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ANTS 2014 special issue: Editorial

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This special issue of the *Swarm Intelligence* journal is dedicated to the publication of extended versions of the best papers presented at *ANTS 2014, Ninth International Conference on Swarm Intelligence*, which took place in Brussels on September 10–12, 2014.

The ANTS series of conferences has taken place at the Université Libre de Bruxelles, Brussels, Belgium, every other year since 1998. As in 2010 and in 2012 (for the seventh and eighth editions of the conference), the authors of the contributions accepted as full papers at the conference were invited to submit an extended version of their work for possible inclusion in this special issue.

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Six of the submitted papers were accepted for publication after at least one round of reviews with comments by at least three referees. The review process for papers where one of the authors was also one of the editors of this special issue has been managed anonymously by one of the other guest editors.

The special issue opens with "*A quantitative micro-macro link for collective decisions: the shortest path discovery/selection example*." In this paper, Reina et al. study how to obtain a quantitative correspondence—a so-called micro-macro link—between the dynamics of the microscopic implementation of a robot swarm and the dynamics of a macroscopic model of nest-site selection in honeybees. The micro-macro link they obtain is a first step toward the longer-term goal of the presented research: the formalization of a design pattern for collective decision making.

In "*Ant colony optimization on a limited budget of evaluations*," Pérez Cáceres, López-Ibáñez, and Stützle explore the question of how well-known ant colony optimization (ACO) algorithms perform when the number of candidate solutions that can be evaluated is very limited. Such a limitation can be caused by hard real-time constraints or by the fact that the evaluation of solutions is very expensive as, for example, in optimization by simulation. The performance of the ACO algorithms is studied considering default parameter settings recommended in the literature, parameter settings tuned for the particular scenario of small evaluation budgets, and the possibility of exploiting surrogate modeling of search landscapes. Experimental results obtained on two combinatorial optimization problems show that tuning is important to adapt to the situation of low evaluation budgets and that advanced ACO algorithms remain preferable over basic ones.

In "*AutoMoDe-Chocolate: automatic design of control software for robot swarms*," Francesca et al. present two studies on the automatic design of control software for robot swarms. In the first study, Vanilla and EvoStick, two previously published automatic design methods, are compared with human designers. The results show that Vanilla performs better than EvoStick, but it is not able to outperform the human designers. On the basis of the results of the first study, the authors devise a new automatic design method, Chocolate, which is an improved version of Vanilla. In the second study, the authors perform an assessment of Chocolate. The results show that under the experimental conditions considered, Chocolate outperforms both Vanilla and the human designers.

In "*Time-variant feedback processes in collective decision-making systems: influence and effect of dynamic neighborhood sizes*," Valentini and Hamann investigate two swarm systems that show time-variant positive feedback: motion alignment observed in locust swarms and adaptive aggregation of swarms of agents. The authors identify a bias in the spatial distribution of agents compared to a well-mixed distribution and then model this bias exploiting the percentage of aligned swarm members and the neighborhood size. The study is concluded with applications of methods from renormalization group theory that provide a novel interpretation of the neighborhood dynamics in terms of scale transformations.

In "*Particle swarm variants: standardized convergence analysis*," Cleghorn and Engelbrecht empirically identify the parameter region that ensures convergent particle behavior in particle swarm optimization (PSO) algorithms. They analyze several PSO algorithms such as the fully informed PSO, the bare bones PSO or the standard PSO 2011 algorithm. The results are compared to theoretical predictions, and the detected discrepancies are attributed to the simplifications that are necessary to perform a theoretical analysis. An additional important contribution of the paper is the definition of a new benchmark function that is found to be particularly useful to support the empirical convergence analysis.

In "*FrogCOL and FrogMIS: new decentralized algorithms for finding large independent sets in graphs*," Blum, Calvo, and Blesa examine the performance of two distributed algorithms, FrogCOL and FrogMIS, for the identification of large independent sets in graphs. FrogCOL is an algorithm for distributed graph coloring that is inspired by a model of the calling behavior of Japanese tree frogs and that was previously proposed by the authors. FrogMIS is a simplified version of FrogCOL, specifically designed for finding independent sets. The authors experimentally study the behavior of these two algorithms on a large number of differently structured graphs and compare them to the state-of-the-art algorithms. The results show that FrogCOL outperforms all the previously available distributed algorithm for finding large independent sets in graphs.

The six papers contained in this special issue are of very high quality. We thank all the people that made this possible: the authors, who submitted their very best work to the journal; the referees, who helped in the selection of these six papers out of the fifty-five submitted to ANTS 2014; and finally, many people at Springer who assisted us in the production of this special issue.

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