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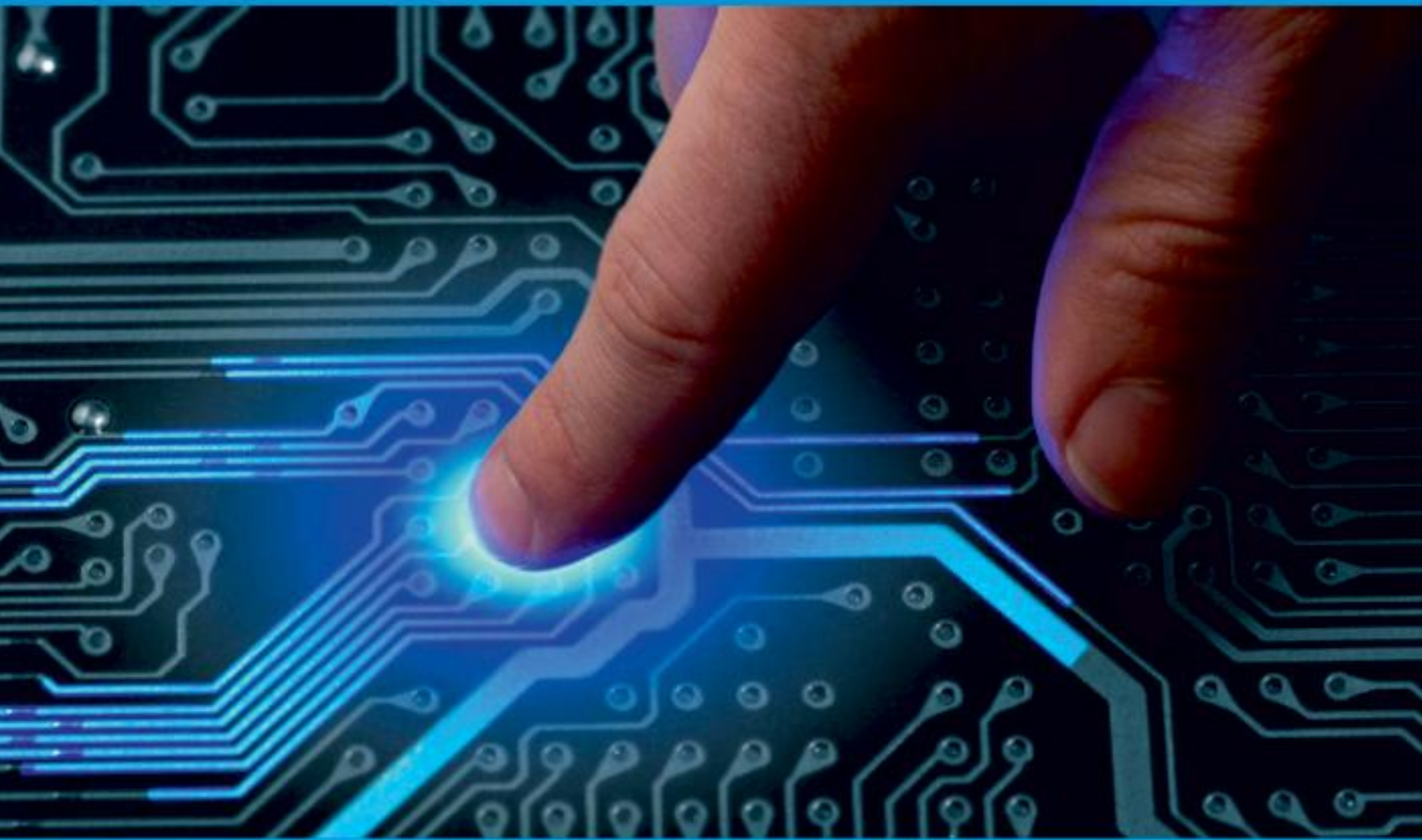

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Analysis of a Heart Disease Prediction System Using Machine Learning

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ABSTRACT: The heart plays an important role in living organisms. Diagnosing and predicting heart diseases requires more accuracy, perfection and correctness, because a small mistake can cause fatigue problems or death of a person, there are many cases of heart related deaths and the number is increasing exponentially day by day. To solve this problem, there is an imperative need for a predictive system for disease awareness. Machine learning is a branch of artificial intelligence (AI), it provides prestigious support in predicting any kind of event that takes training from natural events. In this paper, we calculate the accuracy of machine learning algorithms for heart disease prediction, for these algorithms are KNN classifier, Logistic Regression and Extra Trees Classifier using Kaggle dataset for training and testing. To implement Python programming, the best tool is Anaconda(jupyter) notebook, which has many types of libraries, header files that make the work more precise and accurate.

