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ARTICLE

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OPTIMIZED ML STRATEGIES FOR EARLY DETECTION AND CATEGORIZATION OF HEART FAILURE

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The heart is one of the most important organs in the human body, next to the brain. When the heart does not function properly, it affects the entire body. Heart failure (HF) is a long-term health condition that slowly becomes more serious with time and remains a major concern across the world. It is linked to high rates of illness and death, especially when the problem is not detected in its early stages. This project studies how machine learning methods can be used and improved to help in the early detection and classification of heart failure. The main aim is to assist doctors in making better decisions and to improve patient care. For this study, clinical datasets that are freely available, such as those from the UCI Machine Learning Repository, are used along with hospital medical records. Different machine learning techniques, including Logistic Regression and Random Forest, are applied during the analysis. To obtain reliable results, careful data preprocessing and feature engineering techniques are carried out to improve the quality of the data and the performance of the models. Each model is evaluated using widely accepted measures such as accuracy, precision, recall, F1-score, and the AUC-ROC curve. In addition, styles similar as hyperparameter tuning and cross-validation are applied to optimize model performance and ameliorate their capability to generalize to unseen data. In this environment, machine literacy offers a strong advantage by enabling the analysis of complex, high- dimensional clinical data to identify retired patterns and directly prognosticate issues.