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PARAMETER INVESTIGATION AND ANALYSIS FOR ELITE OPPOSITION BACTERIAL FORAGING OPTIMIZATION ALGORITHM

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ABSTRACT
The investigation and analysis of algorithm parameters is an important task in most of the global optimization techniques. However, finding the best set of parameter value for the optimum performance of an algorithm still remain a challenging task in a modified Bacteria Foraging Optimization Algorithm (BFOA) since most of the existing research focuses on the application of the algorithm and likewise it benchmarking with the global test function. The Elite Opposition Bacterial Foraging Optimization Algorithm (EOBFOA) is a modified nature inspired optimization algorithm from BFOA which focuses on the generation of an elite solution from the opposition solution for an optimization process. This research is focused on the investigation of such parameters population size, probability of elimination dispersal, step size and number of chemotaxis so as to determine the extent to which they affect the optimal solution from the EOBFOA with respect to global minimum or least minimum standard deviation. From the results obtained, it was observed that the global minimum in EOBFOA depend on the exploitation ability of the bacteria in the search space.

Keywords: BFOA, EOBFOA, elite solution, opposition solution, parameters.

1 INTRODUCTION

Every organism in life is faced with the problem of survival needs. The needs for survival ranges from the availability of water, food, minerals, sunlight and even oxygen for sufficient movement and growth. These resources are been acquired using different strategies, the behavioural process of using different strategies for survival is refer to as foraging (Hai, 2014). In optimization process foraging activities are relevant in providing inspiration for the design of different algorithms. The search for nutrient, the quality and quantity of the nutrient with the characteristics of the forager must also be taken into consideration during the algorithm development (Murugan, 2015). In the foraging search process, the ability of exploring the entire search space also depends on the elite individual participating in the foraging process (Naresh, 2011).

Some algorithms developed were obtained from biological processes which mimic the behaviour of some particular organisms (plants and/or animals). For example, Particle Swarm Optimization (PSO) proposed by Eberhart and Kennedy from the Social behaviour of bird and fish schooling, Genetic Algorithm (GA) proposed by Holand from genetics and Darwinian evolution theory, and the Ant Colony Optimization (ACO) developed by Dorigo based on the foraging behaviour of ants (Hanning, 2011). Nature inspired algorithms can be grouped into either population or trajectory-based. The population-based algorithms involve the use of agents that perform the search process so as to arrive or converge to a better solution. Whereas, the trajectory-based uses a single agent that moves through the design space (Mouayad, 2018).

The performance of nature inspired algorithms revolves around the exploration and exploitation abilities of the search agent during the search process in finding a good solution. The exploration process searches the entire search space so as to determine the possible region(s) of the best solution(s) while exploitation is a local search process that uses ideas from problem of interest to obtain a best possible solution from the outcome of exploration (Yang, 2014). In nature inspired algorithms, population size is one of the important parameters in the optimization process. In addition, it favours more of the exploration during the search process. The relationship between population size and dimension of the optimization problem is of great important. Varying the population size or selecting the right population can enhance the performance of the algorithm (Li, 2010).