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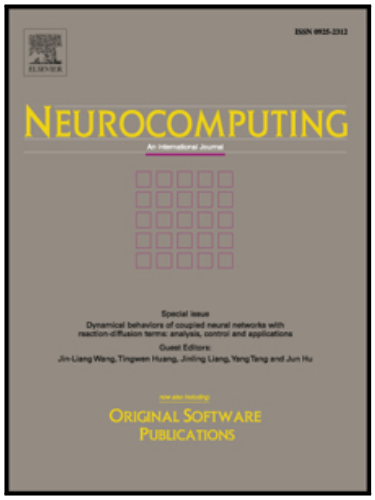

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Bat-inspired Algorithms with Natural Selection mechanisms for Global optimization

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Abstract

In this paper, alternative selection mechanisms in the bat-inspired algorithm for global optimization problems are studied. The bat-inspired algorithm is a recent swarm-based intelligent system which mimics the echolocation system of micro-bats. In the bat-inspired algorithm, the bats randomly fly around the best bat locations found during the search so as to improve their hunting of prey. In practice, one bat location from a set of best bat locations is selected. Thereafter, that best bat location is used by local search with a random walk strategy to inform other bats about the prey location. This selection mechanism can be improved using other natural selection mechanisms adopted from other advanced algorithms like Genetic Algorithm. Therefore, six selection mechanisms are studied to choose the best bat location: global-best, tournament, proportional, linear rank, exponential rank, and random. Consequently, six versions of bat-inspired algorithm are proposed and studied which are global-best bat-inspired algorithm (GBA), tournament bat-inspired algorithm (TBA), proportional bat-inspired algorithm (PBA), linear rank bat-inspired algorithm (LBA), exponential rank bat-inspired algorithm (EBA), and random bat-inspired algorithm (RBA). Using two sets of global optimization functions, the bat-inspired versions are evaluated and the sensitivity analysis of each version to its parameters are studied. Our results suggest that there are positive effects of the selection mechanisms on the performance of the classical bat-inspired algorithm which is GBA. For comparative evaluation, eighteen methods are selected using 25 IEEE-CEC2005 functions. The results show that the bat-inspired versions with various selection schemes observing the "survival-of-the-fittest" principle are largely competitive to established methods.

Keywords: Bat-inspired algorithm, Selection Scheme, Swarm intelligence, Global optimization

1. Introduction

In the global optimization context, the problem of finding the optimal values of the solution's decision variables in order to minimize/maximize certain criteria has captured the research communities attention over the years [1]. The global optimization problems are normally concerned with a continuous domain where the search space of the problem is unbounded in nature [2]. Over the years, the optimization methods have been proposed. Traditionally, the calculus-based methods are used with high computational efforts. However, the performance of such kind of methods is decreased when the complexity of the problem size is increased. To avoid such shortcoming, metaheuristic-based algorithms have come into play. The metaheuristic algorithms are a general class of methods that are applicable to tackle many kinds of optimization

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