e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:04/Issue:02/February-2022 Impact Factor- 6.752 www.irjmets.com

PREDICTION OF HEART DISEASE RISK BASED ON DEEP LEARNING

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ABSTRACT

The Healthcare industry generally clinical diagnosis is done mostly by doctor's expertise and experience. Computer Aided Decision making System plays a main role in medical Area. With the new research on heart disease predicting system, it has become most important to categories the research outcomes and provides readers with an overview of the existing heart disease prediction techniques in each category . deep Neural Networks are one of most newly method that can be utilized to make predictions for medical data. Deep Learning improves the accuracy of the heart disease prediction system. The commonly used techniques for Heart Disease Prediction and their complexities are summarized in the is paper.

Keywords: Heart Disease, Deep Learning.

I. INTRODUCTION

Health status is a broad term that covers all diseases and disorders. A disease is a rare condition that affects the body of an organism. Disruption is a rare or functional disorder. The human body is a marvel of structure. Many of its limbs have great power or palace: They can still function properly even if they are damaged. For example, more than two thirds of the liver must be destroyed before there can be serious side effects, and it can usually live with one lung or one kidney. Some organs may be able to tolerate minor damage before they become fully functional and symptoms appear. For example, if an artery in the brain closes or breaks (stroke) and even a small amount of tissue in an important part of the brain dies, a person may be unable to speak, move, or maintain balance. If a heart attack destroys a small portion of the tissue in the part of the heart that makes or has the symptoms of a heart attack, the heartbeat may be slow and dangerous and the person may die. Diseases often affect anatomy, and changes in anatomy can cause disease. When blood supply to a muscle is blocked or disconnected, tissue dies (called infarction), such as heart attack (myocardial infarction) or stroke (cerebral infarction). Abnormal heart valve can be reason of heart failure. Skin lesions may impair its ability to function as a barrier, which may lead to infection. Abnormal growths, such as cancer, can directly destroy normal tissue or produce stress that eventually destroys it.

A. Disease

1. **Cancer:** Cancer is a group of diseases that involve an abnormal increase in the number of cells, which may have invaded or spread to other parts of the body. Not all tumors or tumors are cancerous; benign tumors are not classified as cancerous because they do not spread to other parts of the body. There are more than 100 known types of cancer that affect humans. Cancer is usually defined by the part of the body from which it originated. However, some parts of the body are made up of many different types of tissue, so to be more precise, cancer is broken down into cell types by which stem cells develop.
2. **Coetaneous conditions:** Many conditions affect the human body system — the system that covers the entire face of the body and is made up of skin, hair, nails, and connective tissue. The main work of this system is a barrier against the external environment. The skin weighs 15 pounds [4 kg], covers an area of about two square feet [2 sq m], and is composed of three distinct layers: the epidermis, the dermis, and the subcutaneous cell tissue . The both types of human skin are : shiny skin, hairless skin on the palms and soles (also called the "palm plantation area"), and hairy skin. Within the latter type, hairs occur in structures called pilosebaceous units, each with a hair follicle, sebaceous glands, and a related arrestorpile muscle. In the embryo, the epidermis, hair, and glands build from the ectoderm, which is chemically influenced by the lower mesoderm that forms the dermis and the subcutaneous tissue.
3. **Endocrine disease**: Endocrine diseaseendocrine system disorders. The medical field associated with endocrine disorders is known as endocrinology. In general, endocrine disorders can be divided into three categories Endocrine gland hypo secretion (leading to hormone deficiency) Endocrine gland hyper secretion (leading to hormonal imbalance) Abscesses (abign or dangerous) of endocrine glands Endocrine disorders it

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is often very complex, which involves mixing. image hypo secretion and hyper secretion due to the response processes involved in the endocrine system. For example, many types of hyper thyroid mare are associated with an overactive thyroid hormone and low levels of thyroid hormone.

4. **Eye disease**: The World Health Organization publishes a category of known diseases and injuries, the International Statistical Classification of Diseases and Related Health Problems, or ICD-10.
5. **Human gastrointestinal tract:** The human gastrointestinal tract (GI or GIT tract) is an organ system responsible for transporting and digesting food, absorbing nutrients, and removing waste products. This tract contains stomach and intestines, and it is divided into upper and lower intestinal tracts. The GI tract encloses all structures between the mouth and the anus, forming a continuous line connecting the major digestive organs, namely, the abdomen, small intestine, and large intestines. In contrast, the human digestive system includes the intestinal tract and digestive organs (tongue, salivary glands, pancreas, liver, and gallbladder). The pamphlet can also be divided into foregut, midget, and hindgut, showing the embryological origin of each component.
6. **Brain Tumors**: In some cases, tumors form in the brain and can be very dangerous. These are called primary brain tumors. In some cases, cancer somewhere in your body spreads to your brain. These are called secondary or metastatic brain tumors. Symptoms of tumors in the brain depend on the size and location of the tumor.

