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An Articulate Heart Attack Detection System Using Mine Blast Optimization (MBO) Based Multilayer Perceptron Neural Network (MLPNN) Model

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ABSTRACT: The creation of an automated system for heart disease detection was once one of the more common undertakings in the healthcare industries. For this purpose, the different types of big data analytics technologies are developed in the conventional works to predict the heart disease. Still, it limits with the problems associated to the elements of high complexity, time consumption, over fitting, and mis-prediction results. Because the previous methods did not optimize the best features, they did not give accurate results in heart attack detection, so the system is needed to control the death ratio.Therefore, the proposed work objects to implement a novel Mine Blast Optimization (MBO) based Multi-Layer Perceptron Neural Network (MLPNN) technique to predict the heart attack from the given datasets. The proposed detection framework includes the stages of preprocessing, feature optimization, and classification. Here, the regression based preprocessing model is implemented to normalize the attributes for increasing the quality. Then, the MBO technique is also used to choose the relevant features based on the best optimal solution. It also helps to reduce the increase the training of classifier with reduced time consumption and high detection accuracy. Finally, the MLPNN technique is utilized to predict the classified label as whether normal or disease affected. During analysis, the results of the proposed MBO-MLPNN technique is validated and compared by using various measures. Here the proposed method achieved 98% accuracy performance for heart attack detection than former methods.

Keywords: Heart Attack Detection, Machine Learning Model, Big Data, Regression based Preprocessing, Mine Blast Optimization (MBO), and Multi-Layer Perceptron Neural Network (MLPNN).

1. INTRODUCTION

Big data analytics [1, 2] is one of the emerging technology in present days, which is extensively utilized in many application systems. Specifically, it gained a significant impact in the healthcare domain, due to their cost effectiveness, efficient operations, and quality of data. Heart [3, 4] is an important organ in the human body, which is the central part of the cardiovascular system. According to the recent reports, it is analyzed that nearly 17.9 million people can lost their lives, due to this dreadful disease [5, 6]. Hence, it is more essential to predict the heart disease for providing an earlier treatment to the patients to save their lives. Typically, the heart disease is categorized into different types such as, heart attack, arrhythmia, stroke, heart failure, and etc. The different types of risk factors [7-9] associated to the heart disease are shown in Fig 1.

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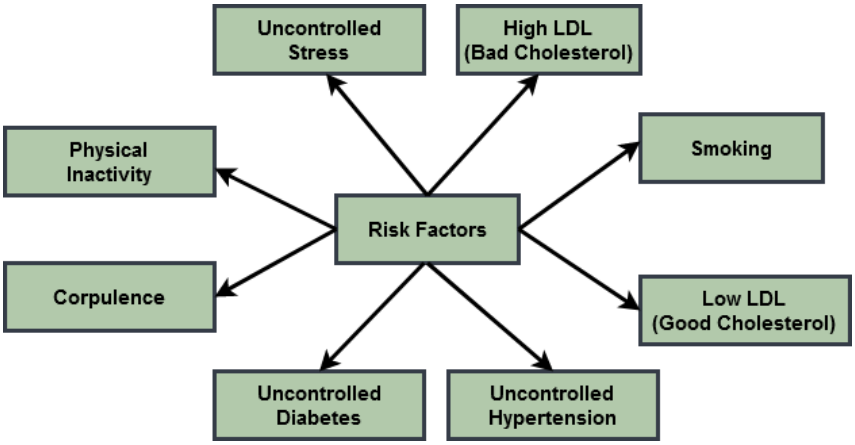

FIGURE 1. Risk factors associated to heart disease

For detecting this disease, various prediction methodologies are developed in the conventional works [10]. Specifically, the data mining techniques [9, 11, 12] are considered as the most suitable options for accurately diagnosing the heart disease. Presently, the machine learning based detection systems are widely used in many healthcare applications for disease identification and classification. For instance [13-16], the Support Vector Machine (SVM), Neural Network (NN), Naïve Bayes (NB), Random Forest (RF), Decision Tree (DT) and etc are the major techniques used in the conventional works for detecting heart disease. Yet, it faced the problems [17-19] of overfitting, difficult to understand, more time consumption, and high error rate. However, these existing techniques did not improve the best features or give accurate heart disease prediction results. Therefore need system is needed to avoid the death ratio. Therefore, the proposed work objects to implement a new classification system for detecting heart attack. The major research objectives of this paper are as follows:

- To normalize the given dataset by eliminating the redundant information and replacing the missing attributes, the regression based preprocessing methodology is implemented.
- To optimally select the features based on the best fitness value, an advanced Mine Blast Optimization (MBO) technique is deployed, which reduces the complexity and training time of classification.
- To predict the classified label as whether normal or disease affected, the Multi-Layer Perceptron Neural Network (MLPNN) technique is utilized, which efficiently produces the classified results with increased detection accuracy.
- To test and validate the performance of the proposed heart attack detection system, an extensive simulation is carried out by using various measures.

The remaining portions of this paper are categorized into the following sections: Section II reviews the conventional machine learning based prediction models used for developing an efficient heart disease detection system. It also examines the pros and cons of each model based on its features and functions. Then, the overall methodology description with its flow and algorithmic representations are presented in Section III. The results of the proposed methodology is validated and compared by using various measures in Section IV. Finally, the overall paper is summarized with its future work in Section V.

2. RELATED WORKS

This review examines the different types of optimization and machine learning based classification approaches for predicting heart disease. Also, it investigates the pros and cons of each mechanism according to its operations, features, and principles.

Venkatesh, et al [20] utilized a big data predictive analysis model for predicting the heart disease with the help of machine learning algorithm. The main purpose of this work was to accurately predict the disease by using the Naïve Bayes (NB) classification methodology. Here, the statistical based clustering mechanism was also used to increase the accuracy of prediction. For improving the detection, the different types of features associated to the heart disease have been considered. Moreover, the performance of this clustering based classification approach was validated and compared in terms of accuracy, precision, recall, and processing time. However, it limits with the problems of increased error value, inefficient prediction, and complex computational operations. Wu, et al [21] presented a comprehensive review about the different types of classification approaches used for predicting the heart disease of patients. It includes the mechanisms of decision tree, random forest, logistic regression, SVM, NB and MLP. This framework includes the operations of data preprocessing, feature selection, and classification. According to this work, it was analyzed that an optimization based classification process could provide an increased performance results. Yet, this work limits with the key problems of high time consumption for data training and testing, and reduced prediction rate.

