ABSTRACT

Heart disease is a major global health concern, requiring accurate and efficient predictive models for early diagnosis and intervention. Traditional manual diagnostic methods face challenges such as complex data interpretation, symptom variability, and the need for specialized expertise. Machine learning techniques offer a data-driven approach to overcoming these limitations, improving early detection, reducing healthcare costs, and enhancing patient care. This study employs an optimized Support Vector Machine (SVM) model for heart disease prediction, leveraging hyperparameter tuning techniques such as Grid Search, Bayesian Optimization, and Randomized Search. The model's performance is compared against a baseline FCMIM-SVM (Fast Conditional Mutual Information Maximization with SVM) model to assess the impact of optimization. The heart disease dataset consists of 1,190 patient records and 12 clinical attributes, including age, sex, chest pain type, blood pressure, cholesterol, fasting blood sugar, ECG results, heart rate, and other diagnostic parameters. Feature selection is applied using FCMIM to retain the most relevant predictors. Experimental results indicate that the optimized Grid Search SVM model achieved the highest classification performance, with an accuracy of 89.49%, precision of 89%, recall of 91%, and an F1-score of 89%, outperforming both the baseline and other optimized models. These findings highlight the effectiveness of hyperparameter tuning in enhancing predictive accuracy, reinforcing the potential of machine learning in medical diagnosis.