International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

A Survey on the Role Analysis of Heart Disease Prediction System Using Internet of Things and Machine Learning

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ABSTRACT—

Prediction of heart disease is very essential in today's environment; various researches have already made prediction of heart disease from large data set. The IoT environment basically generates data from various sensors and predicts the possibility of disease accordingly. Different synthetic datasets contain different body parameters that are extracted by specific sensor values, with a machine learning algorithm playing a major role. In this research, we propose heart disease prediction with a combination of IoT and machine learning approach, the IoT environment introduced real-time data extraction from Body Sensor Network (BSN) with medium sensing system and adequate data storage on cloud server. This audit data took into account synthetic information that is basically used to predict the possibility of heart disease. In this research, we illustrate various machine learning algorithms as well as some deep learning algorithms to achieve drastic disease prediction supervision. Experimental analysis shows the effectiveness of the proposed deep learning classification algorithms compared to classical machine learning algorithms.

Index Term: *Disease prediction system, IoT, machine Learning, Supervised learning, NLP, Heart Disease.*

I. INTRODUCTION

During recent years, there has been a rapid development of healthcare services to provide wireless communication media between doctor and patient through wearable technology, which means "telemedicine". Recently, diabetes is the leading cause of death for all people. In 2000, 171 million people were predicted, which may increase to 642 million worldwide by 2040. This increase in stature should be paid attention to this disease. Many healthcare institutions around the world spend billions of dollars on diabetes healthcare. Patients with diabetes are divided into four types such as type 1 diabetics, prediabetics, type 2 diabetics and gestational diabetes. Type 1 appeared due to lack of insulin in young and adults. Prediabetic is the stage before type 2 and gestational diabetes that occurs in women during pregnancy. Diagnosing levels in all these patients can be done using various blood sugar tests. A1C means higher glucose levels are tested to detect Type 1 and pre-diabetes diagnosis. Fasting glucose test is done to diagnose type 1 diabetes, prediabetes and type 2. OTG- Oral glucose test is done to diagnose prediabetes, type 2 and gestational disease. High glucose levels can affect human health and lead to serious conditions such as vision loss, kidney neuropathy, liver problems, heart problems and leg problems. Diabetic retinopathy is required for diagnosis due to high sugar levels, which can further cause vision loss and night blindness.

In addition, the list of diseases directly related to the heart is endless, according to the International Society of Cardiology, there are more than 15 types of diseases directly related to the heart. These diseases can be traced directly and require a minimum of historical data. But diseases like diabetes, cancer, tuberculosis etc. are said to be indirectly related to heart diseases. These diseases require careful historical observation and observational analysis of ECG waveforms. The following steps are usually performed to perform this task:

- Pre-processing of ECG data, where the data is de-noised. ECGs are generally susceptible to power line noise and harmonic noise, so processing raw ECGs may not yield good results. Therefore, denoising algorithms are applied to the raw ECG to obtain a clean ECG waveform.
- Disease-based feature extraction that evaluates features from ECG waveforms. These features are generally extracted based on the disease to be evaluated. For example, diabetes-related features may consist of peak ratings, while cancer-related features may consist of the mean intensity of the ECG waveform. Although no standard is yet defined for any kind of disease, but feature extraction is done with respect to the kind of disease under study.
- Feature selection to reduce redundant features, where algorithms like feature variation detection are used to reduce repetitive features from the training set. This step is necessary to optimize the accuracy of the system and limit any undesirable features of the input ECG waveforms.

- Classifier training and evaluation uses all of the above steps to train a strong classifier such as SVM or LSTM to evaluate the probability of a disease type being present. This step is of utmost importance and decides the accuracy of the system under test
- Historical analysis from classified results where the patient's ECG is evaluated over time. Then, based on the patterns obtained from the classification step, it is confirmed that the person has or does not have the disease type

Researchers usually follow all the different algorithms when designing their classification system. In the next section, we describe various algorithms and systems proposed by researchers to detect these types of diseases and recommend their improvement. We also propose some variants in existing systems that will allow higher accuracy. Finally, we conclude the article with some interesting observations about the reviewed algorithms and suggest their improvements.

