

Fibonacci-Distribution-Based Optimization Algorithm: Design, Analysis and Comparison with Migrating Birds Optimization

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Abstract

Nature-inspired metaheuristic optimization algorithms have become powerful tools for solving difficult engineering and scientific problems that are nonlinear, multimodal and high-dimensional. In this paper, we propose a new population-based metaheuristic called **Fibonacci Distribution Optimization (FDO)**. The algorithm is inspired by the Fibonacci sequence and its relationship with the golden ratio, which has been widely used in one-dimensional search methods such as Fibonacci and golden-section search. In FDO, candidate solutions are ranked and their movement intensities are distributed according to normalized Fibonacci numbers, generating a balance between global exploration and local exploitation. After describing the mathematical model, flowchart and pseudocode of FDO, we apply the algorithm to the two-dimensional minimization problem and compare its performance with the well-known Migrating Birds Optimization (MBO) algorithm.

$$z(x, y) = (x - 2)^2 + (y - 5)^2$$

Furthermore, FDO is tested on five standard benchmark functions (Sphere, Rosenbrock, Rastrigin, Ackley and Griewank) and its results are conceptually compared with MBO. For each problem we report the best solution coordinates, corresponding function values and normalized computational times. The results illustrate that FDO achieves competitive performance with MBO, with slightly faster convergence on smooth unimodal functions and comparable accuracy on multimodal landscapes.

Keywords

Fibonacci sequence; golden ratio; nature-inspired metaheuristics; Fibonacci search; migrating birds optimization; global optimization; benchmark functions.