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Improved Naked Mole-Rat Algorithm Based on Variable Neighborhood Search for the N-Queens Problem

Samer Alaa Hussein*, Idrees A. Zahid

Information Technology Center, University of Technology, Baghdad, Iraq

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Abstract

Solving problems via artificial intelligence techniques has widely prevailed in different aspects. Implementing artificial intelligence optimization algorithms for NP-hard problems is still challenging. In this manuscript, we work on implementing the Naked Mole-Rat Algorithm (NMRA) to solve the n-queens problems and overcome the challenge of applying NMRA to a discrete space set. An improvement of NMRA is applied using the aspect of local search in the Variable Neighborhood Search algorithm (VNS) with 2-opt and 3-opt. Introducing the Naked Mole Rat algorithm based on variable neighborhood search (NMRAVNS) to solve N-queens problems with different sizes. Finding the best solution or set of solutions within a plausible amount of time is the main goal of the NMRAVNS algorithm. The improvement of the proposed algorithm boosts the exploitation capability of the basic NMRA and gives a greater possibility, with the emerging search strategies, to find the global best solution. This algorithm proved successful and outperformed other algorithms and studies with a remarkable target. A detailed comparison is performed, and the data results are presented with the relevant numbers and values. NMRA and NMRAVNS comparisons are implemented and recorded. Later on, a comparison between the Meerkat Clan Algorithm, Genetic Algorithm, Particle Swarm Optimization, and NMRAVNS is tested and presented. Finally, NMRAVNS is evaluated against the examined genetic-based algorithm and listed to prove the success of the proposed algorithm. NMRAVNS outperformed previous findings and scored competitive results with a high number of queen sizes, where an average time reduction reached about 87% of other previous findings.

Keywords: naked mole-rat algorithm, n-queens problems, optimization, artificial intelligence, variable neighborhood search.