Optimizing Emergency Rescue Center Layouts: A Backpropagation Neural Networks-Genetic Algorithms Method

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Abstract : In the face of natural disasters and other emergency situations, determining the optimal location of rescue centers is crucial for improving rescue efficiency and minimizing impact on affected populations. This paper proposes a method that integrates genetic algorithms (GA) and backpropagation neural networks (BPNN) to address the site selection optimization problem for emergency rescue centers. We utilize BPNN to accurately estimate the cost of delivering supplies from rescue centers to each temporary camp. Moreover, a genetic algorithm with a special partially matched crossover (PMX) strategy is employed to ensure that the number of temporary camps assigned to each rescue center adheres to predetermined limits. Using the population distribution data during the 2022 epidemic in Jiading District, Shanghai, as an experimental case, this paper verifies the effectiveness of the proposed method. The experimental results demonstrate that the BPNN-GA method proposed in this study outperforms existing algorithms in terms of computational efficiency and optimization performance. Especially considering the requirements for computational resources and response time in emergency situations, the proposed method shows its ability to achieve rapid convergence and optimal performance in the early and mid-stages. Future research could explore incorporating more real-world conditions and variables into the model to further improve its accuracy and applicability.

Keywords : emergency rescue centers, genetic algorithms, back-propagation neural networks, site selection optimization
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