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Research Article

Structured Clanning-Based Ensemble Optimization Algorithm: A Novel Approach for Solving Complex Numerical Problems

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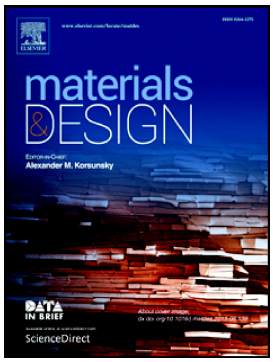
In this paper, a novel swarm intelligence-based ensemble metaheuristic optimization algorithm, called Structured Clanning-based Ensemble Optimization, is proposed for solving complex numerical optimization problems. The proposed algorithm is inspired by the complex and diversified behaviour present within the fission-fusion-based social structure of the elephant society. The population of elephants can consist of various groups with relationship between individuals ranging from mother-child bond, bond groups, independent males, and strangers. The algorithm tries to model this individualistic behaviour to formulate an ensemble-based optimization algorithm. To test the efficiency and utility of the proposed algorithm, various benchmark functions of different geometric properties are used. The algorithm performance on these test benchmarks is compared to various state-of-the-art optimization algorithms. Experiments clearly showcase the success of the proposed algorithm in optimizing the benchmark functions to better values.

1. Introduction

With the ever increasing demand for new and better utility-driven technologies, the challenges surrounding them are becoming more and more complex. These optimization problems were traditionally solved using classical deterministic methods [1], which were often quite efficient in finding the solutions. But the ever increasing complexity of these problems has made these classical techniques quite unreliable for various real-world engineering problems. Here, various metaheuristic optimization [1] algorithms prove to be quite successful. Often inspired by nature, these algorithms makes use of various stochastic [2] techniques for finding the solution. These metaheuristics are higher-level heuristics that try to find a partial solution called heuristic representing a sufficiently good solution to the optimization problem [3–6]. The presence of randomness drives the algorithms towards promising regions of the search space. Simplicity of use, high reliability, and high flexibility has made these algorithms quite popular in last few years [7].

Among these algorithms, many are based on multiagent paradigms. These include various evolutionary algorithms [8] inspired by the evolutionary mechanisms found in nature. These algorithms [9–15] use various mechanisms like crossover, mutation, and selection for solving the optimization problems. Among the most popular metaheuristic, GA [9] was proposed by Holland in 1970s. It represents the information in the form of genetic representation as bits and performs evolutionary processes like selection, mutation, and crossover on it. Other population-based algorithms utilize swarm intelligence-based mechanisms [16–20] to solve the optimization problem. These algorithms make use of information distributed in the individual participants of the swarm. The lack of any central control structure makes it vital for the distributed information to be shared amongst the individuals of the swarm. The interaction between these individuals leads to



Polymer-metal-polymer (PMP) multilayer transparent electrode for organic optoelectronics

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Polymer-Metal-Polymer (PMP) Multilayer Transparent Electrode for Organic Optoelectronics

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