IJFANS INTERNATIONAL JOURNAL OF FOOD AND NUTRITIONAL SCIENCES

ISSN PRINT 2319 1775 Online 2320 7876

Research paper **Volume 11, Iss 11, Nov 2022**

EFFECTIVE EXPECTATION OF CARDIOVASCULAR SICKNESS UTILIZING AI CALCULATIONS WITH ALLEVIATION AND ROPE ELEMENT DETERMINATION METHODS

P. Tejeswar Reddy, M. TechStudent, Department of CSE, K.S.R.M. COLLEGE OF ENGINEERING(UGC-AUTONOMOUS)Kadapa, Andhra Pradesh, India- 516005Approved by AICTE, New Delhi & Affiliated to JNTUA, Ananthapuramu.

Dr. V.Venkata Ramana, Professor, Department of CSE,K.S.R.M. COLLEGE OF ENGINEERING(UGC-AUTONOMOUS)Kadapa, Andhra Pradesh, India- 516005Approved by AICTE, New Delhi & Affiliated to JNTUA, Ananthapuramu.

Dr. V. Lokeswara Reddy, Professor&HOD,DepartmentofCSE,K.S.R.M. COLLEGE OF ENGINEERING(UGC-AUTONOMOUS)Kadapa,Andhra Pradesh, India- 516005.516005 Approved by AICTE, New Delhi & Affiliated to JNTUA, Ananthapuramu.
Email id : vlreddy74@gmail.com

Abstract

Cardiovascular sickness stays a main source of worldwide dreariness and mortality, requiring precise early expectation and counteraction systems. This study proposes an inventive way to deal with improve the effectiveness of CVD expectation utilizing AI calculations combined with two high-level element determination strategies: Alleviation and Rope. The goal is to further develop expectation exactness while limiting the quantity of elements, consequently improving both model execution and interpretability. In this exploration, a thorough dataset containing clinical and segment factors from a different populace was gathered. The Alleviation highlight choice procedure was at first utilized to distinguish and rank the most important elements in view of their effect on forecast exactness. Accordingly, the Rope strategy was utilized to additionally refine the list of capabilities by punishing non-contributory highlights.

Keywords:Cardiovascular sickness; Expectation; Alleviation; Rope; AI; Random Forest; and Decision Tree.

Introduction

The expectation and counteraction of cardiovascular sickness (CVD) have arisen as basic difficulties in current medical services, given its broad pervasiveness and critical effect on worldwide wellbeing according to WHO (WHO, 2023). In this specific circumstance, the reconciliation of AI (ML) (Deepamalar) calculations with innovative highlight choice procedures has collected impressive consideration as a promising road for accomplishing exact and proficient CVD expectation (Haq et al., 2018; Kaushik, 2021; Menaga & Paruvathavardhini, 2022; Pouriyeh et al., 2017). These studies expect to investigate the capability of Alleviation and Tether (Least Outright Shrinkage and Choice Administrator) highlight determination strategies in upgrading the prescient capacities of ML calculations for Cardiovascular infection, enveloping circumstances like coronary course illness, cardiovascular breakdown, and stroke, stays a main source of horribleness and mortality around the world. Customary gamble evaluation models frequently depend on a restricted arrangement of hazard factors, possibly passing up complicated connections and collaborations among various factors that add to CVD (Stanner et al., 2018). Here, ML calculations (Ajmihachami et al., 2023) offer a remarkable benefit by their capacity to process and examine huge datasets, uncover stowed away examples, and produce prescient models that consolidate a large number of elements.

ISSN PRINT 2319 1775 Online 2320 7876
Research paper **Volume 11, Iss 11, Nov 2022**