KEYWORDS: Disease prediction system, Machine Learning, Supervised learning, heart disease.

I. INTRODUCTION

The heart is one of the largest and most vital organs of the human body, so taking care of the heart is essential. Most of the diseases are related to the heart, so the prediction of heart diseases is necessary and for this a comparative study is needed in this area, today most patients die because their diseases are recognized at the last stage due to the lack of accuracy of the device, so there is a need to know about more effective algorithms for disease prediction.

Machine learning is one of the powerful technologies for testing which is based on training and testing. It is a branch of artificial intelligence (AI), which is one of the broad fields of learning where machines emulate human abilities, machine learning is a specific branch of AI. On the other hand, machine learning systems are trained to learn how to process and use data, which is why the combination of both technologies is also called Machine Intelligence.

As a definition of machine learning, it learns from natural phenomena, natural things, so in this project we use biological parameter as test data like cholesterol, blood pressure, gender, age, etc. and based on these, the comparison is made in terms of accuracy of algorithms, as inthis project we used three algorithms which are KNN classifier, Logistic Regression and Extra Trees Classifier.

In this article, we will calculate the accuracy of three different machine learning approaches and based on the calculation, we will conclude which one is the best.

II. LITERATURE SURVEY

A decline in clinical consistency is often a serious problem for patients in internal clinics. Chipara[2] enables remote bedside monitoring to be organized and implemented on the clinic premises. The remote systems shown periodically collect patient assessments of heart rate and oxygen saturation. He is also considering whether WSN in healthcare facilities could have another health insurance option.

A well-trained medical workforce is considered one of the key strengths of the Indian medical care structure. The breadth and effectiveness of the human resources offered by these institutions has improved significantly. Actions to strengthen the security system are described by Khambete[3]. As a result, it highlights the shortcomings in the health problems of the health facility and the measures that need to be taken to increase the level of public resources in India.

Besides Priyan, Malarvizhi Kumar presented a three-layer IOT concept for early detection of heart diseases using deep learning methods. They also created three-layer frameworks for processing and storing the vast amounts of data produced by wearable technology. Tier 1 focuses on processing data from certain sensors, Tier 2 uses Apache HBase to store enormous volumes of data in the cloud, and Tier III uses Apache Mahout to create a logistic-driven predictive model with a regression focus. Finally, he performs an ROC study to obtain information about cardiac nodes.

Mingyu Park et al. [5] implemented a smart chair software in 2016 that uses a smart device to track and visualize the owner's position and help users correct their imbalanced role. They also used tilt and pressure sensors for communication, transmitting data with low energy consumption using I and Bluetooth technologies. This Arduino program often detects different user locations. By providing real-time actionable and visually appealing facts to the smartphone client, this app enhances the user's ability to think about their own current situation. The tension is displayed as red, yellow, green and orange rings on the left and right hands, along with the current position and ideal position of the simulation. This is a perfect example of the Internet of Things.

A cloud and IoT program designed for mobile healthcare was created and upgraded in [6] to identify the actual degree of severity and diagnose it according to gravity. Embedded and wearable IoT tools are different types of IoT devices. These tools are used to collect data from remote areas surrounding the procedure. IoT applications connected to the human body may be able to obtain instantaneous measurements as fresh data. The UCI Repository Dataset and Treatment Sensors are used to create similar medical data to predict how severely diabetes has affected the general population. By performing the five distinct elements of the previously defined management process, such as information gathering, information retrieval, information processing, information separation, and information blending, the resulting knowledge can be securely processed.

Administrators have on-demand access to organized planning via cloud storage [7]. This practice is used to collect data from smart devices, evaluate and analyze information and create online consumer statistics. It works invisibly. It's also a hugely appealing feature of this approach, as it would create a market with plenty of incentives to attract clients for IoT software. Typically, this data can be tested in the cloud using extensive data analysis and machine learning predictions. These calculations can be improved by using machine learning, a form of artificial reasoning that collects data from previous calculations.

A WSN is a self-governing sensor network that communicates data to a central zone through a framework [8]. The use of many different IoT applications by an IoT system that needs a WSN to collect data for different purposes is likely to provide independent and unique results. Data aggregation is only the first stage of the IoT process; additional data must be collected, transformed into notable information, or made available to certain items. Any protest will be thwarted by WSN-enabled gadgets, whose massive advancement is undoubtedly the key innovation that launched the IoT revolution.