Mir and Dhage [22] implemented a new machine learning based classification technique for predicting diabetes in the healthcare systems. Typically, the machine learning [23] was considered as one of the promising approach mainly used for the earlier disease diagnosis. Moreover, this work validated and compared the performance and efficiency of four different machine learning techniques such as NB, SVM, RF and CART for identifying the most suitable approach to predict the heart attacks. Anitha and Sridevi [24] deployed a machine learning based classification techniques for predicting the heart disease. The purpose of this work was to test the performance of three different techniques such as KNN, NB, and SVM in terms of accuracy, TPR, and FPR. According to the study, it was analyzed that the NB technique outperforms other approaches with increased performance results. Tarawneh, et al [25] deployed a hybrid approach for designing a heart disease prediction system. This framework includes the major stages of preprocessing, classification, and diagnosis, in which a filtering technique was utilized to normalize the dataset. Then, the hybridized classification approach was used to predict the classified based on the features obtained from the dataset. Finally, the disease diagnosis was performed based on the medical history of the patients' data. The limitation of this work was, it failed to validate the efficacy and performance of the classification approach by using various measures. Yahaya, et al [26] presented a comprehensive analysis for examining various machine learning and data mining techniques used for predicting the heart disease. Here, the different types of heart diseases such as coronary, cardiomyopathy, ischemic, heart failure, hypertensive, inflammatory, and valvular have been discussed with the appropriate detection techniques.

Singh, et al [27] developed an Efficient Heart Disease Prediction System (EHDP) using the machine learning approach. The purpose of this work was to analyze the risk level of heart disease based on the likelihood parameter. Moreover, this framework includes the stages of data obtainment, preprocessing, and classification. Mohan, et al [28] implemented a hybrid machine learning techniques for predicting the type of heart disease. Amin, et al [3] developed a new prediction model for identifying the cardiovascular heart disease with increased accuracy. The purpose of this work was to validate and test the efficiency of 7 different machine learning based classification techniques for an efficient heart disease detection. In this framework [29], the preprocessing was performed to predict the missing values for normalizing the data. Then, the most suitable and significant attributes were selected to obtain an improved system performance. The key benefits of this work were easy to understand, simple processing, and minimal overfitting. Thangaselvi, et al [30] implemented an Optimal Artificial Neural Network (OANN) technique for detecting the chronic heart diseases with reduced cost consumption. The key factor of this work was to incorporate the Teaching-Learning Based Optimization (TLBO) with ANN for developing an accurate and efficient heart disease detection system. This framework comprises two stages such as, on-line stage and off-line stage, in which the dataset training and testing were performed during offline prediction. Tougui, et al [4] presented a comprehensive analysis to validate the performance of various machine learning techniques used for detecting heart attack disease based on the optimal features. The contribution of this work was to select the most reliable data mining tool and machine learning methodology for heart attack prediction and classification. It investigates the tools of Orange, Weka, RapidMiner, Knime, Matlab, and Scikit-Learn, and examines the performance of LR, SVM, KNN, ANN, NB and RF techniques. Beyene, et al [31] suggested various data mining methodologies for predicting heart disease from the given datasets, which includes the following types of diseases:

- Arrythmia
- Acute coronary syndrome
- Coronary artery disease
- Angina
- Congenital heart disease
- Cardiomyopathy
- Rheumatic heart diseases

In addition to that, it utilized 10-fold cross validation model for optimally selecting the features for classifier training. However, this work failed to validate the results of the methodologies using various evaluation metrics, which was the main drawback of this paper. Maji, et al [32] implemented a hybrid ANN-DT classification methodology for predicting heart disease. In this model, the data pruning was performed to enhance the quality of dataset before classification. Based on this study, it was analyzed that the hybridized technique outperforms the other techniques with increased performance values. The drawback of this work were complex operations, more time consumption, and reduced accuracy.

According to the literature review [33], it is analyzed that the conventional works limit with the following problems:

- Inaccurate prediction rate
- Increased false alarm rate
- Difficult to understand
- Complex mathematical operations
- Requires increased training time

Therefore, the proposed work objects to implement an intelligent optimization and classification methodologies for accurately predicting heart disease with increased accuracy.

3. PROPOSED METHODOLOGY

This section presents the description about the proposed heart attack disease detection system with its overall working flow and algorithms. The original contribution of this work is to deploy an advanced data mining approaches for predicting heart disease from the given dataset with increased accuracy and detection ratio. The proposed framework includes the working modules of regression based preprocessing, Mine Blast Optimization (MBO) based feature selection, and Multi-Layer Perceptron Neural Network (MLPNN) based classification. The flow of the proposed heart attack prediction system is shown in Fig 1, where the dataset preprocessing is performed at first for normalizing the attributes. Typically, the original dataset comprises missing fields, redundant attributes and unwanted information, hence it should be preprocessed before classification. Then, the filtered data can be further used for optimally choosing the features with the help of MBO technique. It minimizes the complexity of classification with reduced dimensionality of features. Finally, the MLPNN technique is deployed to predict the classified label as whether normal of disease affected. The primary advantages of this work are easy to implement, better scalability, reduced complexity, optimized performance, and time efficiency.

A. Dataset collection

This section illustrates the heart disease dataset collection from the Kaggle repository to predict heart attacks. Data was collected from this link https://www.kaggle.com/datasets/rashikrahmanpritom/heart-attack-analysis-prediction-dataset. This dataset contains a total of 5233 datasets which were collected from different patients.