Research and Background

Cardiovascular illness (CVD) stays a critical worldwide wellbeing concern, representing a significant part of grimness and mortality. Early and exact expectation of CVD can work with ideal intercessions and work on persistent results (Mendis et al., 2022a; Mendis et al., 2022b). Lately, AI calculations have shown guarantee around here by utilizing huge scope information to distinguish examples and highlights that add to CVD risk (Dong et al., 2021; Karatzia et al., 2022; Mathan et al., 2018; Mathur et al., 2020; Xu et al., 2021). Among the difficulties experienced in creating strong prescient models are highlight choice and overfitting. This exploration proposition expects to address these difficulties through the mix of Help and Tether include choice procedures into AI calculations for effective expectation is an element determination technique that surveys the pertinence and overt repetitiveness of highlights by thinking about the distance between occurrences. By underlining the highlights that contribute the most to separating among positive and negative occurrences, Help can upgrade the model's discriminative power and diminish dimensionality. Tether (Least Outright Shrinkage and Determination Administrator) is another element choice method that consolidates a punishment term to the model's expense capability, empowering the determination of a subset of significant highlights while contracting the coefficients of less pertinent highlights to nothing. This regularization method (Gupta et al., 2018; Santos & Papa, 2022; Ying, 2019) upgrades forecast execution as well as helps in relieving the gamble of overfitting (Kumar, 2023; Shah, 2023). The proposed examination will include the usage of a thorough dataset of clinical, segment, and way of life factors connected with CVD (Almustafa, 2020; Das et al., 2009; Patel et al., 2015; Ramesh et al., 2022). At first, the dataset will go through preprocessing and highlight designing to guarantee information quality and importance. Along these lines, different AI calculations, for example, Arbitrary Backwoods, Backing Vector Machines, and Inclination Helping will be utilized for model turn of events. These calculations will be incorporated with Help and Rope procedures to refine include choice and upgrade model speculation. The display of the made models will be surveyed using estimations like precision, exactness, audit, and locale under the beneficiary working brand name twist (AUC-ROC). The results will be diverged from existing assumption models to assess the adequacy of the proposed approach. It is speculated that the coordination of Easing and Tie strategies will incite more miserly and exact models, in like manner adding to the field of cardiovascular disease assumption using artificial intelligence (Al-Shayea, 2011; Ghwanmeh et al., 2013).

Features of dataset

- **Age:** The age of the patient, which can play a role in cardiovascular health due to the natural aging process and associated risk factors.
- **Sex:** The gender of the patient (0 for female, 1 for male), which can influence susceptibility to certain cardiovascular conditions.
- **Chest Torment Type (CPT):** Addresses the sort of chest torment experienced by the patient, frequently characteristic of various hidden causes or seriousness of heart issues.
- **Resting Blood Pressure (restbps):** The patient's blood pressure while at rest, a key indicator of cardiovascular health and potential hypertension.
- **Cholesterol (chol):** The cholesterol level of the patient, a significant risk factor for heart disease.
- **Fasting Blood Sugar (fbs):** Indicates whether the patient's fasting blood sugar is above a certain threshold, offering insights into their diabetes risk.
- **Resting Electrocardiographic Results (restecg):** Represents the results of the resting electrocardiogram, aiding in diagnosing heart rhythm abnormalities.
- **Max Heart Rate Achieved (thalach):** The most extreme pulse achieved during exercise, giving data about cardiovascular wellness.
- **Exercise Induced Angina (exan):** Indicates whether the patient experienced angina (chest pain) during exercise, which can be indicative of heart disease.

ISSN PRINT 2319 1775 Online 2320 7876
Research paper **Volume 11, Iss 11, Nov 2022**

- **ST Depression Induced by Exercise (goldpeaks):** Represents abnormal changes in the ST segment during exercise, pointing to potential heart problems.
- **Slope of the Peak Exercise ST Segment (lope):** Describes the slope of the ST segment during peak exercise, helping assess heart function.
- **Number of Significant Vessels Shaded by Fluoroscopy (ca):** Demonstrates the quantity of significant veins with decreased blood stream, a significant symptomatic marker.
- **Thalassemia (thal):** A blood disorder type, influencing the heart's ability to pump blood efficiently.
- **Target:** The presence of heart disease (0 for no, 1 for yes), the outcome variable that the predictive model aims to predict Implementing Machine Learning Techniques on Covert Channels.

Steps of Machine Learning
The Common steps in the implementation of Machine Learning are as follows:

Data Importing
Start by obtaining the "heart.csv" dataset from Kaggle, which contains information about various features related to cardiovascular health. Utilize a data manipulation library, such as pandas in Python, to load the dataset into your machine-learning environment. This step converts the dataset into a structured format that can be easily worked with (CAESAR, 2023; Simmons II, 2021).

