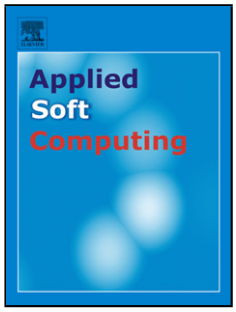

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Routing optimization of emergency grain distribution vehicles using the immune ant colony optimization algorithm

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Highlights

- The grain emergency vehicle scheduling model was established and solved by using the improved and optimized IACO algorithm.
- A hybrid algorithm was proposed to address the shortcomings of standard metaheuristic algorithms.
- Several common optimization algorithms were employed to assess IACO performance.
- This study demonstrated the effectiveness of IACO for emergency grain distribution optimization problem.

Abstract: The routing optimization problem of grain emergency vehicle scheduling with three objectives is studied in this paper. The objectives are: maximizing satisfaction of the needs at the emergency grain demand points, minimizing total cost of grain distribution and minimizing the distribution time. A hybrid algorithm is present to solve the proposed problem based on combining artificial immune and ant colony optimization (ACO) algorithms. This hybrid algorithm calculates the degree of crowding and conducts non-dominated sorting of the population in the ant colony optimization algorithm by applying a Pareto optimization model. A better solution set is quickly generated by making use of the fast global convergence and randomness of the improved immune algorithm together with the distributed search ability and positive feedback of the ACO algorithm. A better solution set obtained as the initial pheromone distribution, is solved further by using ACO until the approximate optimal solution set is obtained. A comparison of the proposed algorithm with several common optimization algorithms on the Solomon benchmark dataset demonstrates that this method obtains better performance in shorter time, and is an efficient way to solve the vehicle routing problem in emergency grain distribution scenarios.

Keywords: grain emergency logistics; immune ant colony optimization; routing optimization