

## ABSTRAK

*Stroke is a leading cause of death and disability globally. Machine learning prediction models often faces significant class imbalance challenges, creating bias toward the majority class with low sensitivity. This study compares Decision Tree (CART) and Random Forest for stroke risk prediction using a sensitivity-based framework focusing on minimizing false negatives. A public dataset with 5110 samples (1:19 ratio) was split using an 80:20 ratio, resulting in 4088 training data (199 strokes) and 1022 test data (50 strokes). Preprocessing included the imputation of 201 missing BMI values using the median. Evaluation was conducted through three scenarios: baseline, SMOTE, and recall-based optimization, using Repeated Stratified 5-Fold Cross-Validation (3 repetitions). Comprehensive analysis included probability calibration, risk stratification, feature importance, and McNemar's test. Baseline CART achieved 91.19% accuracy with 0.22 recall (39 false negatives), while baseline Random Forest achieved 94.62% accuracy with 0.02 recall (49 false negatives). SMOTE application resulted in CART recall of 0.16 (42 false negatives) and Random Forest 0.10 (45 false negatives). Optimized CART achieved 0.80 recall (10 false negatives), 0.136 precision, and 74.07% accuracy, optimized Random Forest achieved 0.34 recall (33 false negatives). McNemar's test showed a significant difference ( $p=2.38 \times 10^{-7}$ ). Optimized CART had a Brier Score of 0.1496 and produced a relative risk of 9.13 between High Risk and Low Risk groups. Overall, optimized CART demonstrated better performance than Random Forest for stroke prediction on imbalanced data, with an acceptable precision trade-off for clinical screening applications.*

**Keywords:** *Decision Tree, Machine Learning, Random Forest, Sensitivity, Stroke.*