact strategy called Z-align in a cluster environment; they show that, with an adequate memory allocation strategy, two real DNA sequences of huge sizes can be aligned with a very good time performance. The paper by Allani Abderrahim et al. proposes a new hybrid technique which combines a Genetic Quantum Algorithm with the Support Vector Machine classifier. The algorithm is used to perform very effectively gene selection and classification of high dimensional Microarray Data containing medical data.

The next three papers concern multiprocessor scheduling and assignment problems. The paper by Young Choon Lee et al. proposes a novel parallel metaheuristic framework with a core component based in a harmony-search-based coordinator. The framework is able to handle a number of metaheuristics and facilities to escape local optima during optimization process. It has been successfully applied to solve the task scheduling problem on multiprocessor computing systems. The paper by Piotr Switalski and Franciszek Seredynski proposes a solution of the multiprocessor scheduling problem based on an application of a relatively new metaheuristic called Generalized Extremal Optimization. The paper shows that the proposed optimization technique outperforms both, an approach based on genetic algorithms and one based on an application of particle swarm optimization in terms of the quality of solutions and computational cost. Finally, the paper by Lakhdar Loukil et al. presents a hierarchical parallel hybrid genetic algorithm with a mutation operator based in simulated annealing, which is applied to solve the Quadratic 3-dimensional Assignment Problem. An extensive experimental study of the algorithm, performed in a grid environment, shows its great efficiency.

The paper by Marcin Seredynski and Pascal Bouvry addresses the issue of providing a necessary level of cooperation between mobile devices exchanging packets in ad-hoc networks. They propose a Prisoner's Dilemma-based trust model for the mobile device behavior, and then apply genetic algorithms to evolve behavioral strategies leading to emerging cooperation in such a network environment.

In the paper by Patrick Ediger and Rolf Hoffmann, a multi-agent system modeled by cellular automata is studied. The purpose of the system is to provide an efficient all-to-all communication in the environment, where two independent

algorithms are running. The authors propose a genetic algorithm-based solution to define finite state machines optimally controlling the behavior of agents performing the communication tasks.

The last paper of this special issue, by Julio Cesar Hernandez-Castro et al., investigates a novel approach consisting in transforming the cryptanalysis of a security protocol into a search problem. Authors successfully propose the use of simulated annealing to perform an attack against a recently proposed and ultra-lightweight authentication protocol.

The varied nature of the applications and the set of novel techniques to deal with them are hopefully representing an interesting set of results to motivate future research to the readers of this journal. We just hope that readers enjoy it as much as we did in organizing this special issue.