Table 1: Samples of heart disease details

sex	cp	trestbps	chol	fbs	restecg	BMI	glucose	BP	thalach	exang	oldpeak	slope	ca	thal	target
1	0	125	212	0	1	26.97	77	0	168	0	1	2	2	3	0
1	0	140	203	1	0	28.73	76	0	155	1	3.1	0	0	3	0
1	0	145	174	0	1	25.34	70	0	125	1	2.6	0	0	3	0
1	0	148	203	0	1	28.58	103	0	161	0	0	2	1	3	0
0	0	138	294	1	1	23.1	85	0	106	0	1.9	1	3	2	0
0	0	100	248	0	0	30.3	99	0	122	0	1	1	0	2	1
1	0	114	318	0	2	33.11	85	0	140	0	4.4	0	3	1	0
1	0	160	289	0	0	21.68	78	0	145	1	0.8	1	1	3	0
1	0	120	249	0	0	26.36	79	0	144	0	0.8	2	0	3	0
1	0	122	286	0	0	23.61	88	0	116	1	3.2	1	2	2	0
0	0	112	149	0	1	22.91	76	0	125	0	1.6	1	0	2	1
0	0	132	341	1	0	27.64	61	0	136	1	3	1	0	3	0
0	1	118	210	0	1	26.31	64	0	192	0	0.7	2	0	2	1
1	0	140	298	0	1	31.31	84	1	122	1	4.2	1	3	3	0
1	0	128	204	1	1	22.35	82	0	156	1	1	1	0	0	0
0	1	118	210	0	1	21.35	70	0	192	0	0.7	2	0	2	1
0	2	140	308	0	0	22.37	72	0	142	0	1.5	2	1	2	1
1	0	124	266	0	0	23.38	89	0	109	1	2.2	1	1	3	0

This data set includes 13 features: age, gender, exercise-induced angina (exang), number of major vessels, type of chest pain (cp), cholesterol (chol), etc. The heart disease dataset are defined in Table 1 above.

B. Regression based Preprocessing

Generally, the data preprocessing is one of the most essential step in the prediction systems, because which helps to obtain an improved classification results. Here, the input medical dataset is preprocessed for normalizing the attributes by filling the missing fields and eliminating the redundant information. The data preprocessing is done by using the regression model, which produces the dataset with improved quality. Typically, the entire performance prediction and classification are highly depends on the dataset used for processing. In this model, the data standardization is performed to eliminate the missing fields, which lies in the range of 0 to 1.

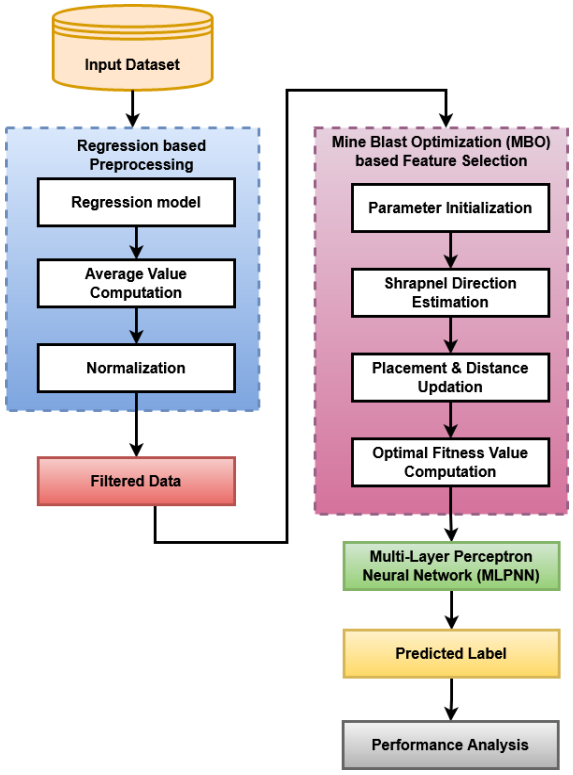

FIGURE 2. Working flow of the proposed heart disease detection system (Courtesy: Google)

The main advantage of using this model is, it efficiently reduces the complexity of pattern evaluation by normalizing the contents. At first, the regression model is formed for the given data as shown in below equation 1:

$$I_D = \vartheta_0 + \vartheta_i E + \varepsilon_i \quad \text{for } i = 1,2 \ldots n \tag{1}$$

For each pair of data samples, the regression model is estimated in equation 2:

$$I_{Di} = \vartheta_0 + \vartheta_i E + \varepsilon_i^* \tag{2}$$

Where, I_D is the input dataset, ε_i denotes the residual value, ϑ_0 and ϑ_i are the least square values. Consequently, the mean is estimated for the given data according to its frequency as represented as equation (3):

$$\mu = \frac{\sum_{i=1}^{n} E_i}{Freq_D} \tag{3}$$

Where, μ is the mean, $Freq_D$ denotes the frequency of data, and E_i indicates the given data. Finally, the normalization is performed by using the following equations (4) and (5):

$$Nor_D = \frac{\varepsilon_i^*}{\dot{\sigma}_i} \tag{4}$$

$$Nor_D = \frac{E_i - \mu_i^*}{\dot{\sigma}_i} \tag{5}$$

Where, $\dot{\sigma}_i$ indicates the variance, μ_i is the mean, and Nor_D denotes the normalized data.

C. Mine Blast Optimization (MBO)

After preprocessing, the optimal number of features are selected from the preprocessed dataset for training the classifier, which is done by using the MBO technique. The main purpose of using optimization technique is to reduce the dimensionality of features, training & testing time of classifier, and computational complexity. Typically, the MBO technique is one of the meta-heuristic model specifically applied for obtaining the best solution to solve the complex prediction problems. In the existing disease prediction systems, various optimization techniques such as Particle Swarm Optimization (PSO), Genetic Algorithm (GA), Bee Colony Optimization (BCO), Greedy Optimization (GO) and etc have been used. When compared to the other optimization techniques, the MBO technique has the key benefits of increased convergence rate, easy to understand, and reaches the optimal solution with minimum number of iterations. In this model, the searching space dimensionality, and the maximum number of iterations are initialized according to the upper and lower bound values as represented below equations (6) and (7):

$$G = \{G_t\}, t = 1,2,3, \ldots, S_D \tag{6}$$

$$G_0 = L_B + Nor_D * (U_B - L_B) \tag{7}$$

Where, S_D is the dimension of searching space, Nor_D denotes the normalized data, G_0 is the initial parameter, U_B and L_B are the upper and lower bounds respectively. Then, the appropriate location and distance of the shrapnel

fragments are updated once the exploration element is satisfied; else, the stopping criteria is validated according to the requirements. Moreover, the direction of shrapnel are computed in equation (8):

$$V_{x+1}^{y} = \frac{H_{x+1}^{y} - H_{x}^{y}}{P_{x+1}^{y} - P_{x}^{y}} \quad (8)$$

