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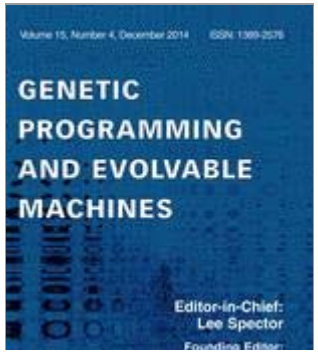
A learning automata-based memetic algorithm

Abstract

Combing a genetic algorithm (GA) with a local search method produces a type of evolutionary algorithm known as a memetic algorithm (MA). Combining a GA with a learning automaton (LA) produces an MA named GALA, where the LA provides the local search function. GALA represents chromosomes as object migration automata (OMAs), whose states represent the history of the local search process. Each state in an OMA has two attributes: the value of the gene (allele), and the degree of association with those values. The local search changes the degree of association between genes and their values. In GALA a chromosome's fitness is computed using only the value of the genes. GALA is a Lamarckian learning model as it passes on the learned traits acquired by its local search method to offspring by a modification of the genotype. Herein we introduce a modified GALA (MGALA) that behaves according to a Baldwinian learning model. In MGALA the fitness function is computed using a chromosome's fitness and the history of the local search recorded by the OMA states. In addition, in MGALA the learned traits are not passed to the offspring. Unlike GALA, MGALA uses all the information recorded in an OMA representation of the chromosome, i.e., the degree of association between genes and their alleles, and the value of a gene, to compute the fitness of genes. We used MGALA to solve two problems: object partitioning and graph isomorphism. MGALA outperformed GALA, a canonical MA, and an OMA-based method using computer simulations, in terms of solution quality and rate of convergence.



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