Data loaded: 44 features.

Training set size: 186, Testing set size: 81

--------------------------------------------------

--- Building Natural Neighbor graph ---

r=2, samples with 0 NaNs: 91

r=3, samples with 0 NaNs: 76

r=4, samples with 0 NaNs: 66

r=5, samples with 0 NaNs: 64

r=6, samples with 0 NaNs: 57

r=7, samples with 0 NaNs: 54

r=8, samples with 0 NaNs: 48

r=9, samples with 0 NaNs: 44

r=10, samples with 0 NaNs: 42

Natural Neighbor graph constructed.

--- Identifying boundary majority samples using Natural Neighbors ---

Identified 23 majority samples on the boundary.

--------------------------------------------------

--- Building k-NN model for expansion mechanism (k=3) ---

--- Starting AdaBoost Training with Expansionary Boundary Flipping ---

Iteration 1/100: G-Mean=0.395, Flipped=0 samples

-> Generating visualization for iteration 1...

Iteration 2/100: G-Mean=0.395, Flipped=6 samples

Iteration 3/100: G-Mean=0.800, Flipped=17 samples

Iteration 4/100: G-Mean=0.757, Flipped=21 samples

Iteration 5/100: G-Mean=0.757, Flipped=24 samples

Iteration 6/100: G-Mean=0.757, Flipped=22 samples

Iteration 7/100: G-Mean=0.757, Flipped=21 samples

Iteration 8/100: G-Mean=0.751, Flipped=22 samples

Iteration 9/100: G-Mean=0.739, Flipped=21 samples

Iteration 10/100: G-Mean=0.754, Flipped=26 samples

Iteration 11/100: G-Mean=0.754, Flipped=26 samples

Iteration 12/100: G-Mean=0.754, Flipped=22 samples

Iteration 13/100: G-Mean=0.757, Flipped=22 samples

Iteration 14/100: G-Mean=0.757, Flipped=23 samples

Iteration 15/100: G-Mean=0.760, Flipped=21 samples

Iteration 16/100: G-Mean=0.760, Flipped=22 samples

Iteration 17/100: G-Mean=0.760, Flipped=20 samples

Iteration 18/100: G-Mean=0.760, Flipped=27 samples

Iteration 19/100: G-Mean=0.760, Flipped=22 samples

Iteration 20/100: G-Mean=0.745, Flipped=23 samples

-> Generating visualization for iteration 20...

Iteration 21/100: G-Mean=0.739, Flipped=21 samples

Iteration 22/100: G-Mean=0.742, Flipped=19 samples

Iteration 23/100: G-Mean=0.745, Flipped=19 samples

Iteration 24/100: G-Mean=0.745, Flipped=17 samples

Iteration 25/100: G-Mean=0.745, Flipped=18 samples

Iteration 26/100: G-Mean=0.745, Flipped=23 samples

Iteration 27/100: G-Mean=0.742, Flipped=19 samples

Iteration 28/100: G-Mean=0.745, Flipped=23 samples

Iteration 29/100: G-Mean=0.745, Flipped=26 samples

Iteration 30/100: G-Mean=0.800, Flipped=25 samples

Iteration 31/100: G-Mean=0.789, Flipped=18 samples

Iteration 32/100: G-Mean=0.739, Flipped=18 samples

Iteration 33/100: G-Mean=0.742, Flipped=23 samples

Iteration 34/100: G-Mean=0.724, Flipped=28 samples

Iteration 35/100: G-Mean=0.742, Flipped=17 samples

Iteration 36/100: G-Mean=0.742, Flipped=19 samples

Iteration 37/100: G-Mean=0.742, Flipped=23 samples

Iteration 38/100: G-Mean=0.742, Flipped=17 samples

Iteration 39/100: G-Mean=0.742, Flipped=20 samples

Iteration 40/100: G-Mean=0.742, Flipped=22 samples

-> Generating visualization for iteration 40...

