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ADVANCED CARDIAC HEALTH ASSESSMENT: INTEGRATING DEEP LEARNING FOR ENHANCED CLINICAL DECISION SUPPORT IN HEART DISEASE PREDICTION

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Abstract: The biggest health problem or obstacle that modern medicine faces worldwide is heart disease. It is now a major contributing element to the rising death rate. If heart illness is not detected early on, its severity is far more serious and may have dangerous repercussions. Techniques include electronic health records, ongoing body monitoring via a network, and patient health condition diagnosis through the use of wearable devices and medical sensor projections on human bodies. Since the human body generates enormous amounts of data on a continual basis, data mining techniques are used to efficiently classify the gathered health data. Furthermore, because it requires precise execution, the classification of health data is the most important procedure. First, a useful technique for feature selection and classification is used to forecast cardiac disease. The suggested study uses an unsupervised feature selection method and an optimized MLP-EBMDA (Multi-Layer Perceptron for Enhanced Brownian Motion-based Dragonfly Algorithm) for classification in heart disease prediction. The dataset will be used as the input for this implementation, and pre-processing will be done before the suggested feature selection technique—which effectively selects features—is used. The novel MLP-EBMDA is used in heart disease classification VI, helping to predict heart disease early on based on specific features. With an accuracy rating of 94.28 percent, the suggested technique may successfully predict heart illness as normal or abnormal.

1.Introduction:

1.1 AN OVERVIEW OF HEART DISEASE AND RISK

Data are currently dispersed as forms, reports, statistics, and other items. They serve as inputs for several categories of approaches. Due to the current technological growth, a number of strategies have been developed, and more are being developed to eliminate problems that arise in many fields. Technology has evolved into a highly useful tool for locating flaws in a certain industry and for quickly and efficiently fixing problems. This rapidly advancing technology is particularly significant in the field of health care. When it comes to producing the outcome in a real-time scenario, this has greatly helped. In spite of this, numerous investigations and studies have been carried out in several domains, primarily A World Health Organization (WHO) research states that one of the main causes of the high death rate globally is cardiovascular illness, or more precisely heart disease. The heart, one of the body's parts, pumps and circulates blood to every part of the body, including the brain, where it is vital to every other part. The death of the nerve system [2] results from the heart stopping blood flow to the brain and other bodily nerves. This means that all of the body's tissues and nerves will stop functioning, which will ultimately lead to death. As a result, the heart is the only organ in a living being. Therefore, heart function must be maintained.

1.1 Risk Factors of Heart Disease

The causes of the rising obstruction are the risk factors. These risk variables can be divided into two categories: risk factors that can be changed and risk factors that cannot. The age, gender, and genetics are the criteria of non-modifiable risk factors. These risk factors are unchangeable and will be the primary cause of heart disease onset. Risk factors that we can change on our own are known as modifiable risk factors. Among the modifiable risk variables are: (1) habit-related; (2) stress-related; (3) food-related; and (4) biochemical and other miscellaneous risk factors. Heart illnesses come in different forms: coronary, rheumatic, congenital, myocarditis, arrhythmia, angina, and atherosclerosis.

Figure1.1.Risk factor of heart disease

1.2 THE NEED FOR HEART DISEASE PREDICTION

An estimated 17.5 million people die from cardiovascular disease each year in the world. The majority of persons who suffer from this cardiovascular illness are middle-class or lower-class, and as a result, 75% of them die from it [10]. Furthermore, heart attacks and strokes account for 80% of deaths caused by cardiovascular illness. India is among the nations where the number of people with cardiovascular disease is rising year, according to a WHO report. Two lakh open heart surgeries are performed annually due to the rising number of patients affected by heart disease [12]. The number of patients has climbed at a pace of 20%–30% over the last few years, which is cause for serious concern.

2. RELATED WORK

The World Health Organization's research indicates that the primary cause of death has increased to be health disorders. Numerous factors, including workload and mental stress, have contributed to this health problem. As a result, the doctors treat cardiac patients based on their medical history, lab results, and responses to questions from the patients. The prediction of cardiovascular disease is done by a hybrid approach that combines machine learning and data mining approaches. Medical technicians will obtain useful information about patients with cardiovascular problems by employing these hybrid procedures, which will help them provide the patient with an accurate diagnosis. Three stages of reviews of various cardiovascular disease prediction methods have been conducted. In the initial accurate diagnosis for the individual. Three different methods of predicting cardiovascular illness have been studied in order to provide the patient with an accurate diagnosis. Three stages of reviews of various cardiovascular disease prediction methods have been conducted. Using classifiers and feature selection techniques, a machine learning algorithm is used in the first phase to predict the presence of cardiac disease. In the second stage, dimensionality reduction and a deep learning approach based on entropy with a Random Forest classifier are employed to predict heart disease. Using deep learning algorithms, cardiac disease is identified in the third phase. Numerous studies have been conducted in the field of medicine to forecast the risk of heart disease using various machine learning and data mining techniques.

