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Adaptive Particle Swarm Optimization Algorithm for Dynamic Environments

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Many real world optimization problems are dynamic in which global optimum and local optimum change over time. Particle swarm optimization has performed well to find and track optimum in dynamic environments. In this paper, we propose a new particle swarm optimization algorithm for dynamic environments. The proposed algorithm utilizes FCM to adapt exclusion radios and utilize a local search on best swarm to accelerate progress of algorithm and adjust inertia weight adaptively. To improve the search performance, when the search areas of two swarms are overlapped, the worse swarms will be removed. Moreover, in order to track quickly the changes in the environment, all particles in the swarm convert to quantum particles when a change in the environment is detected. Experimental results on different dynamic environments modeled by moving peaks benchmark show that the proposed algorithm outperforms other PSO algorithms, for all evaluated environments.

Keywords MPB - Dynamic Environment - PSO - Moving Peaks

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Adaptive Particle Swarm Optimization Algorithm for Dynamic Environments

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Abstract. Many real world optimization problems are dynamic in which global optimum and local optimum change over time. Particle swarm optimization has performed well to find and track optimum in dynamic environments. In this paper, we propose a new particle swarm optimization algorithm for dynamic environments. The proposed algorithm utilizes FCM to adapt exclusion radios and utilize a local search on best swarm to accelerate progress of algorithm and adjust inertia weight adaptively. To improve the search performance, when the search areas of two swarms are overlapped, the worse swarms will be removed. Moreover, in order to track quickly the changes in the environment, all particles in the swarm convert to quantum particles when a change in the environment is detected. Experimental results on different dynamic environments modeled by moving peaks benchmark show that the proposed algorithm outperforms other PSO algorithms, for all evaluated environments.

Keywords: MPB, Dynamic Environment, PSO, Moving Peaks.

1 Introduction

PSO is relatively a new heuristic search method, this algorithm has successfully been utilized in variety of applications such as pattern recognition, image processing, machine learning, etc. PSO is an optimized algorithm which is inspired from social and group life of animals like birds in order to get the optimum solution. In PSO a group of particles are located in search area. Giving that each particle presents a candidate solution of the optimization problem. Location of each particle is driven from the best location which has ever met (in terms of self-experience) and location of the best neighborhood particles (in terms of neighborhood experience).

The applications in which the evolutionary algorithms are applied are divided in two parts: Static and Dynamic. Majority of the real world problems have dynamic nature and are subjected to change over the time. For example, the new tasks that are received continuously and must be scheduled. Parameters which effect the dynamic environment, the frequency of the change, severity of the change, predictability of the change, Cycle length and cycle accuracy. Dynamic environments are divided in to four sections based on defined settings: constant (identical change in each cycle), periodical, homogeneous and alternating [6].

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