Data Preprocessing
Taking care of Missing Qualities Check for any missing qualities inside the dataset (Bennett & health, 2001). In the event that present, settle on a fitting technique to deal with them, which could include attribution or expulsion of deficient lines. Encoding Straight out Factors A few sections, similar to "sex," "cp," "exang," "incline," and "thal," may contain all out information. These should be changed into mathematical qualities utilizing procedures like one-hot encoding (making parallel sections for every class) or mark encoding (relegating an exceptional number to every classification). Highlight Scaling To ensure that numerical components are on a near scale, apply incorporate scaling. Typical systems consolidate normalization (scaling components to an arrive at some place in the scope of 0 and 1) or standardization (scaling features to have an average of zero along with a standard deviation of one).

Data Splitting
Portraying Features and Target: Separate the dataset into features (X) and the objective variable (y), where X contains with or without areas from the "target" section and y contains only the "target" portion. Train-Test Split: Partition the data into planning and testing subsets. The planning set is used to set up the man-made intelligence models, while the testing set is put something aside for surveying their show (Basgalupp et al., 2021).

Model Training
After selecting the appropriate machine learning model, it undergoes training using the preprocessed dataset. Throughout this training process, the model becomes adept at discerning between regular network traffic and covert channel activities, leveraging the engineered features (Musumeci et al., 2018).

Predictions
Apply the trained models to the testing data to generate predictions for each instance.

ISSN PRINT 2319 1775 Online 2320 7876
 Volume 11, Iss 11, Nov 2022

Prevalence of RandomForestClassifier in heart.csv

The predominance of the RandomForestClassifier with regards to the "heart.csv" dataset alludes to its utilization as an AI calculation to foresee the presence or nonappearance of cardiovascular infection (Zaidi, 2023). The RandomForestClassifier is a well-known group learning strategy that forms numerous choice trees during preparing and consolidates their forecasts to deliver an outcome. It is much of the time picked for its capacity to deal with complex connections inside information and alleviate issues like overfitting. In the situation of the "heart.csv" dataset, the RandomForestClassifier has been used to fabricate a prescient model for cardiovascular sickness recognition. This includes preparing the classifier utilizing a subset of the information containing highlights like age, sex, cholesterol levels, circulatory strain, and others, while the objective variable demonstrates whether an individual has coronary illness (1) or not (0) (Madhumita Pal, 2023; Uddin et al., 2023).

Related Works

In (Trevisan et al., 2020), the mind heart association is depicted using the sex-and bearing related contrasts, which will generally change over a single's life span, in this manner contrasting with create. In any case, since the essential for a course unequivocal framework has had making thought just in the most recent years, this issue has not yet been completely made sense of. The information opening is particularly independent for pathologies that have overall been considered relating by and large to men, e.g., cardiovascular afflictions, or to ladies, e.g., neuropsychiatric circumstances, and out and out more communicated in regards to the association lies between these dysfunctions. This part will introduce an outline of the constant check on the sex-and heading associated perspectives that could impact the mind heart association and the conceivable impact of creating on such parts. Sex-and heading associated focuses will, expressly, be assessed as to individual deficiency and the bet factor plans related with the turn of events and co-event of neuropsychiatric as well as the cardiovascular pathologies; the instruments by which the unfortunate and cardiac frameworks communicate with each other; the dual- directional association intermediary to the psychoneurological issues and cardiovascular infirmities; moreover, the qualifications the manner in which the neuropsychiatric as well as the cardiovascular circumstances are seen and handled which could impact the course as well as the co-event of these ailments. The compact crosstalk among heart as well as the frontal cortex is ending up being logically seen as the strange common parts are better seen, posing a prospective effect for clinical perspective. Cardiovascular administering is accomplished through a 3-phase moderate neuronal connection, where every one of the parts collaborate to fulfill the physiological solicitation. In any case, all parts of this affiliation can go through pathologic-mediated changes considering the transduction of changed material data sources starting from a weakening heart. An essential work in the assistance of cardiac-related homeostasis is taken care using the autonomous material system with its brilliant and parasympathetic branches, which work in a comparing way. Beat best mirrors the general congruity between these two frameworks, and particularly beat fluctuation has arisen as a significant cutoff which mirrors the thriving repute of a given person. Mind reflexes and a couple nerve stimulation agents set freed from the certified heart or coming from different protests along with the neurotrophins, similarly add to cardiac-related homeostasis and is viewed as in the continuous parts. A more significant perception of heart-mind joint efforts will work with the short affirmation and the leading body of cardiovascular sicknesses, as well as of neurologic issues connected with heart brokenness, and, at the same time, will help in working on the healing strategy. The comprehension of cardiovascular neuronal management has decidedly developed over the latest fifty years, both from a physical as well as a valuable viewpoint. Cardiovascular neuronal management is handled through a movement of reflex management networks incorporating somata in the intrathoracic extracardiac ganglia, regular heart ganglia, unparalleled cervical ganglia, spinal line, brainstem, and higher core interests (Mourao-Miranda et al., 2005). All of these taking care of spots comprises efferent, afferent, and close by circuitry neurons that team up locally and in a dependent style containing various phases to sort out regional heart mechanical as well as the electrical records on a bang to-throb premise. This

