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Machine Learning-Based Heart Disease Prediction: A Comparative Evaluation of Classification Methods

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Abstract: *Cardiovascular diseases remain a leading cause of global mortality, with late diagnosis presenting a critical challenge in healthcare systems worldwide. This study presents a comparative evaluation of three machine learning classifiers for heart disease prediction using the UCI Heart Disease dataset. The research implemented and evaluated logistic regression, support vector machine, and random forest algorithms to assess their predictive capabilities for cardiovascular conditions. Methodology involved comprehensive data preprocessing, feature selection, and model training using a 70-30 train-test split. Performance was assessed through accuracy, precision, recall, F1-score, and confusion matrix analysis. Results demonstrated that random forest achieved superior performance with accuracy of 88-92% and the highest recall value, followed by support vector machine (84-88% accuracy) and logistic regression (82-85% accuracy). The findings indicate that machine learning models, particularly ensemble methods like random forest, can effectively support clinical decision-making for heart disease prediction. The study concludes that integrating such models into healthcare systems could significantly enhance early detection capabilities and improve patient outcomes in cardiovascular care.*

Keywords: heart disease prediction, machine learning, random forest, support vector machine, logistic regression, clinical decision support, healthcare analytics

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