Iteration 41/100: G-Mean=0.742, Flipped=16 samples

Iteration 42/100: G-Mean=0.742, Flipped=23 samples

Iteration 43/100: G-Mean=0.729, Flipped=23 samples

Iteration 44/100: G-Mean=0.742, Flipped=24 samples

Iteration 45/100: G-Mean=0.742, Flipped=20 samples

Iteration 46/100: G-Mean=0.812, Flipped=19 samples

Iteration 47/100: G-Mean=0.798, Flipped=22 samples

Iteration 48/100: G-Mean=0.812, Flipped=24 samples

Iteration 49/100: G-Mean=0.812, Flipped=20 samples

Iteration 50/100: G-Mean=0.812, Flipped=17 samples

Iteration 51/100: G-Mean=0.812, Flipped=19 samples

Iteration 52/100: G-Mean=0.812, Flipped=24 samples

Iteration 53/100: G-Mean=0.812, Flipped=24 samples

Iteration 54/100: G-Mean=0.812, Flipped=22 samples

Iteration 55/100: G-Mean=0.739, Flipped=20 samples

Iteration 56/100: G-Mean=0.754, Flipped=24 samples

Iteration 57/100: G-Mean=0.795, Flipped=22 samples

Iteration 58/100: G-Mean=0.751, Flipped=23 samples

Iteration 59/100: G-Mean=0.751, Flipped=21 samples

Iteration 60/100: G-Mean=0.809, Flipped=25 samples

-> Generating visualization for iteration 60...

Iteration 61/100: G-Mean=0.809, Flipped=18 samples

Iteration 62/100: G-Mean=0.809, Flipped=19 samples

Iteration 63/100: G-Mean=0.809, Flipped=22 samples

Iteration 64/100: G-Mean=0.809, Flipped=20 samples

Iteration 65/100: G-Mean=0.795, Flipped=17 samples

Iteration 66/100: G-Mean=0.795, Flipped=20 samples

Iteration 67/100: G-Mean=0.795, Flipped=20 samples

Iteration 68/100: G-Mean=0.809, Flipped=21 samples

Iteration 69/100: G-Mean=0.809, Flipped=22 samples

Iteration 70/100: G-Mean=0.795, Flipped=20 samples

Iteration 71/100: G-Mean=0.795, Flipped=22 samples

Iteration 72/100: G-Mean=0.795, Flipped=25 samples

Iteration 73/100: G-Mean=0.795, Flipped=25 samples

Iteration 74/100: G-Mean=0.795, Flipped=26 samples

Iteration 75/100: G-Mean=0.795, Flipped=24 samples

Iteration 76/100: G-Mean=0.795, Flipped=29 samples

Iteration 77/100: G-Mean=0.795, Flipped=23 samples

Iteration 78/100: G-Mean=0.795, Flipped=23 samples

Iteration 79/100: G-Mean=0.795, Flipped=24 samples

Iteration 80/100: G-Mean=0.795, Flipped=20 samples

-> Generating visualization for iteration 80...

Iteration 81/100: G-Mean=0.795, Flipped=22 samples

Iteration 82/100: G-Mean=0.795, Flipped=20 samples

Iteration 83/100: G-Mean=0.795, Flipped=21 samples

Iteration 84/100: G-Mean=0.795, Flipped=18 samples

Iteration 85/100: G-Mean=0.795, Flipped=22 samples

Iteration 86/100: G-Mean=0.795, Flipped=18 samples

Iteration 87/100: G-Mean=0.795, Flipped=20 samples

Iteration 88/100: G-Mean=0.795, Flipped=21 samples

Iteration 89/100: G-Mean=0.795, Flipped=24 samples

Iteration 90/100: G-Mean=0.795, Flipped=24 samples

Iteration 91/100: G-Mean=0.795, Flipped=22 samples

Iteration 92/100: G-Mean=0.754, Flipped=18 samples

Iteration 93/100: G-Mean=0.757, Flipped=22 samples

Iteration 94/100: G-Mean=0.754, Flipped=22 samples

Iteration 95/100: G-Mean=0.757, Flipped=23 samples

Iteration 96/100: G-Mean=0.757, Flipped=16 samples

Iteration 97/100: G-Mean=0.798, Flipped=14 samples

Iteration 98/100: G-Mean=0.798, Flipped=23 samples

Iteration 99/100: G-Mean=0.798, Flipped=24 samples

Iteration 100/100: G-Mean=0.798, Flipped=20 samples

-> Generating visualization for iteration 100...

--- Model Training Finished ---

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--- Performance Metrics on Test Set ---

Accuracy: 0.827

Precision: 0.917

Recall: 0.859

F1-Score: 0.887

G-Mean: 0.779

AUC: 0.837