II. LITERATURE SURVEY

Clinical deterioration of consistency is often a major concern for patients in internal medicine clinics. Chipara[2] enables the implementation and coordination of bedside remote monitoring in the clinic premises. Presented remote systems regularly compile patient assessments of heart rate and oxygen saturation. It also explores the possibility of a health insurance alternative for WSNs in medical facilities.

The main strengths of India's medical service framework are attributed to its well-trained medical staff. Many efforts have been made to improve the scope and effectiveness of the human resources provided by these institutions. Khambete[3] describes steps to strengthen the security system. Accordingly, it illustrates the weaknesses of medical equipment health problems and the cautious steps that need to be taken to improve the quality of public resources in India.

Priyan Malarvizhi Kumar et al. [4] Presented a three-layer IOT design for early detection of deep learning algorithms for heart disease. They also designed three-layer frameworks for storing and processing the vast amount of data generated by wearable gadgets. Tier 1 focuses on processing data from specific sensors, Tier 2 uses Apache HBase to store massive amounts of data in cloud storage, while Tier III uses Apache Mahout to create a logistic-driven predictive model focused on regression. Finally, he performs ROC research to obtain cardiac nodule data.

In 2016, Mingyu Park et al. [5] Implemented smart chair software that monitors and visualizes the owner's position using a smart device to help users correct their imbalanced role. They also used pressure sensors and tilt sensing for communication purposes using I and Bluetooth technology, which transmits low-power data. This is an Arduino application that often senses the various locations of users. This application enhances the consumer's potential to consider their own current state by providing real-time actionable and visualized data to the smartphone client. The left and right hands show actual vs. optimal position in the simulation, with the voltage shown in red/yellow/green and orange circles. This is a perfect illustration of the Internet of Things.

In [6], Cloud and IoT software focused on m-healthcare was developed and revised to identify the actual degree of severity and diagnose it according to gravity. IoT device is known as embedded and wearable IoT tools. These devices are used to obtain information from remote areas around the procedure. Instantaneous measurements can be collected as refresher information gathered by IoT applications connected to the human body. Similar medical information is generated using the UCI Repository dataset and therapeutic sensors to predict the general population that has been extremely affected by diabetes. The resulting knowledge can be securely processed by implementing five different steps of the previously established management process, such as information gathering, information retrieval, information processing, information separation, and information blending.

Cloud storage is a process that provides a structured approach to scheduling administrators on demand [7]. This process works beyond anyone's ability to see and is used to extract data from smart devices, view and analyze these details, and create online consumer statistics. It is also a really captivating aspect for the solution as it would create a sector of lots of incentives to offer encouragement to IoT software customers. Large-scale data analysis and machine learning predictions can conventionally test this data in the cloud. Machine learning is a type of artificial reasoning and allows these calculations to improve by gathering data from them.

A WSN is a self-determining sensor device that transmits its data over a frame to a central zone [8]. An IoT system that requires a WSN to collect data for various applications will be used by few specific IoT applications so far, so separate and distinct results are likely. Data aggregation is only a basic step in the IoT process, and this data needs to be collected and converted into remarkable information or provided to specific objects. The devices that WSNs use are likely to make any protest impossible, and the huge advancement of these devices is undoubtedly the main development that started the IoT movement.

Another mindset related to the Internet of Things is learning; a state where boundaries are established and treated and can work for an individual. This concept is not necessarily the opposite of IoT, as it only supports certain pre-defined functionality in a specific environment (e.g. space, building), is focused on human interaction, and the items used usually do not have to be related [9]. This is not necessarily the opposite of IoT despite the way that a fundamental component of the Internet of Things limits human knowledge.

Machine-to-Machine (M2M) mapping is an improved version of IoT. M2 M emphasizes the association of gadgets and offers the ability to get details from certain gadgets remotely. This knowledge is ready to achieve productivity benefits, reduce expenses, and improve well-being or stability in an administrative application [10]. Knowledge is not organized into different processes; everything happens at a system level that you don't even need to connect to a cloud point. It is a slowly instantaneous, one-way kind of correspondence. Data in IoT implementations come in various forms from heterogeneous demonstrations and are then implemented without human intervention; this is widespread in M2M implementations. IoT can help various

M2 M administrations, but it has significantly more possibilities because the knowledge in IoT applications can be used for many purposes thanks to technological developments.