B. Cardiovascular disease:

Cardiovascular disease (CVD) is a category of diseases involving the heart or blood vessels. Cardiovascular disease includes coronary artery disease (CAD) such as angina and myocardial infarction (commonly known as heart attack). Other CVDs are stroke, severe heart disease, coronary heart disease, coronary heart disease, coronary heart disease, congenital heart disease, valvular heart disease, cordites, aortic aneurysms, peripheral artery disease, and venous thrombosis. The basic methods vary from disease to disease. Coronary artery disease, stroke, and peripheral artery disease include atherosclerosis. These may be caused by high blood pressure, smoking, diabetes, lack of exercise, obesity, high cholesterol, poor nutrition, and excessive drinking, among other things. High blood pressure leads to 13% of CVD deaths, while smoking leads to 9%, diabetes 6%, 6% lack of exercise and 5% obesity. Rheumatic heart disease can be followed by untreated strepthroa. The heart is an important organ or part of our body. Life itself depends on the proper functioning of the heart. If the heart function is improper, it will affect other parts of the human body such as the brain, kidneys etc. It is nothing more than a pump, which pumps blood through the body. When the blood circulation in the body is not working organs such as the brain suffer and if the heart stops working properly, death occurs within minutes. Life depends entirely on the proper functioning of the heart. The word heart disease means heart disease and the vascular system within it. Symptoms of a heart attack can include:

- Discomfort, pressure, heaviness, or pain in the chest, arm, or below the breastbone.
- Discomfort radiating to the back, jaw, throat, or arm.
- Fullness, indigestion, or choking feeling (may feel like heartburn).
- Sweating, nausea, vomiting, or dizziness.
- Extreme weakness, anxiety, or shortness of breath.
- Rapid or irregular heartbeats

a. Types of Heart diseases: There are many cardiovascular diseases involving the blood vessels. They are known as vascular diseases:

- **Coronary artery disease**- (also known as coronary heart disease and ischemic heart disease)
- **Peripheral arterial disease** – disease of blood vessels that supply blood to the arms and legs
- **Cerebrovascular disease** – disease of blood vessels that supply blood to the brain (includes stroke)
- **Renal artery steno sis**
- **Aortic aneurysm**

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II. LITERATURE SURVEY

Numerous research on the diagnosis of cardiac disease have been conducted. They used several approaches on artificial neural network data mining for diagnosis and obtained varying probabilities for each strategy.

Bahadur Patel et al. [3] has developed a system for diagnosing heart disease. Divide all the parameters into two levels according to the severity and each level is given different weight years. In the end both levels are considered a final decision. They used an integrated neuro-fuzzy approach on two levels. Therefore, the error rate is very low and the efficiency is high. In this paper, they have performed an analysis of heart disease

Predicting heart disease, blood pressure and diabetes with the help of neural networks was proposed by Niti Guru et al. [4]. The database contains records with 13 attributes in each record. Monitored networks i.e. Neural Network with back propagation algorithm is used for training and data analysis.

In order to develop a multimedia feature with specific and indirect features of HRV (Heart Rate) the novel method was proposed by HeonGyu Lee et al. [5]. To achieve this, use dividers of several categories e.g. Bayesian Classifiers, CMAR (Multi-Organization-Based Planning), C4.5 (Decision Tree) and SVM (Vector Support Machine).

S. Kiruthika Devi et al. oct-2016 The purpose of our work is to analyze the various data mining tools and techniques in the health care environment that can be used in predicting the cardiovascular system and their effective diagnosis. Methods / Statistical Analysis: A cardiovascular prediction model, which uses a data mining method, can assist physicians in diagnosing heart disease based on the patient's clinical data. Methods for classifying mining data for good decision making in the health care sector discussed are the decision trees, Naive Bayes, Neural Networks and Vector Support Machines. Combining or merging any of these algorithms helps to make decisions faster and more accurate. Improvements: This option can be extended further. It can use many of the input attributes. Other data mining techniques are also used for prediction such as Clustering, timeline, Organization rules. Informal data available on the healthcare industry website can also be extracted using a text mine.