Learning is another way of thinking about IoT; it is a state where limitations are established, addressed and can benefit the individual. Although it supports only a limited set of predefined capabilities in a specific context (such as a room or building), emphasizes human contact, and typically uses unconnected objects, this idea is not necessarily antithetical to IoT [9]. Although a key element of the Internet of Things limits human knowledge, it is not always the other way around.

IoT has been enhanced through machine-to-machine (M2M) mapping. M2 M emphasizes the interconnection of devices and provides the ability to obtain information from specific devices remotely. This knowledge is ready to increase productivity, reduce costs, and increase stability or well-being in an administrative application [10]. There are no distinct methods for organizing knowledge; everything happens at the system level, so you don't even need to connect to a cloud point. It is a one-way, slowly instantaneous type of communication. This is common in M2M implementations. Data in IoT implementations comes in different ways from different samples and is then implemented without human involvement. IoT can support various M2M managements, but it offers significantly more opportunities due to the fact that technological advancements enable the broad use of knowledge in IoT applications.

The investigation demonstrated that information technology can be used to improve the use of electronic health records (EHR). According to the study, EHR adoption has a lower failure rate due to the complexity of its many aspects. WebEHR is the name given by Kopper to his simple and technically sound EHR system (EEHR) [11]. This strategy facilitates the electronic delivery of various human resources, which improves data retention and sharing between different healthcare institutions.

Dr. Yogesh Kumar Sharma and Khatal Sunil S. [12] Naïve Bayes and Q-Learning algorithms, designed for IoT cardiac monitoring and deep learning, were exploited to predict heart attacks. These algorithms provide an improved reinforcement learning method for real-time data sensing. System safety checks include temperature, EKG, blood pressure and heart rate measurements.

An attack detection module for online environments using machine learning was designed by Purushottam R. Patil and Dr. Yogesh Sharma [13]. ANN and genetic algorithms were used to identify the attacks. The modules were created using specialized algorithmic machine learning techniques that often produce positive results. In order to increase the classification accuracy, ANN uses forward and back propagation. Also, compared to other classification strategies, this method offers greater classification accuracy.

Both Vajid Khan and Yogesh Kumar Sharma [14] Handwritten character recognition (HCR) software tries to classify input digits according to all k categories. Two components of a typical HNR structure are handwritten distinguishing digits. information in this area, such as the headlight object classifier. In the sample construction phase, the digit is represented by the shapes of the units, and the classifications are indicated by the majority. Over the years, the HNR room has produced a significant amount of intellectual work. Formulation of procedures for fluctuating numerical numbers in prose.

III. PROPOSED METHODOLOGY

1. Logistic Regression

Logistic regression is a popular classification algorithm in machine learning that is used to predict the probability of a binary or multiclass outcome based on one or more predictor variables (also called features). It is a linear algorithm that uses a logistic function (also called a sigmoid function) to model the relationship between the predictor variables and the target variable.

In logistic regression, the output or response variable (also called the dependent variable or target variable) is categorical in nature and can take on only two possible values, such as 0 or 1 (binary classification), or more than two possible values (multiple-class classification). Predictor variables (also called independent variables or traits) can be continuous, discrete, or categorical in nature.

A logistic regression algorithm works by estimating the coefficients (also called weights or parameters) of a logistic function using a training data set and then using those coefficients to make predictions on a test data set. The logistic function maps any real-valued input to a value between 0 and 1 that represents the predicted probability of a positive class (i.e., class 1) given the input properties. The decision threshold is usually set to 0.5, so if the predicted probability is greater than 0.5, the predicted class is 1, otherwise it is 0.

The key steps involved in the logistic regression algorithm are as follows:

1. Collect and preprocess data, including cleaning, transformation, feature selection, and normalization.
2. Split the dataset into training and test sets using techniques such as k-fold cross-validation to avoid overfitting.
3. Train a logistic regression model on the training data set using techniques such as gradient descent or maximum likelihood estimation to estimate the coefficients of the logistic function.
4. Evaluate model performance on the test dataset using metrics such as accuracy, precision, recall, F1-score, ROC-AUC, and confusion matrix.

2. KNN Classifier

K-Nearest Neighbors (KNN) is a simple and popular classification algorithm in machine learning that belongs to the family of instance or lazy learning algorithms. It works by finding the k-closest training examples in the feature space to a given input and assigning the most common class label among these to the nearest neighbors as the predicted class label for the input.

The KNN algorithm is non-parametric and makes no assumptions about the underlying distribution of the data. It can be used for both binary and multi-class classification problems as well as mean-to-nearest-neighbor regression problems.

