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**PREDICT AND DIAGNOSE CARDIOVASCULAR HEALTHCARE
ILLNESSES BASED ON RADIOACTIVITY WITH MACHINE
LEARNING MODELS**

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ABSTRACT

An Internet of Things (IoT)-based Healthcare program to track and detect serious illnesses is being created to provide better service to the user utilizing online health services. In this work, an effective system for predicting heart illness is developed using the UCI repository data and also healthcare devices due to radioactivity. In addition, classification methods are applied to categorize patient records to detect cardiovascular problems. The classification would be developed utilizing information from the testing set during the training period. During the development stage, individual patients system can track whether or not illness exists. Reference data is used for testing, and a variety of classifications, including J48, Logistic Regression (LR), Multilayer Perception (MLP), and Support Vector Machine (SVM), are used. According to the modeling, the J48 classifications outperform other classifications in terms of effectiveness, clarity; remember F-score, and kappa values.

Keywords: IoT, Classifier; Machine learning; cardiovascular problems; Radioactivity; Healthcare

INTRODUCTION

Healthcare monitoring has risen substantially in recent years as a result of sophisticated technology in the domains of the internet, IoT, and sensor devices. Several hospitals utilize mobile apps to schedule appointments, access patient records, and review results. Health wearables, but on the other hand, maybe used to measure heart rate, and other physiological indicators [1]. The data results will be sent to an integrated component in actual environments to evaluate the patient in a dataset.

The concept of smart devices in health offers several advantages, including lower costs, improves the clinical scientific experience, and decreased medical personnel burden [2]. Furthermore, smart equipment is linked to one another to achieve these goals, which is still a major challenge. Serial communication perhaps the most significant issue. Because the standard wired transmission is not suitable for mobile devices, a significant number of scientific projects have been created to link smart objects via high and low-range wireless broadcasts [3].

In [4] established a health system using ZigBee and long-range wireless communication. In [5] developed a three network architecture for monitoring and tracking health information in healthcare, which consists of three parts: a Hybrid

Sensor Network (HSN), an IoT smart portal, and operating systems for visualization techniques and administration. In [6] developed a technique for developing a laboratory information management approach by integrating ZigBee and Radio Frequency Identification (RFID). ZigBee was utilized to transfer the collected data to the cloud center, while RFID was used for an automated particular type.

In terms of efficacy, the combination of cloud and IoT-based online apps beats traditional cloud-based applications. It can be used in emerging areas such as medical, and account management. Specifically, the Cloud-based IoT network will be beneficial for delivering appropriate administrators to biomedical applications for monitoring and receiving information from a variety of isolated places. IoT-enabled healthcare apps are used to collect critical data such as adequate changes in health constraints, for example, and also to update the severity of medication therapy management over a predetermined period.

Similarly, IoT devices, including the medical variables linked sensor readings, will be utilized effectively for illness detection in the real moment, before the onset of a severe situation. When working with huge amounts of data, Machine Learning (ML) algorithms play a

significant role in the selection process. The process of tailoring statistical techniques to different fields. Conventional statistical modeling techniques encompass machine learning, classification methods, and grouping [7]. Data creation may be done in a variety of methods based on data type, but it is also necessary for developing procedures to help user satisfaction. The vast amount of resources in IoT enable important information to advance without difficulty, such as flexibility, quickness, and so on. All these are believed to be critical challenges inside the IoT [8].

Designers had acquired a large amount of data with various types of data, such as pictures, all-encompassing data, etc, using connected technologies as input. This data would be securely stored in a cloud system and accessed through newly developed smart healthcare. An additional machine learning model has been used to map the data into two categories, Normal and Illness.

Additional Cloud and IoT-based disease diagnostic model is created in this study to track, forecast, and treat cardiovascular disease. In this research, an effective system for predicting patients with cardiovascular disease is developed using the UCI Archive data and health monitors. In addition, classification methods are applied to categorize patient data to detect cardiovascular problems. The

classification would be developed using information from the testing set during the training period.

During the testing phase, actual patient data is used to determine whether or not illness exists. Standard data is used to evaluate a variety of classifiers, including J48, LR, MLP and SVM. According to the simulated findings, the J48 classifiers outperform other classifications in terms of effectiveness, accuracy, remember F-score, and kappa values.

Related Works

Various studies have been conducted in this direction by various investigations and may be presented in the literature [9]. Based on the literature, [10] made a prototype to track illness severity and identify it by combining cloud and IoT. This method is mostly used to predict the severity of an illness. The computational science concept is investigated by extending keywords to generate client-based healthcare estimates. You had set up a mechanism to look after the health of students. In this research, researchers created systematic health information from a student's perspective using the standard UCI Repositories and also sensors which are used in therapeutic departments as well as used to predict the many diseases that are impacted by understudy with seriousness. In terms of F-measure, specificity, and reactivity, many learning

techniques for predicting various illnesses have been verified. Finally, they proved that their approach outperformed the existing method in terms of anticipated correctness.

