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E-Mail :
editor.ijasem@gmail.com
editor@ijasem.org

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Methods for Improving the Precision of Heart Disease Classification Using Hybrid Machine Learning

[1] S. Venkateswara Rao, [2] G.Srilakshmi,

[1]Assistant Professor, Megha Institute of Engineering & Technology for Women, Ghatkesar.
[2]MCA Student, Megha Institute of Engineering & Technology for Women, Ghatkesar.

Abstract—

Researchers have shown a lot of interest in the field of medical science. Many researchers have pinpointed many causes of early death in humans. There are many potential causes of illness, and the relevant research has established that cardiovascular illnesses are one of them. A large number of researchers have put forth unique approaches to save lives and aid medical professionals in the detection, prevention, and management of cardiovascular disease. Every effective plan has its limitations, but there are several easy approaches that help the expert make a conclusion. In addition to two feature selection approaches, Correlation Based Feature Selection (CFS) and Gain Ratio, the suggested method thoroughly examines an act of Hidden Markov Model (HMM), Artificial Neural Network (ANN), Support Vector Machine (SVM), and Decision Tree J48. The Ranker approach is complemented by the Gain Ratio when applied to a separate set of statistics. The proposed approach analyses the process and then intelligently constructs Naive Bayes processing by combining the two best processes using an appropriate layered architecture. Choosing the best approach and comparing the available schemes with various features for statistical analysis is the primary goal at the outset.

Keywords—

Neural networks, supervised machine learning, Naïve Bayes, classification techniques, and machine learning

I. INTRODUCTION

While a number of similar publications provide numerous implication-based, handy approaches, none of these ways really help professionals in any way, shape, or form [1-4]. Thus, more research is made possible by the development and use of these methodologies. Furthermore, the data mining technique outperforms other methods, according to the given study [5-8]. This chapter explains the contribution in the direction to enhance the system's QoS by discussing the study aims, motivation, and significant results. Instead of using a whole set of features linked with the chosen dataset, selection and formation are the best features to use.

II. ISSUES WITH PREDICTION SYSTEM

Maintaining accuracy with the fluctuation of data attributes is a challenge since many of the existing algorithms' approaches are not suitable to assist experts in diverse areas, rely heavily on the statistics used, and so on. 2) Since most algorithms were designed to complete a single job, they aren't suitable for the real-time setting, where cost is a crucial consideration. 3) The technique's execution relies on the altered approach without thinking about it, and one of the main problems is that it exploits the random method. 4) One serious problem with widely used algorithms is the generation of large amounts of incorrect predictions. 5) Most of the newly proposed algorithms, like the traditional techniques, have unique constraints and have the desire to eliminate the impediments.

III. PREVIOUS MODELS

1. Latent Markov Chain

This statistical model was introduced by Baum and Petrie in 1966 [9]. It is the simplest Bayesian network that can detect the Markov process, to put it simply [10]. This is associated with stochastic processes, which provide a problem in optimum nonlinear filtering. Although this model was originally developed for voice recognition, it has now found applications in several domains including as pattern identification, handwriting and gesture recognition, part-of-speech tagging, music scores, partial discharges, bioinformatics, and more.

2. SVM, or Support Vector Machine

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One kind of machine learning technique that can do both regression and classification is Support Vector Machine (SVM). More than that, this approach works better for fixing a wide range of real-world problems. It is usually a simple strategy to construct a line or hyperplane that separates data into classes. This approach works better for a wide range of practical problems, including providing substantial assistance with complex and basic text classification, picture segmentation and classification, handwriting character identification, and a great deal of the biological and additional scientific fields [11]. Third, an ANN, or artificial neural network A model of information processing, Artificial Neural Networks (ANN) are stimulated by a biologically sensitive technique similar to the information processing in a brain. [12] The brain's intricate network of neurons works together in harmony to accomplish certain tasks. An interconnected processing node with direct linkages to other nodes in the network allows it to complete a job. A processing unit is represented by each node, and the underlying connections are shown by the links [13].

