Preface

This book is based on the Proceedings of the 6th Conference *Evolution Artificielle*, EA 2003, held in Marseilles. Previous EA meetings took place in Toulouse (1994), Brest (1995), Nîmes (1997), Dunkerque (1999), Le Creusot (2001) while the best presented papers were published in Springer's LNCS, volumes 1063, 1363, 1829 and 2310.
This year again, authors were invited to present original works, relevant to Simulated Evolution, including but not limited to Evolutionary Optimization and Learning, Theory of Evolutionary Computation, Artificial Life, Population Dynamics, Implementation and Real-World Applications of Evolutionary Paradigms. EA 2003 has turned more and more international and the proposed papers have been selected throughout a rigorous process, each of them being expertized by at least three Referees from an International Program Committee. We are greatly indebted to each of them for their hard work and time they spent to ensure a high quality standards edited in this volume. We also would like to thank all the participants to the Conference and the numerous authors who chosen EA 2003 to submit their manuscript.

We are particularly grateful to Professor Hans-Paul Schwelfel for his invited lecture on *Genesis and Future of Evolutionary Computation* which presented a wide survey of the art from a deep analysis, promising many further interesting applications.

Contributions in this book are organized in nine parts according to their main topics and their are shortly presented bellow.

1. **Theoretical Issues:** the variable length representations in evolutionary algorithms is investigated by M. Defoin Platel et al. using parametrical models in between the royal road landscapes and the NK-landscapes according to Kauffman. M. Nicolau, A. Auger and C. Ryan explored the mathematical formalization of an encoding process using grammatical evolution and gave asymptotics estimates, and experimental results. A basic but general method to maximize many fitness functions is to chose – at random – an initial point and apply random perturbations (following a given or updated random process) to it in order to improve the fitness. The response to the increase of the number of variables for such perturbations is studied by L. Grosset, R. Le Riche, and R. T. Haftka both for random stochastic hill climber and univariate marginal distribution algorithms, while S. Aupetit, P. Liardet and M. Slimane applied such a method to produce binary sequences with low out-of-phase aperiodic auto-correlations.
   Asymptotic distribution laws of upper order statistics was used by S. Puechmorel and D. Delahaye for improving efficiency of selection and crossover operators. The last theoretical contribution by M. Drugan and D. Thierens was a survey on evolutionary Markov Chain Monte Carlo algo-

rithms related to evolutionary schemes; they proposed a new algorithm relied on elitist coupled acceptance rules.

2. **Algorithmic issues:** constraint satisfaction problems are considered by V. Barichard et al. in a general evolutionary framework based on the collaboration between constraint propagation techniques and local search methods. R. Baños et al. proposed a new parallel evolutionary algorithm for graph partitioning that mixed simulated annealing, tabu search, with selection mechanisms. F. Lardeux, F. Saubion and J.-K. Hao investigated hybrid evolutionary algorithms involving recombination operators specially designed for sat problems. This part ended with the presentation of B. Sareni, J. Regnier and X. Roboam on the efficiency of some crossover operators associated with self-adaptative procedures in case of real-encoded multi-objective genetic algorithms.
3. **Applications:** the difficult technological problem of optical fiber alignment has been efficiently solved using new genetic algorithms by M. Murakawa, H. Nosato and T. Higuchi. They incorporated a local-learning method to accelerate the alignment. K. Deb and A. R. Reddy dealt with a very large-sized scheduling problem often encountered in automated foundry: find an optimal sequence for casting a number of molds. A method for creating image classification is described by J. Korczak and A. Quirin. They used evolutionary operators applied to remote sensing data and derived well adapted classification rules to recognize large objects on the image as well as the smaller ones. M. Segond et al. adapted an ant algorithm to detect vortices structures in coastal waters, using data from hydro-dynamical simulations of the stream circulation. In order to speed up the selection of the flight aircraft by the controllers, D. Delahaye and S. Puechmorel presented a virtual keyboard whose optimal efficiency is relied to a NP_hard assignment problem. They applied it on real instances. A. B. Garmendia-Doval, S. D. Morley and S. Juhos proposed and applied cartesian genetic programming to evolve post-docking filters automatically for removing false positives from virtual hit sets.
4. **Implementation Issues:** an amount of various evolutionary algorithms are encountered in the literature. The graphic user interface (guide) of P. Collet and M. Schoenauer unified all kind of such algorithms and gave facilities to create quite new combinations. ParaDisEO is a framework using evolving objects in parallel and distributed computing which is efficiently applied for large combinatorial problems. S. Cahon et al. made use of this approach in three evolutionary models involving asynchronous migration and parallel or distributed evaluation, which are experimented on two real-word problems. Y. Yang, J. Vincent and G Littlefair proposed a new model of coarse-grained parallel genetic algorithm managing clustered groupings. They tested their approach on multi-modal optimization problems.
5. **Genetic Programming:** maintaining a structural diversity and controlling the code size are main challenges in genetic programming, a promising variant of evolutionary programming that produces solutions to problems

