International Journal of Innovative Research of Science, Engineering and Technology (IJIRSET)

Impact Factor 8.699

|www.ijirset.com |A Monthly, Peer Reviewed & Refereed Journal| e-ISSN: 2319-8753| p-ISSN: 2347-6710|

Volume 14, Issue 3, March 2025

|DOI: 10.15680/IJIRSET.2025.1403001|

Heart Disease Prediction Through Machine Learning in Digital Healthcare

Dr.D.J.Samatha Naidu, K.Venkata Ramya, K.Mamatha

Professor, Department of Computer Studies, APGCCS, New Boyanapalli,Rajampet, AP, India

Assistant Professor, Department of Computer Studies, APGCCS, New Boyanapalli,Rajampet, AP, India

Student, Department of Computer Studies, APGCCS, , New Boyanapalli,Rajampet, AP, India

ABSTRACT: The Project discusses a system for diagnosing heart disease using machine learning techniques. The system employs various classification algorithms such as Support Vector Machine (SVM), Logistic Regression, Artificial Neural Networks, K-Nearest Neighbor, Naïve Bayes, and Decision Trees. It also integrates standard feature selection algorithms (Relief, Minimal Redundancy Maximal Relevance, Least Absolute Shrinkage Selection Operator, and Local Learning) to remove irrelevant and redundant features. Additionally, the paper proposes a novel fast conditional mutual information feature selection algorithm to improve accuracy and reduce execution time. Experimental results demonstrate that the proposed feature selection algorithm works effectively with SVM, offering a high-level intelligent system for accurate heart disease identification.

KEYWORDS: **Heart disease classification, features selection, disease diagnosis, intelligent system,**

medical data analytics

I. INTRODUCTION

Heart disease (HD) is a critical health issue affecting millions globally, with common symptoms like shortness of breath, body weakness, and swollen feet. Early detection of HD is crucial but challenging due to issues with accuracy and execution time in traditional diagnosis methods. Current diagnostic techniques, relying on medical history, physical examinations, and symptom analysis, often lack precision and are costly. To improve this, researchers are developing non-invasive diagnostic systems based on machine learning (ML) classifiers, which offer more efficient and accurate identification of HD.

Machine learning models can significantly enhance predictive capabilities when trained on balanced datasets and relevant features. Data preprocessing techniques like data standardization, missing value removal, and feature extraction are essential for improving model performance. Feature selection methods such as LASSO, MRMR, PCA, and optimization techniques like Ant Colony Optimization (ACO) and Bacterial Foraging Optimization (BFO) further improve the accuracy of these models. However, challenges in feature selection persist, especially with big data, where high-dimensional data requires efficient handling to reduce complexity and maintain stability.

II. LITERATURE SURVEY

Various machine learning (ML) techniques have been proposed in the literature to diagnose heart disease (HD). These methods use different classifiers, and their accuracy varies:

- Detrano et al. achieved 77% accuracy using global evolutionary methods and feature selection with the Cleveland dataset.
- Gudadhe et al. used multi-layer perceptron and support vector machine (SVM) and achieved 80.41% accuracy.
- Humar et al. integrated neural networks with fuzzy logic, reaching 87.4% accuracy.
- Resul et al. used an ensemble of artificial neural networks (ANNs), achieving 89.01% accuracy, with good sensitivity and specificity.
- Akil et al. used the ANN-DBP algorithm with feature selection and reported strong performance.
- Palaniappan et al. proposed a system with Naive Bayes (NB), Decision Tree (DT), and ANN classifiers, achieving up to 88.12% accuracy with ANN.

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- Olaniyi et al. used ANN for angina HD prediction, with 88.89% accuracy.
- Samuel et al. integrated ANN and Fuzzy AHP for HD diagnosis, achieving 91.10% accuracy.
- Liu et al. used relief and rough set techniques to reach 92.32% accuracy.
- MOHAN et al. proposed a hybrid machine learning method, achieving 88.07% accuracy.
- Geweid et al. used an improved SVM-based technique for HD identification.