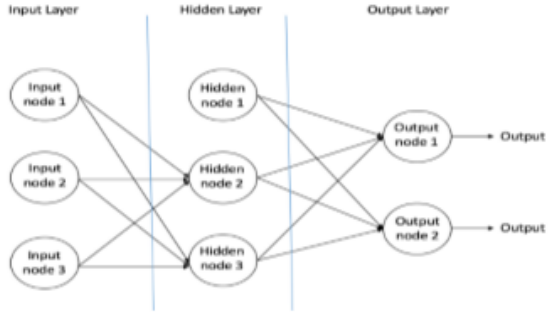

Figure 1 Neural Network

This plan depicts the accepted style of data categorization and is in the shape of a Decision Tree. This approach organizes the data in a tree structure, with each leaf representing a class and each inner node representing a decision. [14] This approach typically executes a process of recursively splitting a branch into sub-branches until the problem is not addressed by the scheme. [15] The branch characteristics are like the nodes in a built tree; their relative evaluation determines the tree's trajectory. It has surpassed numerous approaches due to its durable outputs and easy operating characteristics. Tree Construction and Tree Pruning are the two last steps in a decision tree [16].

IV. PROPOSED METHODOLOGY

Following an exhaustive examination of all available methods, a number of researchers highlighted the many benefits of each proposed approach and focused on a number of limitations that are still present with practical approaches and significantly impact the methods' operational behavior. Key constraints include inflexibility, lengthy model construction, alternate parameters, and incorrect verdicts, among numerous related concerns. 1. Suggested Plan Two feature compression techniques, CFS with best-first search and Gain ratio with ranker mechanism, and four distinct classification algorithms were chosen for the proposed study. It is not possible to construct a more competent approach using a procedure that is optimized for each algorithm, as stated in the literature review. In addition to two additional feature compression approaches, the suggested approach investigates and analyses four selected methods: Decision Tree (J48), Artificial Neural Network (ANN), Hidden Markov Model (HMM), and Support Vector Machine (SVM). (2) and (17) Integrate the feature compression techniques with the linear models once you've analyzed them. Additionally, compare the data with the other method used to enhance QoS in case any discrepancies are found.

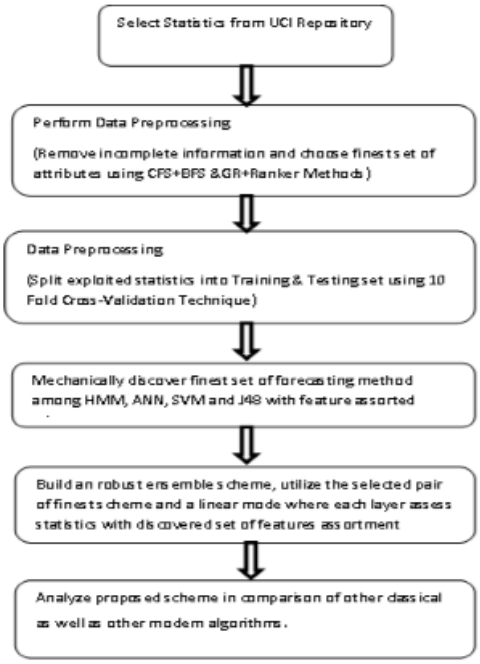

Figure 2 Process Flow Diagram of Proposed Work

The University of California, Irvine (UCI) data pool is an online library of several datasets that may be freely accessible for input investigations; initially, a

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number of statistics were extracted from it. In the end, go with a different combination of classification methods like J48, ANN, SVM, and HMM. These methods were examined in order to circumvent the limitation.

V. EXPERIMENTAL RESULTS

Several research were launched and addressed in this chapter to prove that the suggested method was better and more appropriate than the other classical and contemporary algorithms.

