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Metaheuristics-Based Feature Selection for Cancer Diagnosis Using Medical Imaging and Deep Learning

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Abstract:

Accurate and efficient cancer diagnosis through medical imaging requires the selection of relevant features that enhance classification performance while minimizing computational complexity. This study introduces a hybrid framework that integrates deep learning with metaheuristics-based feature selection techniques to improve diagnostic accuracy in medical image analysis. Convolutional Neural Networks (CNNs) are employed to extract high-dimensional features from imaging modalities such as MRI, CT, and histopathology. To address the challenge of redundant or irrelevant features, metaheuristic algorithms—including Genetic Algorithms (GA), Particle Swarm Optimization (PSO), and Ant Colony Optimization (ACO)—are used to identify optimal subsets of discriminative features. The selected features are then fed into classification models for final diagnosis. Experimental results demonstrate that the proposed approach significantly improves performance metrics such as accuracy, sensitivity, and specificity compared to conventional methods. This intelligent diagnostic system holds promise for aiding clinicians in early and reliable cancer detection.

Keywords:

Metaheuristics, feature selection, cancer diagnosis, medical imaging, deep learning, CNN.

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