Where, V_{x+1}^{y} is the direction, H_{x+1}^{y} indicates the objective function, y and $(x+1)$ are the iterations. Subsequently, the position of shrapnel fragments are updated by using the following equation (9):

$$P_{x+1}^{y} = P_{c(x+1)}^{y} + \exp\left(-\sqrt{\frac{V_{x+1}^{y}}{Di_{x+1}^{y}}}\right) P_{x}^{y} \quad (9)$$

Based on the above conditions, the shrapnel is created and its position is updated. Here, the best temporary solution is obtained according to the best shrapnel fragments, and its appropriate location also updated for generating the temporal solution. Moreover, the parameters both distance and location are represented as shown in below equations (10) and (11):

$$P_{x(x+1)}^{y} = Di_{x}^{y} * r * \cos(\varphi) \quad (10)$$

$$Di_{x+1}^{y} = \sqrt{\left(P_{x+1}^{y} - P_{x}^{y}\right)^{2} + \left(H_{x+1}^{y} - H_{x}^{y}\right)^{2}} \quad (11)$$

Furthermore, the distance of the shrapnel's distance is adaptively reduced based on the following equation (12):

$$Di_{x}^{y} = \frac{Di_{x-1}^{y}}{\exp(a/\delta)} \quad (12)$$

Where, a and δ indicates the reduction constant and index of iteration correspondingly. Based on this value, the optimal best fitness value is identified, which is used for selecting the set of features to train the classifier.

Algorithm I - Mine Blast Optimization (MBO)

Input: Preprocessed data;
Output: Optimal solution;
Step 1: Initialize the parameters of MBO technique, which includes maximum number of iterations and population;
Step 2: The location and distance values are initialized for the shrapnel fragments;

```
If (Exploration Constant == 1)
    Compute the distance of current iteration;
else
        Stop criterion;
end
```

Step 3: Compute the direction of shrapnel fragments with the placements;
Step 4: The constraints are validated for validating whether the shrapnel is created or not;
Step 5: Then, the best shrapnel is selected as the temporary solution;
Step 7: After that, its position is updated for obtaining the optimal temporal solution.
Step 8: The location and distance of shrapnel fragments are updated;
Step 9: Finally, the convergence criterion is validated, ft the optimal solution is reached, the stopping criterion is executed;

D. Multi-Layer Perceptron Neural Network (MLPNN)

After optimization, the selected features are fed to the classifier for predicting the result as normal or disease affected. Here, an efficient machine learning classifier, named as, MLPNN technique is used to predict the output label. Conventionally, the different types of classification approaches are used in the existing heart disease detection systems, which includes NB, SVM, RF, DT, and etc. However, it has the key problems of increased training time, complex modeling, mis-predicted results, and error outputs. Therefore, the proposed work intends to utilize an efficient MLPNN technique for detecting the heart disease with increased accuracy and reduced error value. The architecture model of the classifier is shown in Fig 3. Typically, the MLPNN is one of the robust classification model, and has a better ability to handle non-linear fittings. This architecture comprises three layers such as input, hidden, and output, in which the weight value is computed in the input layer as shown in below equation (14):

$$M_{j} = \sum_{j=1}^{x}(\omega_{ij}, k_{i}) + B_{j} \;\; j = 1,2,\ldots y \quad (14)$$

Where, ω_{ij} is the weight value, B_{j} denotes the bias function, and k_{i} represents the input. Then, the sigmoid function is estimated in the hidden layer as represented in equation (15):

$$\text{Sigmoid}\,(M_{j}) = \frac{1}{1+\exp(M_{j})} \quad (15)$$

Finally, the output values are produced in the output layer based on the following equation (16):

$$O_{p} = \text{sigmoid}\,(O_{p}) = \frac{1}{1+\exp(O_{p})}, k = 1,2,\ldots r \quad (16)$$

Where, O_p is the output parameter, p is the connection weight, and k is the random value. Based on this training and testing models, the output label is predicted as normal or disease affected. To the performance of the predicted results produced MLPNN technique, various evaluation measures are validated during simulation analysis.

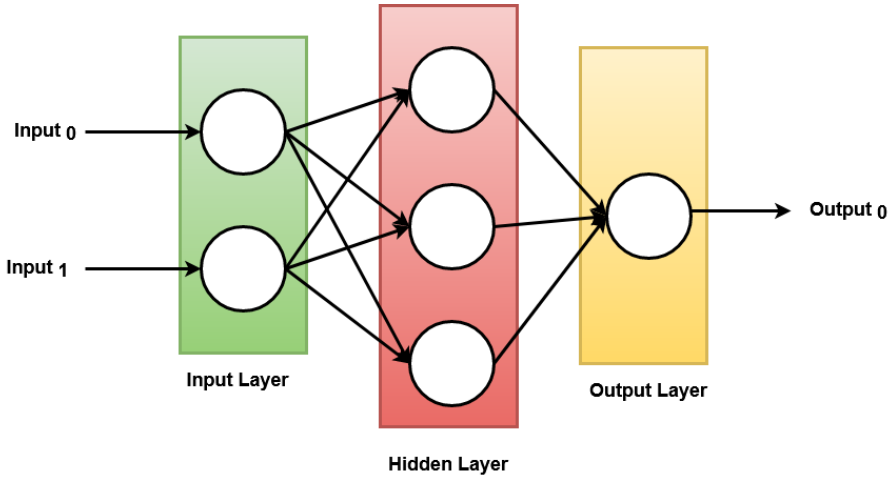

FIGURE 3. Architecture model of MLPNN

4. RESULTS AND DISCUSSION

This section validates the results of proposed MBO-MLPNN technique by using various evaluation measures. Also, the obtained results are compared with the recent state-of-the-art model approaches. The main purpose of this work is develop a novel and advanced MBO-MLPNN classification system to detect the heart attack with increased detection accuracy and efficiency. Here, the performance of the proposed approach is assessed in terms of precision, accuracy, recall, sensitivity, specificity, f1-score, and kappa coefficient. These are calculation presented in equations (17-22):

$$\text{Accuracy} = \frac{TP+TN}{TP+TN+FP+FN} \times 100\% \quad (17)$$

$$\text{Sensitivity} = \frac{TP}{TP+FN} \times 100\% \quad (18)$$

$$\text{Specificity} = \frac{TN}{TN+FP} \times 100\% \quad (19)$$

$$\text{Precision} = \frac{TP}{TP+FP} \times 100\% \quad (20)$$

$$F1-\text{score} = \frac{2 \times \text{Precision} \times \text{Sensitivity}}{\text{Precision} + \text{Sensitivity}} \times 100\% \quad (21)$$

$$KC = \frac{2 * (TP * TN - FN * FP)}{(TP + FP) * (FP + TN) + (TP + FN) * (FN + TN)} X100\% \quad (22)$$

Normally, the overall efficacy and better performance of the classifier is assessed according to the improved values of these parameters. Table 2 and Fig 4 presents the overall comparative analysis of the conventional and proposed machine learning based classification methods used for heart attack detection. Based on the estimated results, it is observed that the proposed MBO-MLPNN technique outperforms the other approaches with increased performance values. Due to the utilization of regression based preprocessing model, the quality of data is efficiently improved, which helps the classifier to predict an accurate results with high detection efficiency.