in the form of computer programs. A measure of genotypic and phenotypic diversity, based on the notions of entropy and variance, was applied by M. Tomassini et al. to three standard test problems, related to even parity, symbolic regression and artificial ant, while B. Wyns, S. Sette and L. Boullart introduced a self-improvement operator to reduce the effects of code growth.

The discrepancy, constantly encountered in genetic programming when the learning result issuing from training data is specialized over the entire distribution of instances, leads to the so-called overfitting that G. Paris, D. Robilliard and C. Fonlupt explored on two benchmarks and proposed guidelines to reduce its effect.

6. **Coevolution and Agent Systems:** evolutionary processes may be issued from various paradigms. In auction theory A. J. Bagnall and I. Toft gave an adaptive agent model using a basic learning mechanism for optimal strategy in common auction scenarios. The multi-population approach was used by F. Streichert et al. to extract global and local optima in multimodal search spaces: they proposed a niching like method associated to cluster analysis for identifying species from an initially undifferentiated population. In their contribution R. Gross and M. Dorigo showed how to obtain an efficient cooperative transport of a pray by two simple autonomous mobile robots without any inter-communication facility and very limited computational ability.
7. **Artificial Life:** the plant model considered by C. Lattaud is based on multi-agent systems, each agent being a plant organ and each plant being composed either of a unique organ or of three organs. This approach allowed to define interactions between plants throw a diffusion process of chemical substances (allellopathy model) and to simulate evolution of artificial plant communities. M. Annunziato et al. proposed an on-line adaptive control and optimization of complex processes, based on artificial environments.
8. **Cellular Automata:** the analyze presented by M. Giacobini, M. Tomassini, and A. Tettamanzi concerned the takeover time for selection mechanisms applied on a spatially structured population, involving circular cellular automata with synchronous or asynchronous propagation. Their theoretical approaches are corroborated by empirical results. A class of 2-D cellular automata are studied by E. Sapin, O. Bailleux, and J.-J. Chabier to search transition rules leading to automata that can be used to simulate the logic AND and NOT gates.
8. **Machine Learning:** methods for learning integrate evolutionary strategy and cover a large range of applications. M. C. Codrea et al. proposed a feature learning algorithm which is performed with an automatic identification of plant species from their fluorescence induction curves. Receiver Operating Characteristics (ROC) curves figure the dependency of the true positive rate with respect to the false positive one in test interpretations, and the area under the curve (AUC) is a popular learning criterion in medical data analysis. M. Sebag, J. Azé, and N. Lucas presented the ROGER algorithm

implementing an evolution-strategy based on optimization of the AUC criterion. Its performances were compared to those issuing from a support vector machine, namely SVMTorch. The last contribution by D. KAZAKOV and M. BARTLETT dealt with a model that simulated the evolution of language on the basis of learning communication systems.

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