Amita Malav 2017The heart is an important part of the human body. Life depends entirely on the proper functioning of the heart. What if the heart has a certain disorder, cardiovascular disease is a very serious disease of reducing the number of patients. According to a WHO study, about 17 million people worldwide die from heart disease, which accounts for 29.20% of all deaths, especially in developing countries. There is therefore a need to complete this difficult task of CVD using advanced data mining techniques, in order to obtain information for predicting heart disease. In this paper, we propose an effective hybrid algorithmic method for predicting heart disease. This paper works as an effective predictor to determine and extract anonymous heart disease information using a combination of a K-means clustering algorithm and a synthetic neural network. In our proposed model we considered 14 of the 74 of the UCI Heart Disease Data Set. This procedure uses medical terms such as age, weight, gender, blood pressure and cholesterol level etc. to predict. Creating a group of different features using the k-means algorithm and predicting using the Back distribution method in sensory networks. The main purpose of this paper is to develop a prototype for predicting heart disease with a high degree of accuracy.

Amin Ul Haq et al. (2018) That developed a machine-based diagnostic program for predicting heart disease using a set of cardiovascular data. We used seven popular machine learning algorithms, three-factor selection algorithms, a cross-country verification method, and metrics to test the performance of seven categories such as category accuracy, specificity, sensitivity, Matthews coefficient, and performance time. the proposed system can easily identify and differentiate people with heart disease from healthy people. Additionally, the curved curves of the receiver and the curve area of each separator are computerized. We have discussed all the variables, feature selection algorithms, pre-processing methods, verification method, and test performance metrics used in this paper. Our performance of the proposed system is guaranteed in full features and in a set of reduced features. having features that reduce the impact on the performance of dividers depending on the accuracy and timing of the dividers. The proposed machine-based decision-making system will enable physicians to diagnose heart patients appropriately.

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C. Beulah Christalin Latha et al.(2019) The focus of this paper is not only on increasing the accuracy of weak classification algorithms, but also on the implementation of the algorithm with a medical dataset, to show its utility to predict disease at an early stage. The results of the study indicate that ensemble techniques, such as bagging and boosting, are effective in improving the prediction accuracy of weak classifiers, and exhibit satisfactory performance in identifying risk of heart disease. A maximum increase of 7% accuracy for weak classifiers was achieved with the help of ensemble classification. The performance of the process was further enhanced with a feature selection implementation, and the results showed significant improvement in prediction accuracy.

III. DEEP LEARNING METHOD

Deep neural networks (DNNs), also called deep feed forward networks or feed forward neural networks or multilayer perceptron's (MLPs), are a powerful mechanism for supervised learning. DNNs are one type of deep learning architecture, in addition to recurrent deep neural networks (RNNs) and convolutional deep neural networks (CNNs). This research focuses on the use of DNNs for the task of network intrusion detection. DNNs can represent functions of increasing complexity, by inclusion of more layers and more units per layer in a neural network [5]. In the context of NIDSs, DNNs can be used to discover patterns of benign and malicious traffic hidden within large amounts of structured log data. According to [6], a neural network is considered deep if it contains more than three layers, including input and output layers. Therefore, any network with at least two hidden layers is considered a deep neural network.