2.1 ROLE OF FEATURE EXTRACTION AND SELECTION IN HEART DISEASE PREDICTION

The earlier studies on the selection and extraction of various approaches are expounded upon in this part. In addition to cutting down on the training time and expense of the prediction models, feature selection is essential for eliminating redundant and unnecessary features.

2.2 Feature Selection Model for Heart Disease Prediction using Machine Learning Techniques

Fitriyani et al. (2020) developed a novel method called the HDPM heart disease prediction model, which balances trained data and XGBoost to detect heart diseases. This method was successfully applied for a clinical decision support system supported by DBSCAN density-based spatial clustering with noise and using SMOTE- ENN (synthetic minority sampling technique). - Edited by Nearest Neighbor. Along with the outcomes of other models like LR (Logistic Regression), Navies Bayes –NB, Decision Tree –DT, Multilayer Preceptor –MLP, SVM –Support Vector Machine, and the findings of earlier studies, the results of applying two distinct datasets, statlog and Cleveland, are also presented. These two models were used to infer the study's findings, which produced an accuracy of 96.40% for the remaining dataset and 95.90% for the statlog dataset.

Babu et al. (2018) presented hybrid approaches that combine auto-encoder based on RNN with Grey Wolf optimization to diagnose a variety of diseases (GWO+RNN).The features are extracted using the GWO, and the disease is identified using the RNN algorithm, which has shown better results than the previous approaches. The outputs of several datasets, including Hungarian, mammographic, and Cleveland, are compared with the suggested model. The results collected indicate a 16.82 percent gain in accuracy when compared to alternative methods. To get greater accuracy than the already used procedures, a variety of techniques might be employed to make improvements.

Gokulnath et al.'s (2019) main goal is to optimize the function by using genetic algorithms (GA) and support vector machines (SVM) to significantly choose features. The outcomes of the suggested model are contrasted with those of other methods such as consistency subset, chi squared, filtered subset, info gain, and CFS. When compared to other methods, the suggested method produced an accuracy of 88.34 percent using the chosen features for the prediction of heart disease. Furthermore, these methods have demonstrated that ROC analysis performs well in SVM classifiers.

Classifiers are typically employed in machine learning approaches to deliver an individual's faults. They are also introduced for the purpose of forecasting cardiac disorders through the evaluation of several parameters, such as heart rate, cholesterol, ECG readings, and HbA1c. In order to identify heart disorders, Kumar et al. (2021) assessed several machine learning approaches and their classifiers based on the computation time and accuracy rate over the prediction of heart disease datasets. LMT-Logistic Model Trees, Random Forest, J48, Random Tree classifiers, and Hoeffding trees are the classifiers used to identify cardiac disorders. Following investigation, the outcome derived from the

assessed datasets indicates that the hoeffding tree. has produced results with a higher accuracy of 85.1852 percent compared to the other classifiers, and it takes 0.17 seconds to compute the patient's likelihood of having heartdisease.

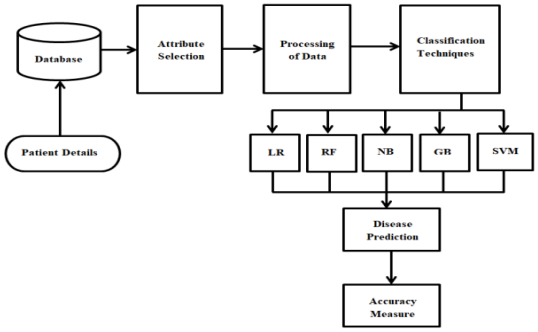

Figure 2.1 Proposed system for heart disease prediction

3.METHODOLOGY

The prediction of heart disease using FTGM-YOLO with informative entropy based random forests is covered in this chapter. The primary cause of death, according to a World Health Organization (WHO) report, is heart disease. The death rate can be decreased by early detection of cardiac disease and corrective treatment. This is the primary justification for presenting this approach.

FTGM-YOLO stands for fast track gram matrix-principal component analysis. Dimension reduction and fusion are the primary uses of the fast-track gram matric-principal component analysis in the resolution of over-fitting problems. Additionally, it reduces the amount of time and space needed, enhances classifier performance, and gets rid of unnecessary data. A technique for calculating original data into a reduced dimension or to the same number in linear algebra and simple matrix operations is principal component analysis. IEB-RF stands for informational entropy based random forest. This technique is included in the system to enhance the performance of the classifier. Its flexibility in handling large amounts of data is matched by its high classifier accuracy. The random forest is capable of classification as well as regression. Additionally, it provides a good forecast that is simple to grasp. It often becomes impossible to interpret the obtained high-dimensional non-parametric model.