ISSN PRINT 2319 1775 Online 2320 7876
Research paper **© 2012 IJFANS. All Rights Reserved**, Volume 11, Iss 11, Nov 2022

neuronal management structure exhibits flexibility and memory limit, permitting it to keep a good heart capacity due to common physiological stressors like standing and exercise. The said neuronal management framework exhibits flexibility and memory limit, permitting it to keep a good heart capacity considering regular physiological stressors like standing and exercise. Be that as it may, fanatical events, for instance, myocardial ischemia along with some other kind of cardiovascular stressor could vanquish the homeostatic capacity of the structure, provoking over the top sympathoexcitation joined with removal of central parasympathetic drive. As such, autonomous dysregulation is fundamental to the progress of cardiovascular breakdown as well as the improvement of hazardous arrhythmias. As necessary, knowing the physical as well as the anatomical avocation for cardiovascular neuronal management is persuasive for execute truly novel neuromodulator meds to coordinate the advancement of heart ailment. Frame This strong and expansive handbook watches out for a fundamental commitment to our repetitive example awareness of joint endeavors among heart and cerebrum, an appraisal subject conveying making interest.

(Oh & Jeong, 2020) analyzed the relationship among CVD and SES -associated prosperity repute for female as well as the male workers. While taking a gander at the relationship for male and female trained professionals, the two qualifications and resemblances were taken note. The essential discernments follow. In any case, the drinking as well as the smoking affinities differed among female as well as the male subject matter experts. Next, when the OR of weight and stomach plumpness was greater for male containing additional huge pay or male living in urban organizations, then again, it was greater for reduced pay ladies or ladies remaining across country regions. Then, the predominance of having a spot with the pre-hypertension pack as well as the pre-diabetes category was greater for female as well as the male specialists over all grown-ups. In like manner, for female as well as the male specialists, since age expanded or pay reduced, the OR of CVD threat reached out for weight, stomach substantialness, high FG, hypertension, hypertriglyceridemia, hypercholesterolemia, raised LDL-C, reduced HDL-C, once subjects remained in a typical district, were presently smokers, partook in strolling on different occasions consistently or less, planned practice on different occasions consistently or less, or didn't partake in overwhelming development. Past assessments considering colossal volumes of information, which could think about the divulgences of this review, zeroed in on certainly grown-ups alone as opposed to on laborers. In any case, two or three evaluations have been composed among laborers in a specific district or at a specific business environment. Consequently, the instances of thriving direct and CVD-associated flourishing repute were determined to move in female specialists as well as the male educated authorities, and the same was the basic discovery of the continuous review. In a survey that separated the drinking and smoking habit of labours using the KWCS- Korean Working Conditions Study, the continuous smoking speed of male was seen as great among youngsters and decently matured male; regardless, a steady decay was found in female with development in their ages, assisting the disclosures of this survey. The time when a person stops consuming smoke and how much the smoke habit was there before a person had stopped are the fundamental contemplations impacting the decline in CVD threat 32%.

The emerging scenarios of heart-related sickness were computed by (Raja et al., 2021). The data sets utilized have healthcare variable characteristics. The datasets were handled with Python utilizing the ML Method, namely the Random Forest Method. This approach analyses historical medical information of the patients to anticipate future ones at the beginning phase, therefore reducing the loss of life. In this study, a reliable cardiac disease forecasting framework was constructed utilizing the Random Forest method. In their framework, a CSV file (a spreadsheet file) containing the patient's info was read.