The analysis showed that the use of electronic health records (EHR) can be improved with the help of information technology. As the study shows, EHR use is less likely to fail due to the multifaceted complexity associated with it. Kopper proposed a simple and technically usable EHR solution (EEHR)[11] and called it WebEHR. This approach facilitates the electronic delivery of various human resources, thereby improving the storage and sharing of data between different health centers.

According to Dr. Yogesh kumar sharma and Khatal Sunil S. [12] Designed cardiac Internet of Things monitoring and deep learning, Naive Bayes and Q-Learning algorithms were used to predict heart attack. These algorithms illustrate a reinforcement learning technique that is more powerful for real-time data sensing. Temperature, EKG, blood pressure and heart rate checks used to test for unsafe conditions in systems.

Purushottam R. Patil and Dr. Yogesh Sharma [13] proposed a machine learning attack detection module for the web environment. ANN and genetic algorithm were used for attack detection. The modules have been designed based on proprietary machine learning algorithmic strategies that generally provide good results. ANN uses forward and back propagation to achieve better classification accuracy. Moreover, this approach provides higher classification accuracy than other classification techniques.

Yogesh Kumar Sharma and Vajid Khan [14] Handwritten Character Recognition (HCR) software tries to organize input digits in all classifications k. Normal HNR structures have 2 elements: handwritten distinctive digits. Related information as an object classifier at the research level of searchlights. The sample structure phase uses unit shapes to denote the digit and the vast majority of k classifications. An intelligent amount of work has been built up in the HNR room over the years. Fluctuating techniques for characterizing numerical numbers are formulated in prose.

III. Proposed System Design

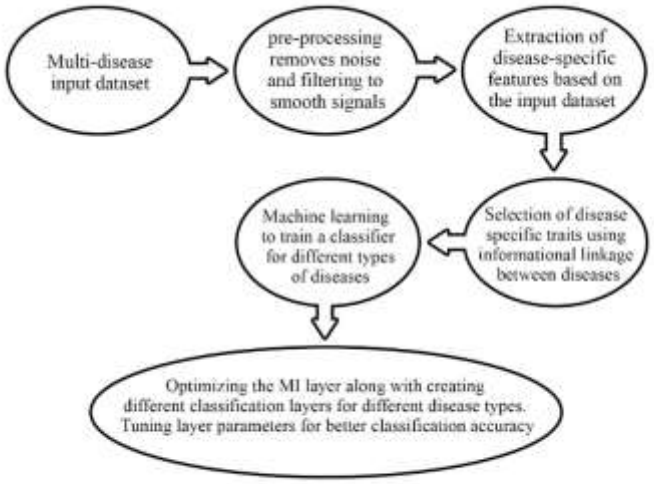

Figure 1: Proposed System Design

First we will deploy the IoT setup with various sensors, these are completely wearable devices or sensors that automatically capture data from human bodies, the generated data should be analog data that needs to be converted to digital data. ADC is a converter that is used in middleware architecture for data conversion. Arduino is a microcontroller that uploads data to a cloud server in parallel. The cloud data service provides streaming data to machine learning algorithms to predict heart disease. This research worked with various machine learning algorithms as well as deep learning algorithms. Experimental analysis was performed with numerous synthetic real-time healthcare monitoring data.

IV. CONCLUSION

This paper gives us a basic idea of a previously published paper on heart disease detection and diagnosis based on a different machine learning algorithm. Through this survey and study, she clearly found and observed that some machine learning algorithms such as Naive Bayes, Random Forest, ANN and RNN provide better accuracy in heart disease detection and prediction. And different algorithm has different performance based on different scenario, but most importantly, the selection of dataset and features is also very important to get better prediction results. The use of machine learning algorithms was implemented on various medical data sets and the findings were compared to the improved machine learning methodology expected for monetization security. Selecting a machine learning algorithm and avoiding overfitting, damping, hyperparameter tuning, and various cross-testing methods can be used to achieve optimal performance, although this may increase computational cost and time.

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