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Simulated Evolution and Learning: An Introduction

XIN YAO
School of Computer Science, The University of Birmingham, Edgbaston, Birmingham B15 2TT, UK
x.yao@cs.bham.ac.uk

ROBERT I. McKAY
School of Computer Science, University College, The University of New South Wales, Australian Defence Force Academy, Canberra, ACT 2600, Australia
rim@cs.adfa.edu.au

Evolution and learning are two fundamental forms of adaptation. There has been a strong interest in recent years in exploring these two forms of adaptation and their roles and interactions in adaptive systems. The four papers included in this special issue study various aspects of simulated evolution and learning. They demonstrate that simulated evolution and learning can be applied to a wide range of problems, from game-playing to algorithm self-adaptation and from timetabling to numerical optimisation.

The four papers in this special issue originated from the *Second Asia-Pacific Conference on Simulated Evolution and Learning (SEAL'98)* held in Canberra, Australia, on 24–27 November 1998. They have been substantially extended and revised after the conference. All extended papers have been independently reviewed again.

Evolutionary optimization is one of the most active research areas in simulated evolution. Its attractiveness lies in its ability in dealing with complex, nondifferentiable (or even discontinuous) and multimodal functions. A key feature of evolutionary algorithms for optimization is self-adaptation. Two papers in this special issue investigate self-adaptation and propose improved self-adaptation schemes.

The paper by Ohkura et al. describes a new extension to evolution strategies (ES) for numerical global optimization. A robust ES algorithm is proposed to deal with the lower bound problem first identified by Liang et al. [1]. The new algorithm uses redundant neutral strategy parameters and new mutation mechanisms to improve self-adaptation.

The paper by Liang et al. analyses in detail how self-adaptation may fail in evolutionary algorithms and thus hinder the progress of evolutionary search. Two methods for self-adapting strategy parameters are proposed and tested experimentally. Both show good performance on a set of numerical optimization benchmark functions.

It is common wisdom that no algorithm is best for all possible problems [2]. Every algorithm has its own strength and weakness. Combining different techniques can often lead to a more effective algorithm for certain class of problems. Papers by Reiser and Riddle and by Burke et al. have showed exactly this point. Both have found that hybrid algorithms performed better than any individual algorithms.

The paper by Reiser and Riddle presents a novel approach to the combination of inductive logic programming and evolutionary algorithms. Two problems have been used as examples to show the effectiveness of this approach, including a real world problem in natural language processing. The experimental results show that the proposed approach performed significantly better than the conventional inductive logic programming approach when data is plentiful and noisy.

The paper by Burke et al. describes a number of heuristic algorithms, including evolutionary algorithms, that were applied to the nurse rostering problem. It is found that a hybrid algorithm that combines some of the best features of two or more heuristic algorithms tends to give better results than any single algorithms.

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References

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