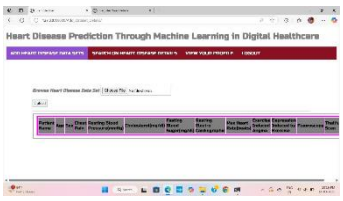
Despite these advancements, the main challenges in these methods include low prediction accuracy and high computation time. These issues are often due to the inclusion of irrelevant features in the datasets. The need for better prediction accuracy and more efficient computational methods remains a significant research gap, highlighting the importance of developing new techniques for improved HD diagnosis.

III. METHODOLOGY

Software Testing is a critical element of software quality assurance and represents the ultimate review of specification, design and coding, Testing presents an interesting anomaly for the software engineer**.** This testing is also called as glass box testing. In this testing, by knowing the specified function that a product has been designed to perform test can be conducted that demonstrates each function is fully operation at the same time searching for errors in each function. It is a test case design method that uses the control structure of the procedural design to derive test cases. In Blackbox testing by knowing the internal operation of a product, tests can be conducted to ensure that “all gears mesh”, that is the internal operation performs according to specification and all internal components have been adequately exercised. It fundamentally focuses on the functional requirements of the software.

IV. PRESENTS AN INTERESTING ANOMALY FOR THE SOFTWARE ENGINEER**. EXPERIMENTAL RESULTS**

Thus the experimental results show that the proposed features selection algorithm select features that are more effective and obtains high classification accuracy than the standard feature selection algorithms. According to feature selection algorithms, the most important and suitable features are Thallium Scan type chest pain and Exercise induced Angina. All FS algorithms results show that the feature Fasting blood sugar (FBS) is not a suitable heart disease diagnosis. A little improvement in prediction accuracy have great intense in diagnosis of critical diseases. The novelty of the study is developing a diagnosis system
for identification of heart disease. attak



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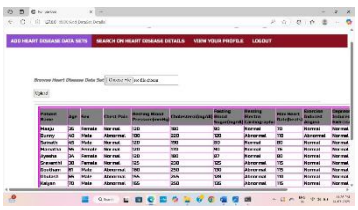

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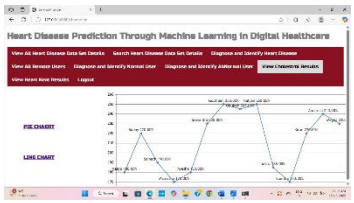

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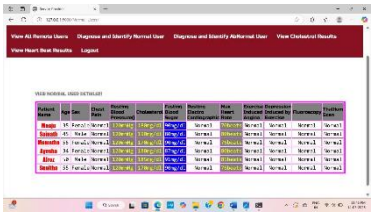

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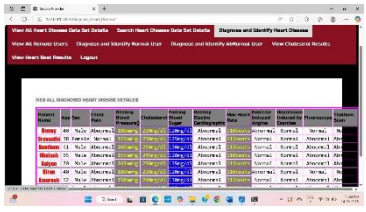

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Fig a, shows the patient details of Heart Disease and remaining figures shows about the how many patients have the normal and ub-normal condition in the form of line chart

VI. CONCLUSION

The study presents a machine learning-based diagnosis system for heart disease using classifiers such as Logistic Regression (LR), K-Nearest Neighbors ((d) (e) ector Machine (SVM), Naïve Bayes (NB), and Decision Tree (DT).Experimental results indicate that Logistic Regression with Relief, LASSO, FCMIM, and LLBFS performs best in processing time compared to MRMR and other classifiers. The proposed FCMIM algorithm effectively selects features, leading to higher classification accuracy. Key features identified for heart disease diagnosis include Thallium Scan type, chest pain, and exercise-induced angina, while fasting blood sugar (FBS) is found to be an unsuitable diagnostic feature. The study highlights the significance of small improvements in prediction accuracy for diagnosing critical diseases and emphasizes the potential of machine learning-based decision support systems for heart disease diagnosis.

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ISSN INTERNATIONAL STANDARD SERIAL NUMBER INDIA

P. Kumar
Editor-in-Chief

www.ijirset.com ijirset@gmail.com

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