EvoHybrid'04
Application of Hybrid Evolutionary Algorithms to Complex Optimization Problems

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1. Overview

EvoHybrid'04 is a bird-of-a-feather GECCO workshop that focuses on the application of hybrid evolutionary algorithms (EAs) to complex optimization problems. Standard EAs often perform poorly when searching for good solutions for practical optimization problems and may benefit if they are combined with other techniques.

In the past few years, results obtained by several investigations give a clear indication that the joint application of stochastic optimization algorithms and classical methods and/or specialized algorithms might improve the efficiency of search.

Broadly speaking, most existing approaches fall into two large classes of hybrid architectures:

- The EA can be complemented with a local and/or deterministic search method. The joint application of both techniques provides a trade-off between stochastic global exploration and fine-grained exploitation.
- The EA can be enhanced with problem specific heuristics adding explicit knowledge about the problem being solved.

Adopting several current approaches as a starting point, this workshop aims at promoting a widespread discussion about this topic and, most important, to analyze if it is possible to develop new hybrid architectures that perform better than today's methods. Some of the topics addressed at EvoHybrid'04 are:

- Application of hybrid evolutionary approaches to real-world optimization problems;
- Common hybridization techniques, such as local improvement of candidate solutions, intelligent chromosome decoders or heuristic variation operators;
- Less common combinations of EAs with other state-of-the-art techniques frequently used in the optimization of complex problems. Linear programming and branch-and-cut are two examples of such methods;

- Analysis of the strengths (and weaknesses) of today's hybrid approaches. How do they compare to other techniques that are also applied to such problems?
- Promising directions for future research.

EvoHybrid'04 is the second GECCO workshop dedicated to the application of hybrid evolutionary approaches to complex optimization problems. The first edition took place in July 12, 2003, in Chicago, USA.

2. Accepted Contributions

Ten papers were submitted to EvoHybrid'04. Based on 3 independent reviews from members of the program committee, five contributions were accepted, resulting in an acceptance rate of 50%. The reviewing process was double-blind. In the next paragraphs, we introduce the five papers accepted for presentation at EvoHybrid'04 and for inclusion in the GECCO-2004 Workshop Proceedings.

The first paper is entitled *Hill-Climbers, a Memetic Algorithm, and their Comparison on the Minimum Linear Arrangement Problem* by B. Julstrom. It presents a framework where a memetic algorithm is built by applying infrequent episodes of recombination to a population of independent stochastic hill-climbers. The proposed algorithm is tested on several instances of the minimum linear arrangement problem.

The second paper, entitled *Application of a New Hybrid Evolutionary Strategy to Spacecraft Thermal Design* by R. Galski, F. Sousa, F. Ramos and I. Muraoka, proposes an hybrid evolutionary strategy where each step of global stochastic search is followed by a local deterministic refinement routine. This approach is applied to the inverse design of a spacecraft thermal control system.

The third paper, entitled *The Largest Compatible Subset Problem for Phylogenetic Data* by A. Auyeung and A. Abraham, deals with the construction of a phylogenetic tree. Due to the noisy nature of the experimental data used in the construction, conflicts often occur. The largest compatible subset problem arises when we want to filter out the noise by discarding the minimum amount of information. In this paper a hybrid approach, combining an evolutionary algorithm and other specific methods for specially structured graphs, is proposed for this problem.

The fourth paper is entitled *An Enhanced Evolutionary Algorithm with a Surrogate Model* by Y. Lian, M.-S. Liou and A. Oyama. It proposes an enhanced evolutionary algorithm to solve computationally expensive design multi-objective optimization problems. In this model, a real-coded evolutionary algorithm is coupled with a local search gradient-based method. Local optimization is performed on a surrogate model based on the available data. To guarantee convergence to the original problem, a trust region management to handle surrogate models is used.

The final paper, entitled *On Fitness, Niching Strategies, and Hybrid Niche Size Estimation for Discovering an Unknown Number of Clusters in Noisy Data* by O. Nasraoui and E. Leon, investigates some questions related to clustering problems,

namely robustness to noise, scalability of the chromosome encoding or automatic niche size estimation. It also presents a hybrid niche size estimation strategy used to implement a sound mating restriction. Results of empirical simulations illustrate the role of robust fitness, niching, and hybrid niche size estimation.

3. Program Committee

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