3.1 PROPOSED METHODOLOGY

This research will primarily concentrate on heart-related illnesses because heart disease is a leading cause of death. Early disease prediction is the best strategy to lower the death rate. Despite the existence of numerous classification models for heart disease prediction, the accuracy of the classification results is quite low. The primary problems identified with the current methods are fast dimensionality, accuracy, efficiency, and feature selection that is pertinent.

Only the relevant characteristics that have been chosen for extraction and fusion are used in the newly developed deep Convolutional Neural Network (deep CNN). The goal of this work is to address the problems with deep learning (DL) and machine learning (ML)

algorithms for feature extraction using data mining approaches. A branch of artificial intelligence (AI) called machine learning makes it possible for software to forecast outcomes more precisely. Deep Learning (DL) functions as human knowledge and is a subset of both machine learning (ML) and artificial intelligence (AI). Deep learning is primarily applied to significant data pieces involving statistical and model prediction. The proposed methodology's general workflow is depicted in Figure 3.1 below. The introduced method's step-by-step procedure is depicted in the flow graph.

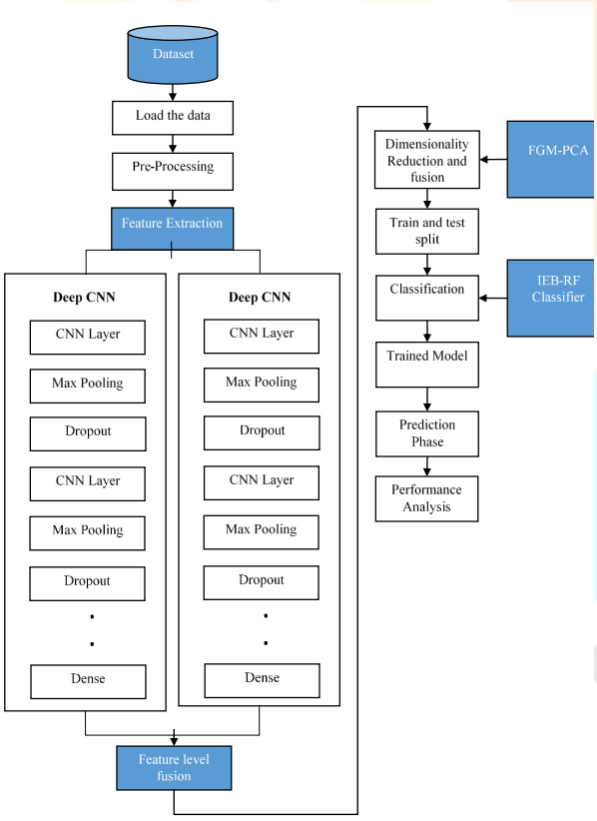

Figure 3.1 Overall view of the proposed system for predicting heart disease

4. CONCLUSION AND FUTURE WORK

Nearly all fields benefit from the use of data mining techniques, which also aid in producing useful outcomes. The suggested study highlights how important machine learning methods are to the handling and mining of health data. Heart disorders can be fatal if not properly treated in a timely manner, which is why they are regarded as one of the main issues in many nations. Early detection of cardiac disease is thought to be significant and is covered in a number of World Health Organization mortality reports. This study therefore focuses on applying machine learning approaches to forecast cardiac disease. The primary objective of this research is to predict cardiac disease at an early stage using machine learning techniques. In order to accomplish this techniques for feature selection, goal-setting, and categorization have all been applied successfully and economically. By using feature selection and classification approaches well, clinical reps can identify cardiac illnesses early on and assist in diagnosing and treating them. This lowers death rates while also preserving the lives of the patients. Three distinct techniques were used to effectively forecast cardiac disease in order to reach this goal. Heart disease cannot be accurately predicted at the medical representative level using any of the many data mining techniques that have been used. Therefore, the goal of this study is to

optimize feature selection and classification procedures in order to increase the method's performance.

This thesis is structured into three distinct approaches in order to evaluate each approach's efficacy and determine how the suggested approach performs better. The original goal of the study was to combine MLP with the enhanced Motion-Based Dragonfly Algorithm (MLP-EBMDA). This hybrid approach is employed in feature selection and classification procedures; heart disease prediction was shown to be effectively achieved through the use of an optimized unsupervised method. A number of metrics, including precision, F1 score, recall, and precision rate, are used to assess the suggested method. The effectiveness of heart disease prediction is determined by comparing the suggested technique with selected experimental data and the given parameters, which are based on existing methodologies. The accuracy percentage of the suggested technique in identifying normal and abnormal diseases is approximately 94.28%.