Proposed Methodology

In our proposed model, ten highlights have been assessed to make this correlation more exceptional. The presented calculations were led in light of the all highlights, Help chosen includes the acquired results were contrasted with different attempts to show the level of progress, while decline in execution likewise noted in one event (RFBM, DTBM, KNNBM, ABBM, GBBM). The most

ISSN PRINT 2319 1775 Online 2320 7876
Research paper **© 2012 IJFANS. All Rights Reserved**, **Volume 11, Iss 11, Nov 2022**

noteworthy addition was seen for Stomach muscle approach rather than past works which was about rate improvement were determined for 13 ascribes. Cardiovascular illness is utilized to decide if a patient is in danger of having a respiratory failure. The below figure 1 depicts the block diagram of effective expectation for cardiovascular sickness.

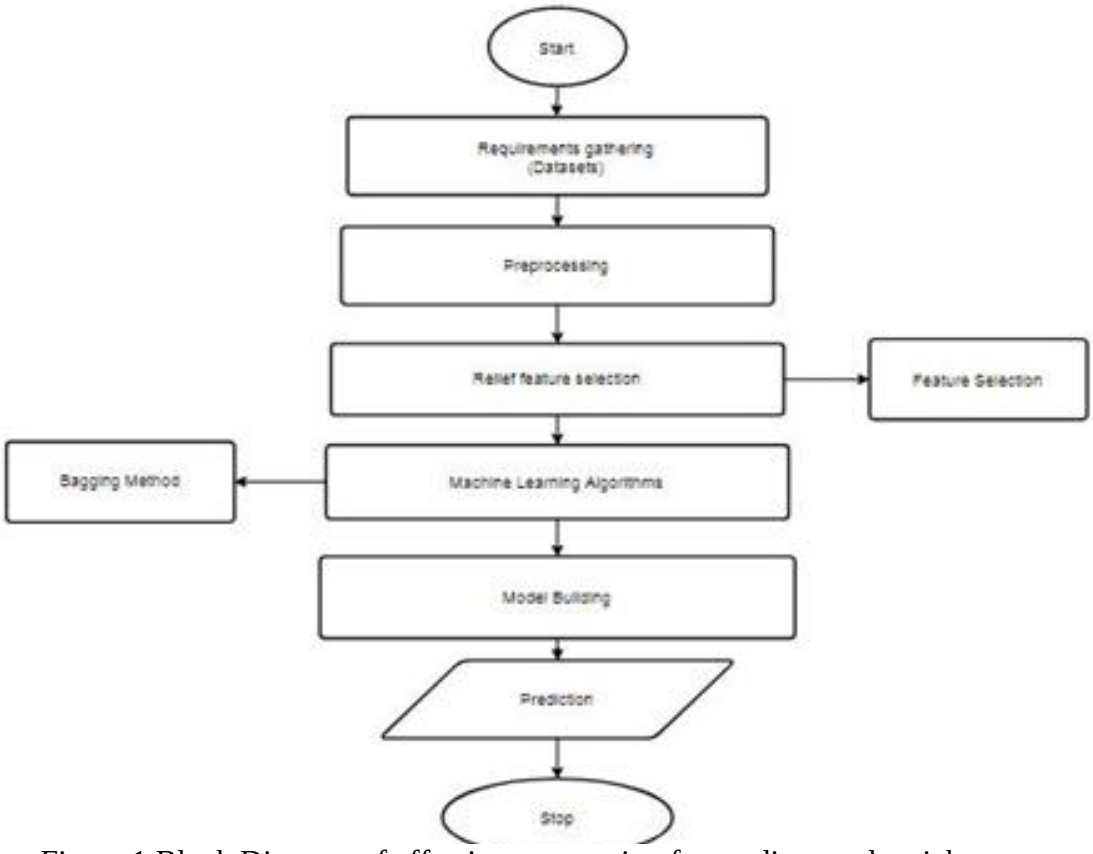

Figure 1 Block Diagram of effective expectation for cardiovascular sickness

Implementation

Random Forest Classifier

- **Load the Data:** Start by loading the dataset "heart.csv" which contains the relevant features and target variable.
- **Data Preprocessing:** Play out any vital preprocessing steps like taking care of missing qualities, encoding clear cut factors (if any), and dividing the information into highlights (X) and target (y).s
- **Feature Selection:** You referenced utilizing the Alleviation and Rope highlight choice strategies. In the first place, apply these methods to choose the most important highlights for your expectation model (Yadav & Pal, 2020).
- **Model Building:** Whenever you have chosen the highlights, you can fabricate an Irregular Woodland classifier utilizing the chose highlights. Irregular Backwoods is a gathering of choice trees and is a strong calculation for grouping undertakings.
- **Training and Testing:** Divide your information into preparing and testing sets. Train your Irregular Backwoods model on the preparation information and assess its exhibition on the testing information.