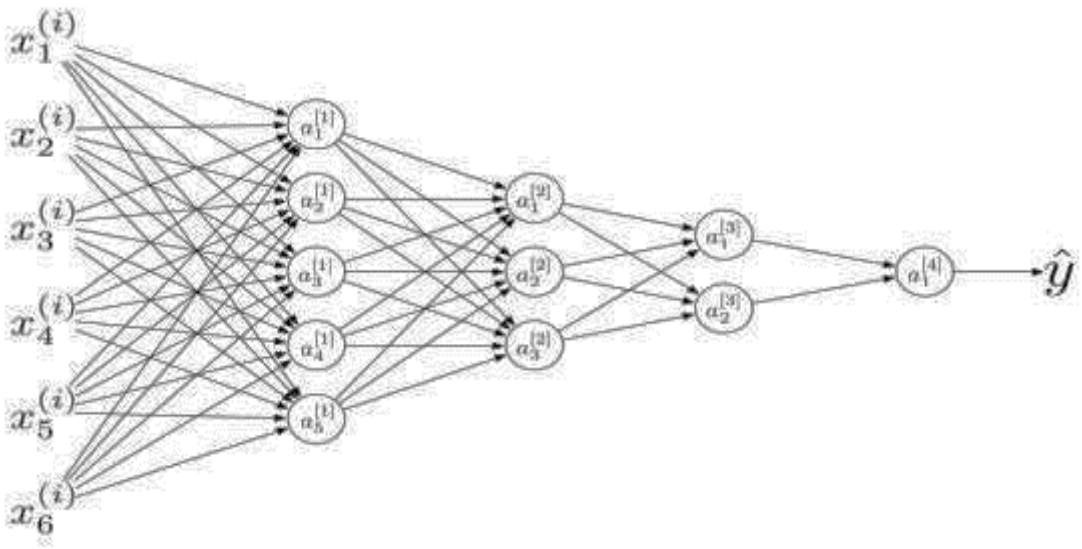

Figure 1: Comprehensive neural network representation

An example of standard deep learning representations can be seen in Figures 1. The former shows a deep, fully connected neural network, as each of the neurons in the input layer are connected to every other neuron at each successive layer. The latter is a more simplified representation of a two layer fully connected neural network. These figures convey common notation used for representing deep neural networks [7], and will be the notation followed for the rest of this work. Nodes represent inputs, and edges represent weights or biases. The superscript (i) denotes the i^{th} training example, and superscript [l] denotes the l^{th} layer.

The basic technical approach of deep learning for neural networks has been around for decades, so why has this area been gaining so much attention in recent years? The main reason for this is due to an increase in scale of both amounts of data and computational power available. A larger amount of available data, combined with larger neural networks has led to an increase in performance of deep neural network learning algorithms, specifically in the context of supervised learning [7]. This concept can be seen depicted in Figure 2.

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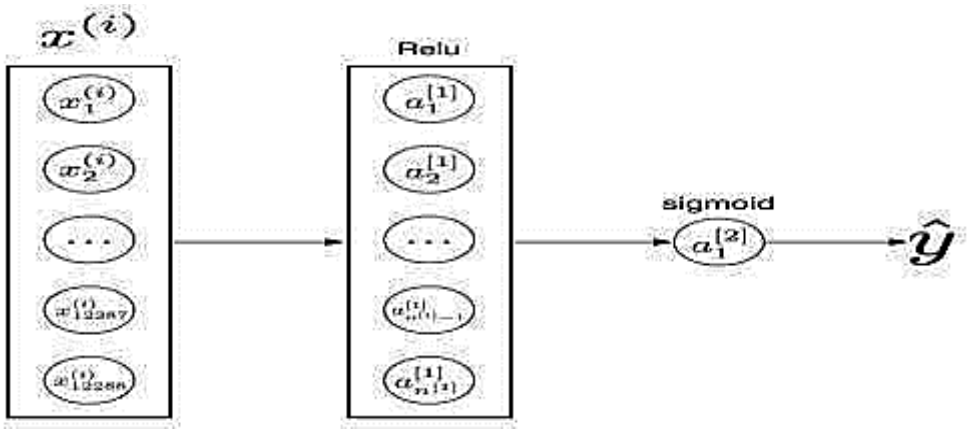

Figure 2: Simplified neural network representation

As described, an improvement in performance can be gained by increasing both the amount of data and the size of the neural network. Once the amount of data is maximized, then the size of the network can continue to be increased until the performance of the neural network levels off. With an increased network size comes increased length of computation times. Another important factor that has helped deep neural networks become more useful in recent years is due to advances and innovations in algorithms, helping drive more efficient computation and enabling neural networks to run much faster. Previously, the sigmoid activation function equation was most commonly used. One drawback to the sigmoid activation function is that there are regions of the function where the slope gradient is nearly zero. This often results in a learning algorithm taking a long time to converge in minimizing the loss. Later, a new activation function called Rectified Linear Unit (ReLU) became more widely used.

IV. RESULT ANALYSIS

For comparing the performance of the Deep Learning method. We implement the Deep Neural Network method. In this paper we use deep Neural Network for classification purpose. So we use two step first is training and second is testing step. In train step we use 90% data and testing step we used 10% data. We get both accuracy training and testing that show in below. In deep neural network we used relu active function this function are used max value for selection. By using deep learning method we get accuracy 93.75% that is more form old year research work.

Table 1. Accuracy in percentages

Training with Deep Learning	Testing with Deep Learning
97.00	**93.75**

Table 2. Comparison of the Proposed Model with the existing approaches

Source	Approach	Accuracy
Proposed Model	Deep Neural Network	93.75%
Amin Ul Haq et al.(2018)	features selection with SVM	88%
C. Beulah Christalin Latha et al.(2019)	Feature selection with Naïve Bayes, Bayes Net	85.48%

V. CONCLUSION

Heart disease is one of the leading causes of death worldwide and it is important to postpone heart disease early. A computer-assisted heart prediction system assists the physician as a tool for diagnosing heart disease. Another classification system for heart disease is reviewed in this paper. From the analysis concludes, data mining plays a major role in classifying heart disease. An in-depth Neural Network with offline training is ready to predict infections early and system efficiency can be achieved with a pre-processed and standardized data set.

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