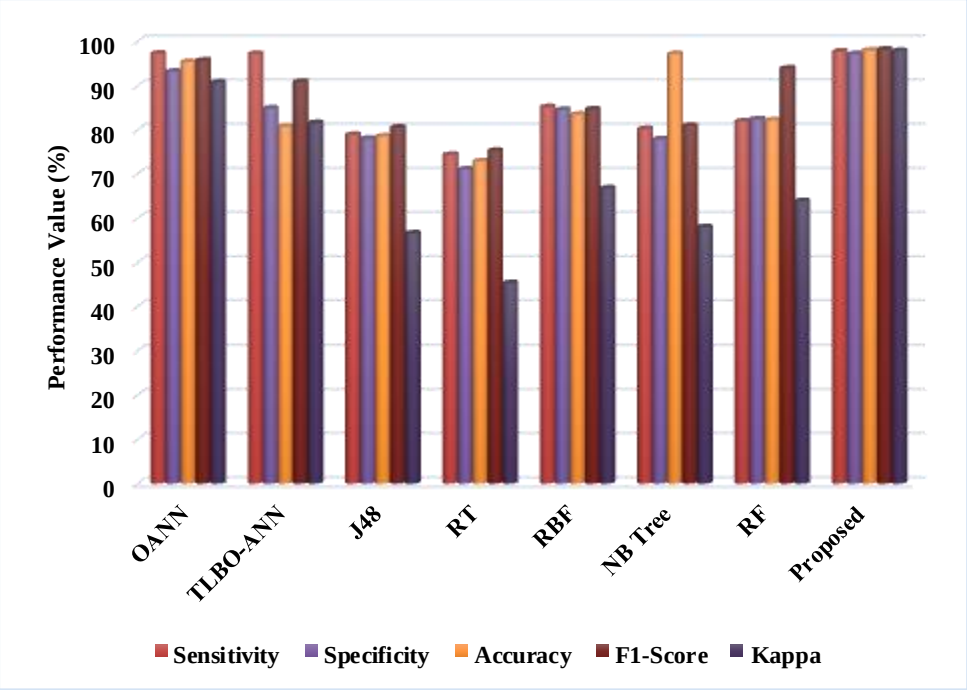

FIGURE 4. Comparative analysis

Table 2. Overall performance analysis

Methods	Sensitivity	Specificity	Accuracy	F1-Score	Kappa
OANN [30]	97.33	93.23	95.41	95.74	90.76
TLBO-ANN [30]	97.22	84.91	80.75	90.91	81.59
J48	78.94	78.03	78.55	80.59	56.64
RT	74.41	71.11	72.94	75.30	45.38
RBF	85.19	84.56	83.49	84.66	66.81
NB Tree [20]	80.24	77.94	97.21	80.97	58.06
RF [31]	81.98	82.44	82.18	93.93	63.95
Proposed	97.8	97.2	98	98.2	97.9

Similarly, Table 3 and Fig 5 compares the accuracy, sensitivity, specificity, precision, and f-measure of conventional and proposed machine learning methodologies. To validate the detection efficiency of the proposed MBO-MLPNN technique, the above mentioned parameters are compared with the conventional NB, SVM, LR, RF, and Adaboost algorithms. These results also indicate that the proposed technique overwhelms the existing approaches with increased performance values. Because, the MBO technique could efficiently selects the most relevant features from the normalized dataset to train the classifier. Due to the reduced dimensionality of features and proper data training, the overall performance of the MLPNN technique is highly improved over the other techniques.

Table 3. Detection efficiency

Techniques	Accuracy	Sensitivity	Specificity	Precision	F-Measure
NB [20]	83.55	82.31	84.75	84.37	83.33
SVM [21]	84.46	81.09	87.80	86.92	83.91
LR [31]	85.07	82.92	87.19	86.62	84.73
RF [23]	86.60	84.14	89.02	88.46	86.25
AdaBoost	86.59	83.53	89.63	88.96	86.16
Proposed	98.5	99	98	98.5	98.3

