Mandar Angchekar: 386916341
Evolutionary Machine Learning

Differential Evolution vs. Genetic Algorithm

Introduction
This comparative report focuses on the application of Differential Evolution (DE) and Genetic Algorithm (GA) to the Wisconsin Diagnostic Breast Cancer (WDBC) dataset, aiming to enhance the predictive accuracy of cancer diagnostics. The WDBC dataset contains computed features from Fine Needle Aspirate (FNA) images of breast masses, classified as malignant (M) or benign (B), which are pivotal in the medical field for early cancer detection.

Dataset Description
The WDBC dataset consists of features derived from FNA images of breast masses, each with a unique ID and a binary label indicating the diagnosis. The dataset's integration into machine learning models offers the potential for developing more precise diagnostic tools.

Methodology
Differential Evolution (DE)

- Initial Population Fitness: Values ranged from 0.5 to 0.92, with an initial best fitness of 0.92.
- Population Size: 10
- Progress: Incremental fitness improvements observed across generations.
- Best Solution: Achieved a fitness of 0.94 by the 100th generation.
- F = 0.6, CR = 0.7

Genetic Algorithm (GA)

- Population Size: 1200 individuals.
- Initial Max Fitness: 0.94.
- Progress: Steady improvement in average and best fitness, with a best overall fitness reaching 0.955 by the 100th generation.

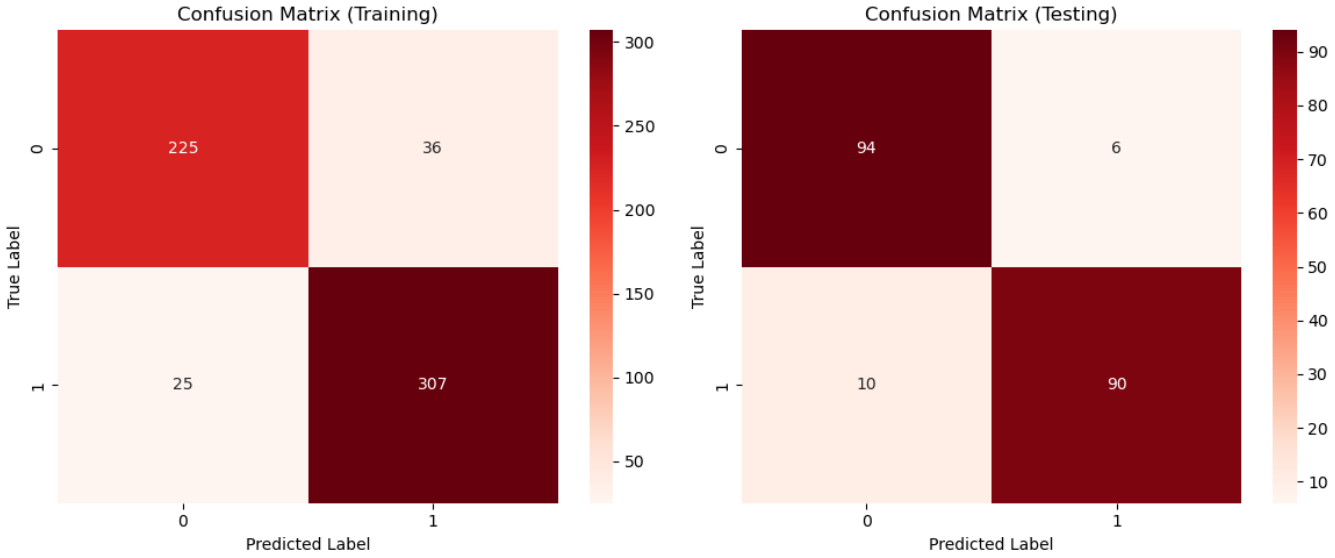
Results
Performance Evaluation

- DE: The best fitness reached was 0.94.
- GA: The best overall fitness recorded was 0.955, indicating a marginally superior optimization capability.

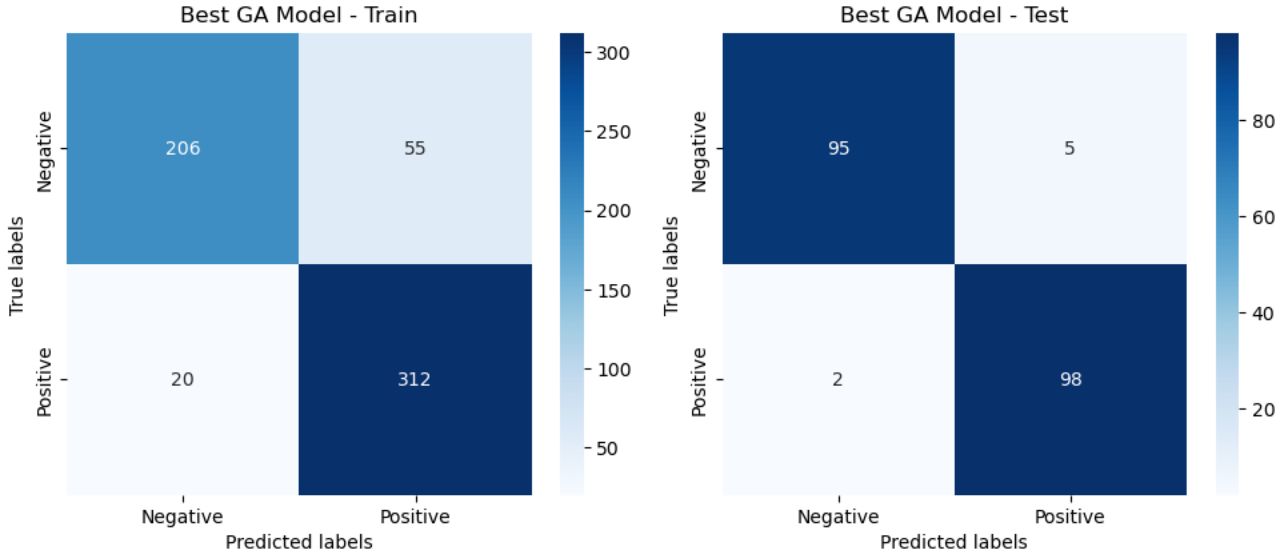
Confusion Matrices Analysis
The confusion matrices for GA show an excellent performance on the test set with an extremely low FN rate, indicating high sensitivity and a strong ability to correctly identify malignant cases. DE shows a higher number of FNs on the test set, which in a medical setting could be a significant concern. GA's higher TN count on the test set also suggests better specificity compared to DE.

Mandar Angchekar: 386916341
Evolutionary Machine Learning

Differential Evolution Algorithm:



Genetic Algorithms:



Conclusion

The results highlight GA's refined predictive performance, both in training and testing phases, for the WDBC dataset. While GA's optimization process may have benefited from the larger population size allowing for a more thorough search of the solution space, DE's performance suggests it still offers a reliable alternative, especially when computational resources are limited. Both algorithms are effective, but the GA, particularly with its high sensitivity, may offer a more reliable solution for medical diagnostic tools where the correct identification of malignant cases is paramount.