Decision Tree Bagging Method

Decision Tree is a Regulated PC based insight strategy for overseeing manage depiction and lose the faith issues by tirelessly dividing information thinking about a specific breaking point. The choices

ISSN PRINT 2319 1775 Online 2320 7876
Research paper **Volume 11, Iss 11, Nov 2022**

are in the leaves and the information is isolated in the focuses. In Depiction Tree the choice variable is altogether (result as Yes/No) and in Lose the faith tree the choice variable is steady. Choice Tree participates in the going with benefits: it is reasonable for lose the faith as well as solicitation issue, ease in translation, straightforwardness of managing self-evident and quantitative attributes, ready for filling missing qualities in credits with the most possible worth, pervasive show considering effectiveness of tree crossing assessment. Choice Tree could experience the issue of over-fitting for which Eccentric Forests is the strategy, which depends upon outfit showing approach. Impediments of choice tree is that it will overall be unstable, it might be attempting to control size of tree, it could be inclined to taking a gander at mistake and it gives a locally ideal blueprint not generally ideal strategy. Choice Trees can be utilized in applications like expecting future utilization of library books and improvement gather issues. In a choice tree, for anticipating the class of the given dataset, the assessment begins from the root place point of the tree. This calculation separates the likely gains of root brand name and the record (authentic dataset) quality, taking into account the appraisal, follows the branch, and leaps to the going with focus point. For the going with focus, the assessment again separates the quality worth and the other sub-focuses and move further. It go on with the cycle until it appears at the leaf focal point of the tree. The hard and fast association can be better seen utilizing the under calculation. Expect there is a competitor who has a proposal for business and prerequisites to close whether he ought to perceive the game plan. Consequently, to manage this issue, the choice tree begins with the root place (Pay brand name by ASM).

Result and Discussion

In this section, the screenshots of the implementation along with the obtained results have been presented. Furthermore, a comparison table showing the obtained values using algorithms like DT, RF, KNN, ADB, and GB.

Home Page

The user can view the home page of cardiovascular diseases web application as shown in the below figure 2.

Figure 2 Depiction of Home page in our cardiovascular diseases-based web application

About Page

In the about page that has been shown in the below figure 3, the users can learn more about cardiovascular diseases and risk and symptoms of the particular disease.

ISSN PRINT 2319 1775 Online 2320 7876
Research paper **Volume 11, Iss 11, Nov 2022**

Figure 3 Depiction of About page in our cardiovascular diseases-based web application

Training Page

The training of the algorithm could be done in this training page (which has been shown in the below figure 4) to see which one has the best accuracy.

Figure 4 Depiction of Algorithm Training page in our cardiovascular diseases-based web application

Detection Page

This detection page depicted in the below figures 5 and 6 show the detection result of patient have a chance to getting Heart Stroke or not.

ISSN PRINT 2319 1775 Online 2320 7876
Research paper Volume 11, Iss 11, Nov 2022

Figure 5 Depiction of Detection page showing the Patient exhibiting a chance of getting Heart Stroke

In the above figure 5, the chance for a person to get a heart stroke was expected successfully.

Figure 6 Depiction of Detection page showing the Patient exhibiting no chance of getting Heart Stroke

In the above figure 6, the chance for a person not to get a heart stroke was expected successfully.

Comparison Table

The gave assessment measurements shed light on the exhibition of different AI calculations for anticipating cardiovascular infection. Exactness, accuracy, and review are vital measurements used to check the viability of these models. The Choice Tree (DT) calculation displayed a 83% exactness. It exhibited an accuracy of 0.81, meaning that around 81% of its positive forecasts were precise. The review of 0.86 demonstrated its capacity to recognize 86% of genuine positive cases. Then again, the Irregular Timberland (RF) calculation beat the DT with a 85% exactness, 0.82 accuracy, and an eminent 0.90 review. This infers a more grounded capacity to recognize positive cases accurately, the k-Closest Neighbors (KNN) calculation had a nearly lower exactness of 65%, alongside 0.66 accuracy and 0.67 review. Albeit moderate, its expectations could profit from progress. The AdaBoost (ADB) calculation scored a 80% exactness, 0.78 accuracy, and 0.84 review, displaying a reasonable accuracy review compromise. Ultimately, the Inclination Helping (GB) calculation yielded a 82% exactness, 0.79 accuracy, and a raised 0.88 review. This showed an inclination for review, proposing an emphasis on catching more genuine positive casesThe determination of these measurements ought to line up with the issue's specific situation. For example, in clinical determinations like cardiovascular illness expectation, a higher review may be liked as missing a positive case could have extreme ramifications. Every calculation's exhibition qualities as uncovered