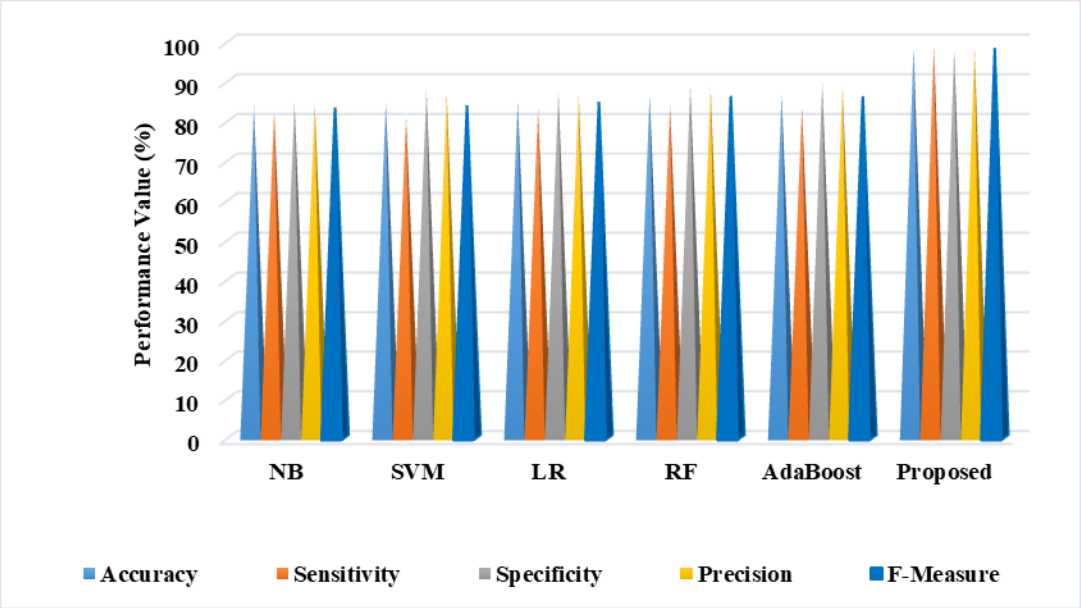

FIGURE 5. Comparison between machine learning techniques

Table 4 and Fig 6 compares the detection accuracy of conventional and proposed classification techniques. Typically, the detection accuracy is highly depends on the exact prediction results produced by the classifier. It must be improved for ensuring the better system performance and effectiveness. Based on the analysis, it is observed that the proposed MMBO-MLPNN technique provides an increased detection accuracy, when compared to the other techniques.

Table 4. Detection accuracy

Techniques	Detection accuracy (%)
RF + Chi-square	83.60
MLP + CS [21]	85.48
Hybrid Classifier + Subset FE [25]	85.48
Ensemble + PSO	85.71
RF + GA	86.60
Proposed	95.6

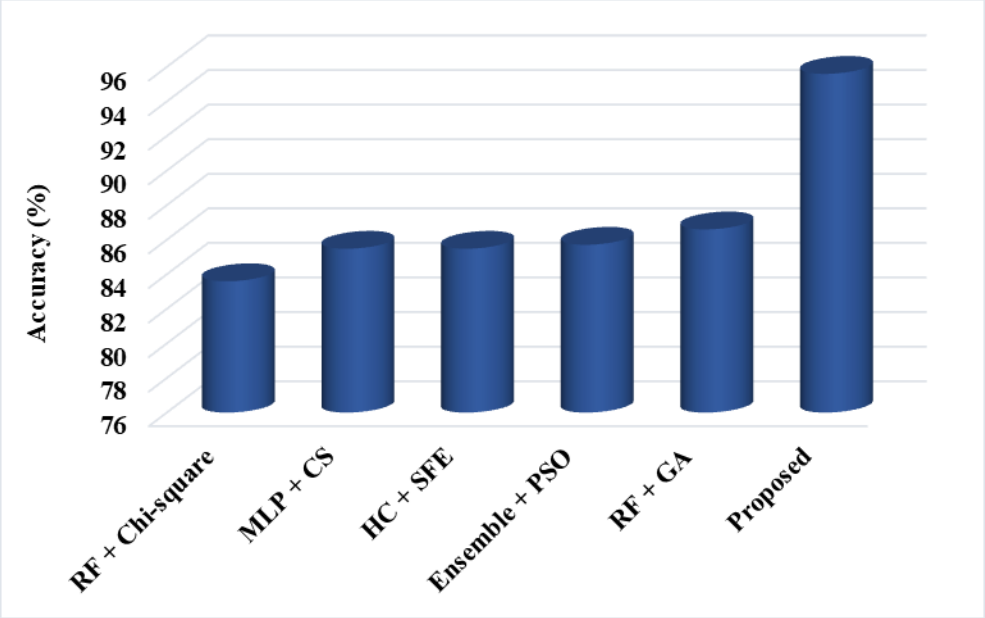

FIGURE 6. Comparative analysis based on detection accuracy

Table 5 to Table 6 depicts the overall comparative analysis of conventional [34] and proposed heart attack detection approaches, and its graphical representations are shown in Fig 7 to Fig 9. The obtained results indicate that the proposed MBO-MLPNN technique provides the better performance results, when compared to the other classifiers, due to the proper feature optimization and training processes.

Table 5. Accuracy, sensitivity, and specificity analysis

Classification techniques	Sensitivity	Specificity	Accuracy
LR [31]	82	95	89.62
ABM1	91	97.9	95
MLP [21]	98.4	97.6	97.95
KNN [24]	100	100	100
DT [16]	100	100	100
RF [23]	100	100	100
Proposed	100	100	100

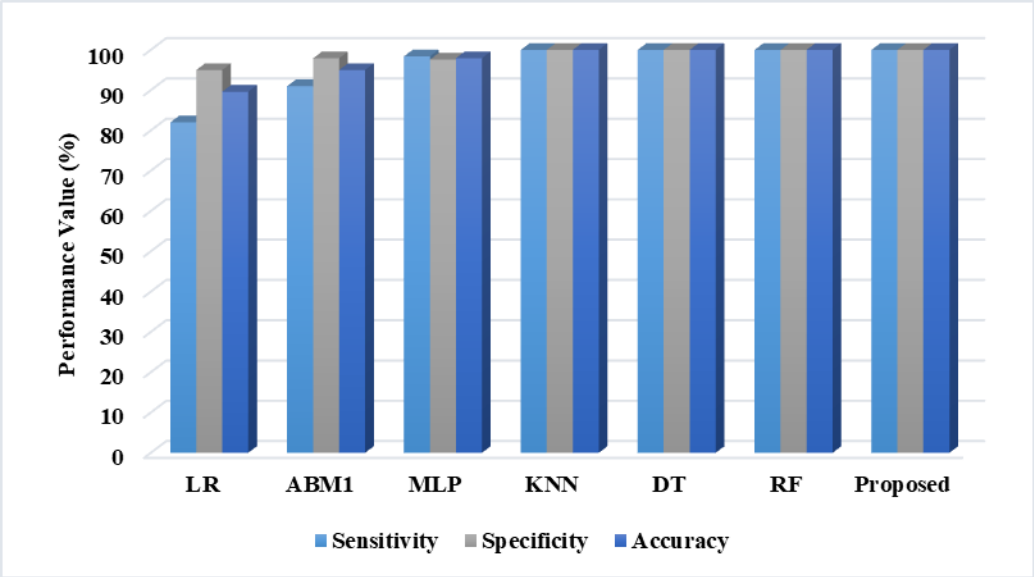

FIGURE 7. Comparative analysis in terms of sensitivity, specificity, and accuracy