One important parameter in a KNN algorithm is the value of k. A larger value of k makes the algorithm more robust to noise in the data, but may also make the algorithm less flexible and more prone to underfitting. On the other hand, a smaller value of k makes the algorithm more sensitive to noise in the data, but may also make the algorithm more flexible and prone to overlap.

The key steps involved in the KNN algorithm are as follows:

1. Choose a value of k (the number of nearest neighbors to consider).
2. For each test example, find the exercise examples that are closest to it in feature space using a distance metric (such as Euclidean distance or Manhattan distance).
3. Assign the most common class label among k nearest neighbors as the predicted class label for the test example.

3. Extra Trees Classifier

In Extra Trees Classifier, each decision tree is constructed using a randomly selected subset of features and a random subset of training data. The split criteria are also chosen randomly, making the algorithm less sensitive to noise in the data and reducing overfitting. Moreover, unlike the Random Forest algorithm, the Extra Trees Classifier constructs each decision tree using a larger number of randomly selected elements.

The algorithm works by creating a set of decision trees, each of which independently predicts the class label of a given input. The final prediction is made by aggregating the predictions of all the individual trees. This aggregation can be done by taking a majority vote of the predicted labels or using a weighted vote based on the prediction confidence of each tree.

The main advantages of the Extra Trees Classifier are its low computational cost, high scalability, and robustness to noise in the data. It is especially useful for high-dimensional datasets with a large number of features. However, it may not perform as well as other algorithms on small data sets or on data sets with a low signal-to-noise ratio.

Extra Trees Classifier (ETC) is an ensemble learning method for classification that works by constructing a large number of decision trees at training time and creating a class that is the mode of the classes (classification) or mean prediction (regression) of individual trees. Unlike a random forest, the Extra Trees method selects a split randomly from the elements that are used for the split, and thus can be computationally less expensive than other ensemble methods.

The main difference between Random Forest and Extra Trees is that instead of using bootstrapping to subsample the data and then select the best partition in each iteration of the decision tree algorithm, Extra Trees simply selects a random subset of features for each partition. This creates more diversity among the trees, which in turn reduces the risk of overlapping training data.

Extra Trees Classifier has the following advantages:

1. It can handle high-dimensional data sets with a large number of features.
2. Less sensitive to noise in the data and reduces switching.
3. Low computational cost and high scalability.
4. Applicable to both classification and regression problems.

IV. RESULT AND DISCUSSION

Figure 1. shows the accuracy of KNN, Logistic Regression and Extra Trees classifier algorithms for machine learning. Of all the machine learning algorithms, the Extra Stress Classifier algorithm shows the highest accuracy of 100%, Logistic Regression shows an accuracy of 81% and KNN shows an accuracy of 73%.

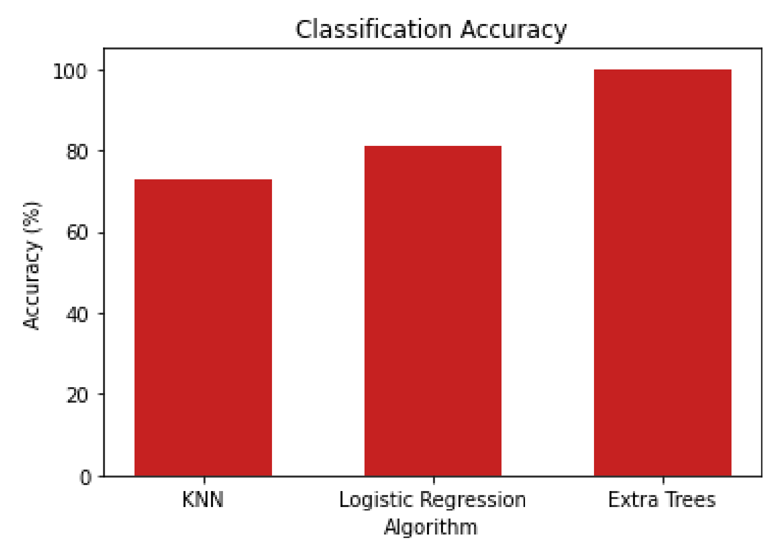

Figure 1: Classification Accuracy Using Machine Learning Algorithms

V. CONCLUSION

Heart is one of the essential and vital organ of human body and prediction about heart diseases is also important concern for the human beings so that the accuracy for algorithm is one of parameter for analysis of performance of algorithms. Accuracy of the algorithms in machine learning depends upon the dataset that used for training and testing purpose. When we perform the analysis of algorithms on the basis of confusion matrix, we find Extra Trees Classifier is best one. For future scope there will be more machine learning approach use for the best heart disease analysis and for earlier disease prediction so that the death rate can be minimized by disease awareness.

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