Up until now, machine learning methods have been the only ones used to forecast heart disease. However, in order to accurately forecast cardiac illnesses, this study attempted to combine deep learning and machine learning methods. In this study, machine learning and deep learning approaches are used for classification and feature extraction, respectively. By using deep learning approaches for feature-level fusion and relevant feature extraction, it was possible to remove unnecessary data at this point through effective learning. This implementation uses the IEB-RF model for features and classification, and FTGM-YOLO for dimensionality reduction in order to distinguish between normal and pathological patient data. This model's assessment is contrasted with those of other models that have been suggested based on relevant performance metrics. The suggested arrangement permits the for the Cleveland Heart Disease dataset, suggested IEB-RF to achieve a 97% accuracy rate in feature categorization when compared with other current approaches.

5. REFERENCE

1. Abdar, M, Książek, W, Acharya, UR, Tan, RS Makarenkov, V & Pławiak, P 2019, 'A new machine learing for an accuate diagnosis of coronary artery disease', Computer Methods and Programs in Biomedicine vol. 179, P. 104992.

2. Abed-Alguni, BH & Barhoush, M 2018, 'Distributed grey wolf optimizer for numerical optimization problems', Jordanian J. Comput. Inf. Technol. (JJCIT), vol. 4, no.

3, pp. 130-149. 3. Alarifi, A, Tolba, A, Al-Makhadmeh, Z & Said, W 2020, 'A big data approach to sentiment analysis using greedy feature selection with cat swarm

optimization-based long short-term memory neural networks', The Journal of Supercomputing, vol. 76, pp. 4414-4429.

4. Alkeshuosh, AH, Moghadam, MZ, Al Mansoori, I & Abdar, M 2017, 'Using PSO algorithm for producing best rules in diagnosis of heart disease', in 2017 International Conference on Computer and Applications (ICCA), pp. 306-311.

5. Alsaeedi, AH, Aljanabi, AH, Manna, ME & Albukhnefis, AL 2020, 'A proactive metaheuristic model for optimizing weights of artificial neural network', Indonesian Journal of Electrical Engineering and Computer Science, vol. 20, pp. 976-984.

6. Al-Tashi, Q, Abdulkadir, SJ, Rais, HM, Mirjalili, S, Alhussian, H, Ragab, MG, Alqushaibi & Alawi 2020, 'Binary multi-objective grey wolf optimizer for feature selection in classification', Access, IEEE, vol. 8, pp. 106247-106263.

7. Al-Tashi, Q, Rais, H & Jadid, S 2018, 'Feature selection method based on grey wolf optimization for coronary artery disease classification', in International Conference of Reliable Information and Communication Technology, pp. 257-266.

8. Amin, MS, Chiam, YK & Varathan, KD 2019, 'Identification of significant features and data mining techniques in predicting heart disease', Telematics and Informatics, vol. 36, pp. 82-93.

9. Ayon, SI, Islam, MM & Hossain, MR 2020, 'Coronary artery heart disease prediction: A comparative study of computational intelligence techniques', IETE, Journal of Research, pp. 1-20.

10. Azhar, M & Thomas, PA 2020, 'Heart disease prediction based on an optimal feature selection method using autoencoder', International Journal of Scientific Research in Science and Technology, vol. 7, no. 4, pp. 25-38.

11. Babič, F, Olejár, J, Vantová, Z & Paralič, J 2017, 'Predictive and descriptive analysis for heart disease diagnosis', in 2017 Federated Conferences on Computer Science and Information Systems (Fedcsis), pp. 155-163.

12. Babu, SB, Suneetha, A, Babu, GC, Kumar, YJN & Karuna, G 2018, 'Medical disease prediction using grey wolf optimization and auto encoder based recurrent neural network', Periodicals of Engineering and Natural Sciences (PEN), vol. 6, pp. 229-240.

13. 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, vol. 118, pp. 165-174.

14. 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, vol. 2021.

15. Buchan, K, Filannino, M & Uzuner, Ö 2017, 'Automatic prediction of coronary artery disease from clinical narratives', Journal of Biomedical Informatics, vol. 72, pp. 23-32, 2017.

16. Burse, K, Kirar, VPS, Burse, A & Burse, R (Eds.) 2019, 'Various preprocessing methods for neural network based heart disease prediction', Smart Innovations in Communication and Computational Sciences, Springer, Singapore.

17. Chantar, H, Mafarja, M, Alsawalqah, H, Heidari, AA, Aljarah, I & Faris, H 2020, 'Feature selection using binary grey wolf optimizer with elite-based crossover for Arabic text classification', Neural Computing and Applications, vol. 32, no. 16, pp. 12201-12220.

18. Chaurasia, V & Pal, S 2014, 'Data mining approach to detect heart diseases', Int J Adv Comput Sci Inf Technol (IJACSIT), vol. 2, pp. 56-66.

19. Choi, E, Schuetz, A, Stewart, WF & Sun, J 2017, 'Using recurrent neural network models for early detection of heart failure on set', Journal of the American Medical Informatics Association, vol. 24, pp. 361-370. 169