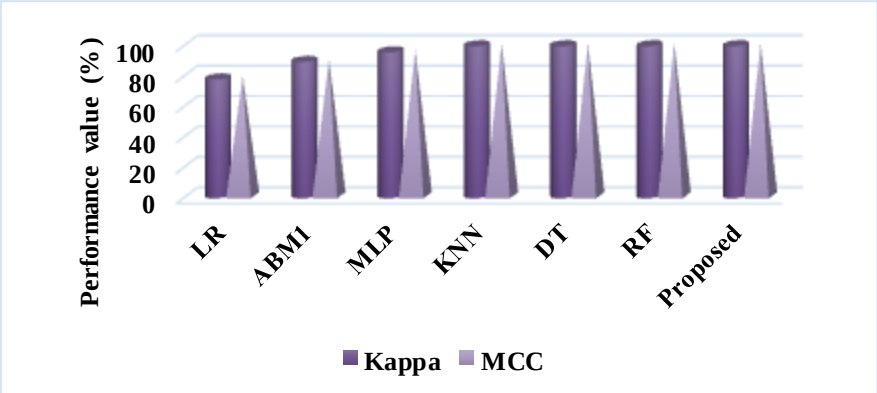

FIGURE 8. Kappa and MCC analysis

Table 6. Analysis based on kappa and MCC

Classification techniques	Kappa	MCC
LR [31]	78.2	78.6
ABM1	89.7	89.8
MLP [21]	95.9	95.9
KNN [24]	100	100

DT [16]	100	100
RF [23]	100	100
Proposed	100	100

Table 7. Analysis based on precision, recall, and f-measure

Classification techniques	Precision	Recall	F-Measure
LR [31]	89.6	89.6	89.6
ABM1	95	95	95
MLP [21]	98	98	98
KNN [24]	100	100	100
DT [16]	100	100	100
RF [23]	100	100	100
Proposed	100	100	100

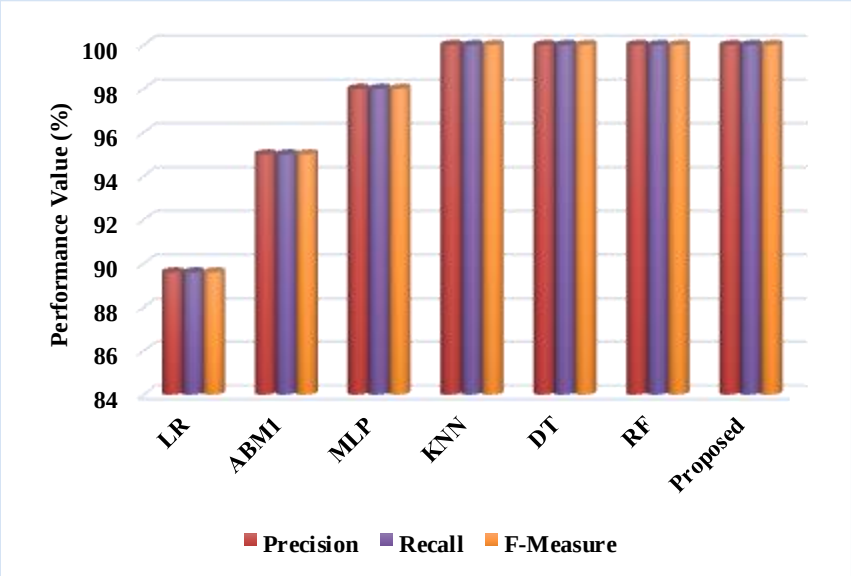

FIGURE 9. Precision, recall, and f-measure

Fig 9 explains the precision, recall and F-measure parameters for heart attack prediction with various methods. Here the proposed method achieved efficient result because the proposed analysis the optimized features of heart disease prediction, so it avoid the death ratio.

5. CONCLUSION

This paper presents a novel MBO-MLPNN model for developing an efficient heart attack prediction system. The main contribution of this work is to develop an automated detection system based on the machine learning model with increased detection accuracy and reduced complexity. The proposed framework comprises the modules of preprocessing, feature optimization, and classification. Here, the regression model is used to preprocess the given dataset by normalizing the attributes, eliminating the redundant information, and replacing the missing attributes. This kind of preprocessing efficiently improves the quality of data, because the overall detection performance of classifier is entirely depends on the features of dataset. So, the data quality is also concentrated in the proposed model, and the normalized dataset is used for further data mining operations. Then, the MBO technique is employed to optimally choose the relevant features to train the classifier. The primary reason of using this approach to simplify the process the classification with reduced complexity, time, and error results. Finally, the MLPNN technique is used to produce the predicted results as whether normal of disease affected. During evaluation, the performance and results of the proposed MBO-MLPNN technique is validated and compared by using various measures. According to the comparative analysis, it is evident that the combination of MBO-MLPNN technique outperforms the other approaches with detection efficiency and accuracy.

In future, this work can be enhanced by implementing a deep learning-based prediction model for detecting other heart diseases.

Conflict of Interest

All authors there is no Conflict of interest to publish this Article.

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CONFLICTS OF INTEREST

The author declares no conflict of interest.