[11] Explained the principles of IoT and its practical applications in the context of u-healthcare services. Researchers had proposed a new structure that is beneficial to the IoT-based u-healthcare services. [12] Described a novel approach that relies on IoT medicinal devices in body sensing devices. The individual can be examined using a variety of powerful and also light-weight sensing devices in their invention. Researchers also considered the measures that would be required while developing the health component. Researchers suggested a web-based new methodology for health monitoring called Healthcare Industry IoT. Their system can go through people's medical records to see if the death circumstances are true. It also uses sensors and hospital instruments to collect important patient data that is necessary for evaluation. In either way, researchers integrated into their structure to prevent medical error and multiple psychological thefts by employing security approaches such as watermarking and signaling enhancements.

[13] Gave insight on the various methods available for developing m-healthcare apps. Web developers and application developers

are examples of applications that are used to monitor a person's health restrictions remotely using an IoT-based architecture. They've built a variety of web tools for sharing patient data with physicians outside of a therapy environment. [14] Proposed community implementation stages for elderly and developmentally challenged people. The major objective of their framework is to provide urgent reaction or in the case of a patient's exceptional condition. [15] Proposed an effective safety copy for reducing the dangers associated with IoT-based health care. They also looked into the improvements that are available in the IoT-based healthcare sector [23-28]. The study on a neuro-fuzzy transitory information presentation method as an intellectual diagnosis platform for predicting and diagnostic many serious diseases.

The study on intellectual as well as sophisticated fuzzy rule-based categorization program as a framework to go along this road. It presented a new online health care diagnostic paradigm for remotely monitoring cardiac sufferers using a mobile phone and wearable devices [16]. Researchers proposed a new observing framework for providing a crisis in check solution by employing the motion tracking illness patients' situation [17-22].

Proposed Model

Figure 1 depicts the suggested

system framework. Healthcare IoT sensors, Cloud Database, and ML-based sentiment analysis system are the five key components. **Figure 1** depicts a generic schematic diagram of the completed schedule.

IoT gadgets, both wearable and

implantable, are believed to be IoT equipment. They are used to collect medical data from far-flung areas. Such linear measures were acquired as patient information utilizing IoT devices can be connected to the body.

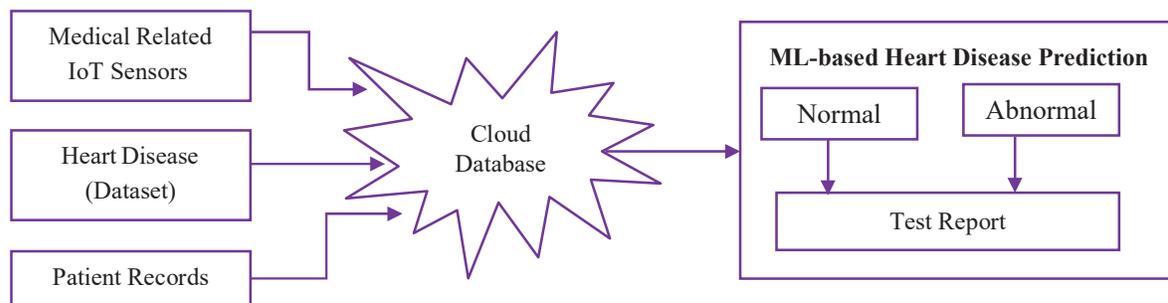


Figure 1: Proposed model

The UCI repository's benchmarking cardiovascular disease data is utilized. The cardiovascular disease data contains historical logs of medical data obtained from healthcare facilities. The patient records are made up of historical health care providers that have been acquired from hospitals. Many of these files are kept in the cloud. The necessary information will be kept on the internet and will be accessible at any time. The cardiovascular disorder prediction method is used in machine learning-based classification techniques to forecast cardiac disorders.

The IoT-based health paradigm that is being described works in three phases. The data will be collected during the first stage using IoT from the human data, information from scheduled functions, and

medical data. All of the obtained data would be stored in the cloud server in the next stage. The detection of diseases occurs in the last phase, which involves categorizing the information. The categorization method begins by going through the assessment period, uses the cardiovascular disorder data to assess the classification to determine whether or not there is heart disease present.

Performance Evaluation

A baseline cardiac disease data from the Data sets are used to verify the classifier findings. The dataset's characteristics are given in **Table 1**. There are 280 occurrences, 14 characteristics, and two classes in the CKD data. The existence of cardiovascular disease is labeled in 145 of the 280 occurrences, whereas the

presence of cardiovascular disease is identified in the other 110.