ISSN PRINT 2319 1775 Online 2320 7876
Research paper **Volume 11, Iss 11, Nov 2022**

by these measurements can direct calculation determination and further model refinement. The below table 1 shows the summary of all the results obtained using algorithms like DT, RF, KNN, ADB, and GB.

Table.1. Comparison showing the performance metrics of all Algorithms

Algorithms	Accuracy	Precision	Recall
DT	83%	0.81%	0.86%
RF	85%	0.82%	0.90%
KNN	65%	0.66%	0.67%
ADB	80%	0.78%	0.84%
GB	82%	0.79%	0.88%

Conclusion

This study takes practically identical course, yet with an enhanced and innovative approach and with a greater dataset for setting up the framework. Our investigation reveals the way that the Assist with including assurance estimation can give a solidly related feature set which then, at that point, can be used with a couple of man-made intelligence computations. The survey has moreover perceived that RFBM works commendably with the raised influence components and yields an accuracy, essentially greater than prior research. RFBM yielded a best accuracy containing 13 components. Cardiovascular disorder is used to choose if a patient is at risk for having a respiratory disappointment.

References

1. WHO. https://www.who.int/news-room/fact-sheets/detail/cardiovascular-diseases-(cvds). (Accessed on August 24, 2023). 2023.
2. Deepamalar M. Artificial Intelligence Based Semantic Web Decision Support System for Health Care Big Data.
3. Kaushik S. Big Medical Data Analytics Using Sensor Technology. Efficient Data Handling for Massive Internet of Medical Things: Healthcare Data Analytics: Springer; 2021. p. 45-70.
4. Menaga S, ParuvathavardhiniJJSSfIA. AI in Healthcare. 2022:115-40.
5. Pouriyeh S, Vahid S, Sannino G, De Pietro G, Arabnia H, Gutierrez J, editors. A comprehensive investigation and comparison of machine learning techniques in the domain of heart disease. 2017 IEEE symposium on computers and communications (ISCC); 2017: IEEE.
6. Haq AU, Li JP, Memon MH, Nazir S, Sun RJMis. A hybrid intelligent system framework for the prediction of heart disease using machine learning algorithms. 2018;2018:1-21.
7. Stanner S, Coe S, Frayn KN. Cardiovascular disease: diet, nutrition and emerging risk factors: John Wiley & Sons; 2018.
8. Ajmihachami MAR, Alhameedawi KAM, Hasan AA. Using Ensembles and Machine Learning Techniques to Classify Heart Diagnosis. 2023.
9. Mendis S, Graham I, Narula JJGH. Addressing the global burden of cardiovascular diseases; need for scalable and sustainable frameworks. 2022;17(1).
10. Mendis S, Graham I, Narula J. Addressing the Global Burden of Cardiovascular Diseases; Need for Scalable and Sustainable Frameworks. 2022.
11. Karatzia L, Aung N, Aksentijevic DJFiCM. Artificial intelligence in cardiology: Hope for the future and power for the present. 2022;9:945726.
12. Mathur P, Srivastava S, Xu X, Mehta JLJCMIC. Artificial intelligence, machine learning, and cardiovascular disease. 2020;14:1179546820927404.
13. Xu Y, Liu X, Cao X, Huang C, Liu E, Qian S, et al. Artificial intelligence: A powerful paradigm for scientific research. 2021;2(4).
14. Dong F, Qiu C-W, Qiu J, Hua K, Su W, Wu J, et al. Artificial intelligence: A powerful paradigm for scientific research. 2021.