REFERENCES

[1] Marimuthu, M., Abinaya, M., Hariesh, K. S., Madhankumar, K., & Pavithra, V. (2018). A review on heart disease prediction using machine learning and data analytics approach. International Journal of Computer Applications, 181(18), 20-25.
[2] Das, N., Das, L., Rautaray, S. S., & Pandey, M. (2018). Big data analytics for medical applications. International Journal of Modern Education and Computer Science, 11(2), 35.
[3] Amin, M. S., Chiam, Y. K., & Varathan, K. D. (2019). Identification of significant features and data mining techniques in predicting heart disease. Telematics and Informatics, 36, 82-93.
[4] Tougui, I., Jilbab, A., & El Mhamdi, J. (2020). Heart disease classification using data mining tools and machine learning techniques. Health and Technology, 10(5), 1137-1144.
[5] Mujumdar, A., & Vaidehi, V. (2019). Diabetes prediction using machine learning algorithms. Procedia Computer Science, 165, 292-299.
[6] Kavitha, M., Gnaneswar, G., Dinesh, R., Sai, Y. R., & Suraj, R. S. (2021, January). Heart disease prediction using hybrid machine learning model. In 2021 6th International Conference on Inventive Computation Technologies (ICICT) (pp. 1329-1333). IEEE.
[7] Singh, A., & Kumar, R. (2020, February). Heart disease prediction using machine learning algorithms. In 2020 international conference on electrical and electronics engineering (ICE3) (pp. 452-457). IEEE.
[8] Ramalingam, V. V., Dandapath, A., & Raja, M. K. (2018). Heart disease prediction using machine learning techniques: a survey. International Journal of Engineering & Technology, 7(2.8), 684-687.
[9] Bharti, R., Khamparia, A., Shabaz, M., Dhiman, G., Pande, S., & Singh, P. (2021). Prediction of heart disease using a combination of machine learning and deep learning. Computational intelligence and neuroscience.
[10] Haq, A. U., Li, J. P., Memon, M. H., Nazir, S., & Sun, R. (2018). A hybrid intelligent system framework for the prediction of heart disease using machine learning algorithms. Mobile Information Systems.
[11] Kannan, R., & Vasanthi, V. (2019). Machine learning algorithms with ROC curve for predicting and diagnosing the heart disease. In Soft computing and medical bioinformatics (pp. 63-72). Springer, Singapore.
[12] Diller, G. P., Kempny, A., Babu-Narayan, S. V., Henrichs, M., Brida, M., Uebing, A., ... & Gatzoulis, M. A. (2019). Machine learning algorithms estimating prognosis and guiding therapy in adult congenital heart disease: data from a single tertiary centre including 10 019 patients. European heart journal, 40(13), 1069-1077.
[13] Reddy, N. S. C., Nee, S. S., Min, L. Z., & Ying, C. X. (2019). Classification and feature selection approaches by machine learning techniques: Heart disease prediction. International Journal of Innovative Computing, 9(1).
[14] Gonsalves, A. H., Thabtah, F., Mohammad, R. M. A., & Singh, G. (2019, July). Prediction of coronary heart disease using machine learning: an experimental analysis. In Proceedings of the 2019 3rd International Conference on Deep Learning Technologies (pp. 51-56).
[15] Beunza, J. J., Puertas, E., García-Ovejero, E., Villalba, G., Condes, E., Koleva, G., ... & Landecho, M. F. (2019). Comparison of machine learning algorithms for clinical event prediction (risk of coronary heart disease). Journal of biomedical informatics, 97, 103257.
[16] Safdar, S., Zafar, S., Zafar, N., & Khan, N. F. (2018). Machine learning based decision support systems (DSS) for heart disease diagnosis: a review. Artificial Intelligence Review, 50(4), 597-623.
[17] Nashif, S., Raihan, M. R., Islam, M. R., & Imam, M. H. (2018). Heart disease detection by using machine learning algorithms and a real-time cardiovascular health monitoring system. World Journal of Engineering and Technology, 6(4), 854-873.
[18] M. Aljanabi, M. A. Ismail, and A. H. Ali, "Intrusion detection systems, issues, challenges, and needs," International Journal of Computational Intelligence Systems, vol. 14, no. 1, pp. 560-571, 2021.

[19] Dwivedi, A. K. (2018). Performance evaluation of different machine learning techniques for prediction of heart disease. Neural Computing and Applications, 29(10), 685-693.
[20] Venkatesh, R., Balasubramanian, C., & Kaliappan, M. (2019). Development of big data predictive analytics model for disease prediction using machine learning technique. Journal of medical systems, 43(8), 1-8.
[21] Wu, C. S. M., Badshah, M., & Bhagwat, V. (2019, July). Heart disease prediction using data mining techniques. In Proceedings of the 2019 2nd international conference on data science and information technology (pp. 7-11).
[22] Mir, A., & Dhage, S. N. (2018, August). Diabetes disease prediction using machine learning on big data of healthcare. In 2018 fourth international conference on computing communication control and automation (ICCUBEA) (pp. 1-6). IEEE.
[23] Katarya, R., & Meena, S. K. (2021). Machine learning techniques for heart disease prediction: a comparative study and analysis. Health and Technology, 11(1), 87-97.
[24] B. Q. Elias, M. Alsajri, P. J. Soh, and A. A. Al-hadi, "Design of Flexible Planar Antennas Using Substrate Gap Structure for Surface Wave Reduction," in 2019 22nd International Conference on Control Systems and Computer Science (CSCS), 2019, pp. 453-458: IEEE.
[25] Tarawneh, M., & Embarak, O. (2019, February). Hybrid approach for heart disease prediction using data mining techniques. In International Conference on Emerging Internetworking, Data & Web Technologies (pp. 447-454). Springer, Cham.
[26] Yahaya, L., Oye, N. D., & Garba, E. J. (2020). A comprehensive review on heart disease prediction using data mining and machine learning techniques. American Journal of Artificial Intelligence, 4(1), 20-29.
[27] Singh, P., Singh, S., & Pandi-Jain, G. S. (2018). Effective heart disease prediction system using data mining techniques. International journal of nanomedicine, 13(T-NANO 2014 Abstracts), 121.
[28] M. K. Khaleel, M. A. Ismail, U. Yunan, and S. Kasim, "Review on intrusion detection system based on the goal of the detection system," International Journal of Integrated Engineering, vol. 10, no. 6, 2018
[29] M. Aljanabi, M. A. Ismail, and V. Mezhuyev, "Improved TLBO-JAYA algorithm for subset feature selection and parameter optimisation in intrusion detection system," Complexity, vol. 2020, 2020.
[30] A. H. Ali, M. Aljanabi, and M. A. Ahmed, "Fuzzy generalized Hebbian algorithm for large-scale intrusion detection system," International Journal of Integrated Engineering, vol. 12, no. 1, pp. 81-90, 2020
[31] Beyene, C., & Kamat, P. (2018). Survey on prediction and analysis the occurrence of heart disease using data mining techniques. International Journal of Pure and Applied Mathematics, 118(8), 165-174.
[32] Maji, S., & Arora, S. (2019). Decision tree algorithms for prediction of heart disease. In Information and communication technology for competitive strategies (pp. 447-454). Springer, Singapore.
[33] Kondababu, A., Siddhartha, V., Kumar, B. B., & Penumutchi, B. (2021). A comparative study on machine learning based heart disease prediction. Materials Today: Proceedings..
[34] Ali, M. M., Paul, B. K., Ahmed, K., Bui, F. M., Quinn, J. M., & Moni, M. A. (2021). Heart disease prediction using supervised machine learning algorithms: Performance analysis and comparison. Computers in Biology and Medicine, 136, 104672

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