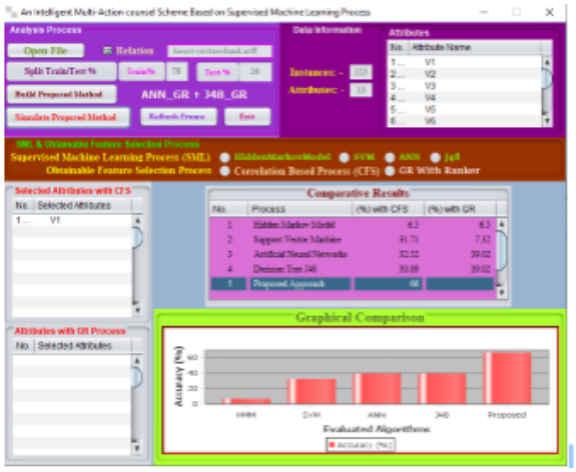
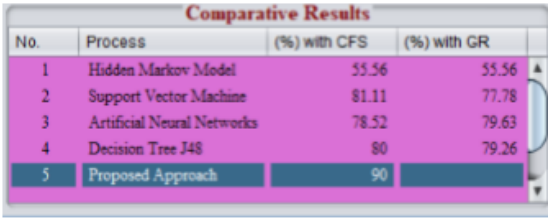


Figure 3 Designed model of Accuracy prediction

The effectiveness of the suggested method is further explained by the values given in the figure below, which also includes the parameters of the updated statistics. The results demonstrate that the suggested strategy outperforms the alternatives in terms of accuracy.



Comparative Results

No.	Process	(%) with CFS	(%) with GR
1	Hidden Markov Model	55.56	55.56
2	Support Vector Machine	81.11	77.78
3	Artificial Neural Networks	78.52	79.63
4	Decision Tree J48	80	79.26
5	Proposed Approach	90	

Figure 4 Comparative results with previous methods

Table 1 Proposed Approach V/s N. Senthil kumarMohanAlgorithm over Heart Diseases Dataset [14]

Algorithms	Attained Accuracy
HRLFM [41]	88.4%
Proposed Approach	**90%**

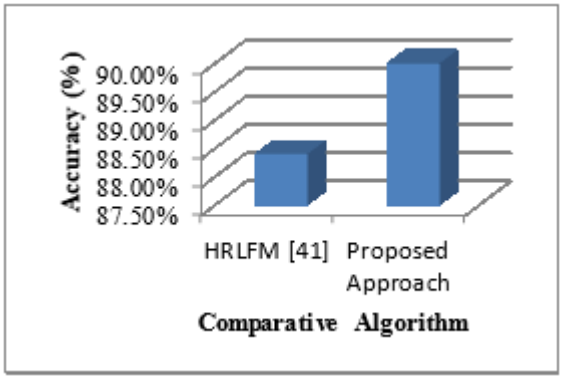


Figure 5 Proposed &Senthil kumar Mohan Algorithm over Heart Diseases Dataset [14]

Values in the table and graph that have been given above illustrate the importance of the recommended strategy to this inquiry. We compare the recommended strategy to alternative approaches and assess their effectiveness and applicability.

VI. CONCLUSION

Efficiency, appropriateness, and quality of service were all targets of this investigation's efforts to enhance performance. The purpose of the literature review was to develop a more effective approach by discussing the features and shortcomings of current methods. Four distinct algorithms—a Hidden Markov Model (HMM), a Support Vector Machine (SVM), an Artificial Neural Network (ANN), and a variant of Decision Tree (J48)—are explored in the proposed study. Using a linear model based on the feature selection process with best-first search and Gain ratio in conjunction with the Ranker technique, the suggested method rigorously evaluates these four approaches to exploited statistics and chooses the top

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two. In order to prove that the suggested method works, several simulations have been run. Based on all of the comparisons, it is clear that the suggested method solves the problems with both old and new methods.

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