ISSN PRINT 2319 1775 Online 2320 7876
 Volume 11, Iss 11, Nov 2022

15. Mathan K, Kumar PM, Panchatcharam P, Manogaran G, Varadharajan RJDafes. A novel Gini index decision tree data mining method with neural network classifiers for prediction of heart disease. 2018;22:225-42.
16. Santos CFGD, Papa JPJACS. Avoiding overfitting: A survey on regularization methods for convolutional neural networks. 2022;54(10s):1-25.
17. Ying X, editor An overview of overfitting and its solutions. Journal of physics: Conference series; 2019: IOP Publishing.
18. Gupta S, Gupta R, Ojha M, Singh K, editors. A comparative analysis of various regularization techniques to solve overfitting problem in artificial neural network. Data Science and Analytics: 4th International Conference on Recent Developments in Science, Engineering and Technology, REDSET 2017, Gurgaon, India, October 13-14, 2017, Revised Selected Papers 4; 2018: Springer.
19. Kumar GS. https://towardsdatascience.com/regularization-machine-learning-891e9a62c58d. (Accessed on August 24, 2023). 2023.
20. Shah R. https://www.analyticsvidhya.com/blog/2021/07/prevent-overfitting-using-regularization-techniques/. (Accessed on August 24, 2023). 2023.
21. Das R, Turkoglu I, SengurAJEswa. Effective diagnosis of heart disease through neural networks ensembles. 2009;36(4):7675-80.
22. Patel J, TejalUpadhyay D, Patel SJHD. Heart disease prediction using machine learning and data mining technique. 2015;7(1):129-37.
23. AlmustafaKMJBb. Prediction of heart disease and classifiers' sensitivity analysis. 2020;21(1):1-18.
24. Ramesh T, Lilhore UK, Poongodi M, Simaiya S, Kaur A, Hamdi MJMJoCS. Predictive analysis of heart diseases with machine learning approaches. 2022:132-48.
25. Al-ShayeaQKJIJoCSI. Artificial neural networks in medical diagnosis. 2011;8(2):150-4.
26. Ghwanmeh S, Mohammad A, Al-Ibrahim AJJoILS, Applications. Innovative artificial neural networks-based decision support system for heart diseases diagnosis. 2013;5(03):176-83.
27. Simmons II B. Investigating Heart Disease Datasets and Building Predictive Models: Elizabeth City State University; 2021.
28. CAESAR M. https://www.kaggle.com/code/caesarmario/listen-to-your-heart-a-disease-prediction. (Accessed on August 24, 2023). 2023.
29. Bennett DAJA, health NZjop. How can I deal with missing data in my study? 2001;25(5):464-9.
30. Basgalupp M, Cerri R, Schietgat L, Triguero I, Vens CJIS. Beyond global and local multi-target learning. 2021;579:508-24.
31. Musumeci F, Rottondi C, Nag A, Macaluso I, Zibar D, Ruffini M, et al. An overview on application of machine learning techniques in optical networks. 2018;21(2):1383-408.
32. Zaidi J. https://towardsdatascience.com/project-predicting-heart-disease-with-classification-machine-learning-algorithms-fd69e6fdc9d6. (Accessed on August 24, 2023). 2023.
33. Madhumita Pal SP, corresponding author Ganapati Panda, Kuldeep Dhama, and Ranjan K. Mohapatra. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9206502/. (Accessed on August 24, 2023). 2023.
34. Uddin KMM, Ripa R, Yeasmin N, Biswas N, Dey SKJI-BM. Machine learning-based approach to the diagnosis of cardiovascular vascular disease using a combined dataset. 2023;7:100100.
35. Trevisan C, Sergi G, Maggi SJB, dynamics h. Gender differences in brain-heart connection. 2020:937-51.
36. Mourao-Miranda J, Bokde AL, Born C, Hampel H, Stetter MJN. Classifying brain states and determining the discriminating activation patterns: support vector machine on functional MRI data. 2005;28(4):980-95.
37. Oh MS, Jeong MHJTKJoM. Sex differences in cardiovascular disease risk factors among Korean adults. 2020;95(4):266-75.

ISSN PRINT 2319 1775 Online 2320 7876

Research paper **Volume 11, Iss 11, Nov 2022**

38. Raja MS, Anurag M, Reddy CP, Sirisala NR, editors. Machine learning based heart disease prediction system. 2021 International Conference on Computer Communication and Informatics (ICCCI); 2021: IEEE.
39. Yadav DC, Pal SJIJoPR. Prediction of heart disease using feature selection and random forest ensemble method. 2020;12(4):56-66.