The precision, specificity, and memory measures were utilized to make the comparisons. **Table 2** explains the idea of the confusion matrix before explaining performance measurements. The proposed task was completed using Programming language and Amazon Cloud. In this research, the classification of data into the existence and presence of cardiovascular problems is a critical procedure. Because of the simulation, the percentage of accurately categorized cases is known as accuracy. It is among the most often used categorization performance measures, with a value closer to 100 indicating higher classification accuracy.

$$\text{Accuracy} = (TP^+ + TN^-) / (TP^+ + TN^- + FP^+ + FN^-) \dots\dots\dots(1)$$

Precision is defined as below:

$$\text{Precision} = TP^+ / (TP^+ + FP^+) \dots\dots\dots (2)$$

$$\text{Recall} = TP^+ / (TP^+ + FN^-) \dots\dots\dots (3)$$

F-score measures the accuracy of the testing process. It is an

Equation 4 shows the average measure of both accuracy and recall.

$$\text{F-Score} = 2TP^+ / (2TP^+ + FN^- + TN^-) \dots\dots\dots (4)$$

Kappa value:

$$K = (\text{Overall Accuracy} - \text{Expected Agreement}) / (100 - \text{Expected agreement}) \dots\dots (5)$$

Table 3 summarises the findings of the various classifiers' effectiveness against cardiovascular disease data, and **Figure 2** depicts the results. The MLP must have the worst result, with a minimum precision of 78.14, as seen in the table data. SVM and LR performed well, with an accuracy of 84.07 and 83.70, respectively, which is better than MLP's efficiency. Even though SVM and LR beat MLP, they do not outperform the J48 classification. Next, the MLP had the lowest accuracy of 78.20 in terms of F-score, indicating poor classification accuracy. At the same time, the SVM and LR outperform the MLP in terms of techniques. Furthermore, the J48 received a 91.50 F-score, indicating higher categorization ability. In terms of accuracy, the greater the score, the higher the categorization accuracy. With a minimal knowledge gathered of 78.40, the Classification method performed poorly, but the SVM and LR classifiers achieved precision values of 84.10 and 83.70, respectively. Surprisingly, the J48 classifier performed better in terms of classification, with a direct authority level of 91.50. The Classification method achieves the least accuracy rate, while the J48 classifier achieves the greatest value. Simultaneously, the SVM and LR classifications performed nearly equally well, with recall values of 83.30 and 82.77, correspondingly. Ultimately, it's also

revealed that the Classification method has the worst performance of the classifier, as evidenced by its low kappa value of 57. With kappa values of 68.77 and 67.73, respectively, the SVM and LR classifications outperformed MLP. It's worth noting that the J48 classifier achieved the highest kappa value of 82.68.

Interestingly, on the used cardiovascular disease data, the J48 classification is shown to be effective in terms of any performance indicators. Therefore, the J48 classification is confirmed to become the optimal method for the IoT-based forecasting model for cardiovascular disease, as shown in the **Table 3 and Figure 2.**

Table 1: Description of the Dataset

Data	Source	Instances	Attributes	Class	Present/Absent
Cardiovascular Disease	UCI	280	14	1	145/110

Table 2: Confusion Matrix

	Actual +	Actual -
Predicted (+)	TP+	FP+
Predicted (-)	FN-	TN-

Table 3: Heart Disease Data

Method	Precision	F- Value	Accuracy	Recall	Kappa Value
J48	92	92	92	82	82
Support vector machine	84	84	84	84	67
LR	83	83	83	83	66
MLP	78	78	78	78	56

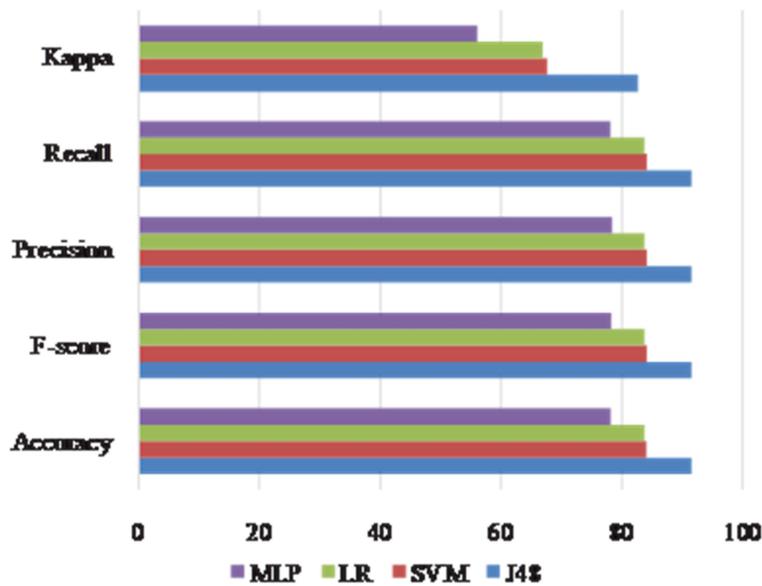


Figure 2: Contrast chart of classifier

CONCLUSION

To track, forecast, and treat cardiovascular disease, and efficient Cloud and IoT-based chronic disease patterns are

created in this study. The UCI Repository data and health system were used to develop an effective system for heart disease diagnosis in this study, which used

the UCI Archive data and health sensor to forecast patients with heart disease. In addition, categorization methods are applied to categorize patient information to detect myocardial infarction. The classification method begins by going through the training phase, which uses the cardiovascular disease data to build a classifier to determine whether or not there is cardiovascular disease present due to radioactivity. The classification is thus ready to put the input medical data to the trial and see if the patient has cardiovascular disease. In comparison to MLP, SVM, and LR classifications, the J48 classification is determined to be the most suited algorithm for the IoT health forecasting technique of cardiovascular disorder basing upon comprehensive testing findings.

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