



Heart Disease Diagnosis by Neural Networks

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

In the present time the Mortality rate will be increased all around the world on their daily basis. So the cause for this might possibly be largely ascribe to the developing in the numbers of the patients with the cardiovascular patient's diseases. To aggravate the cases, many physicians that have been known for the misdiagnosis of the patients announce heart related ailments. In this research paper, the intelligent systems have been designed in which they will help in the successful diagnosis of the forbearing to avoiding misdiagnosis. In the dataset of a UCI stat log of heart disease that will be using in this investigation. The dataset contains 14 attributes which are essential in the diagnosis of the heart diseases. A system is sculpted on the multilayer neural networks trained with convolutional & simulated convolutional neural networks. The identification of 89% was acquired from the testing of the networks.

Keywords: Convolutional neural networks; diseases; diagnosis; machine learning; neural networks.

1. INTRODUCTION

Heart must be explained as a compound organism in the human body that contains various nerves & muscles. The Heart pumps 52% of the blood to the several segments of the human body renewed materials. So any defect or

failure in the human heart may outcome in sudden deaths. In the USA, statistics have shown that about 900,000 people will die of the heart disease in every year. So this is the main reason why researchers have focused more on designing intelligent systems that must be used for diagnosing heart diseases of the human body

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with high accuracy, to avoid misdiagnosis. Besides, many people are living with heart disease without awareness. This kind of heart disease is referred to as a silent killer. Also, the heart diseases that have given resulting in the deaths of the so many peoples that have the manifestation of the diseases without taking into a consideration. Then there are attributes that increases the probability of that disease. These are Unhealthy diet, smoking, high blood pressure, inadequate physical exercises, and harmful use of alcohol, high blood sugar level and high cholesterol. The Cardiovascular of heart diseases assimilate with rheumatic heart, peripheral arteries, coronary heart, inflammatory heart disease & different forms of the heart disease. Then the other forms of the heart diseases include tumor of heart, disorder of the lining of the heart and vascular tumor of the brain[1].

Coronary of heart diseases that can be explained as the heart diseases that will affect a blood vessel transferring a heart muscle while that stroke is caused by disturbance of the blood transfer to the human brain. This must be as the results of the rupturing or blockage of a blood vessel. So these 2 types of cardiovascular of heart disease happen mostly in the people of the age of 68 years to 80years. The main risk factors of a coronary of heart disease & stroke are common. These are the higher blood pressure, high blood cholesterol, diabetes, smoking of tobacco, unhealthy diet, and atrial fibrillation physical in activities and advancing in the age. So expected to the higher risk requires in a diagnosis of that diseases, so the need to structured an intelligent system that will helping in the diagnosis of a disease that prevents misdiagnosis. In this systems can be modeled by the modeling of the human activities on the computer. The neural networks are the framework of the human's brain on the systems. This could be done in the order that makes a systems able to accomplish the pursuit of a human brain. The neural networks have 3 parts in which will be output layers, input layers and hidden layers. The input layers are the layer in which the input information will be presented into the convolutional neural networks, the input layers are the non-processing layers of a neural networks. The hidden layers are the layer through input layer & output layer. The Hidden layer consists of interconnection elements called neurons that were the complex associations between patterns [2,3].

Convolutional neural network is a special network which is used to recognize the image. They are a highly proficient area which identifies face, objects. In CNN after doing pixel every convolutional layer and every layer is connected to each other because of its good standard and using deep learning. Convolutional neural networks are more efficient because they reduce parameters. The convolutional neural network is applicable in both supervised learning and unsupervised learning that will perform both functionality sometime in sequence manner and some time in random format[4].

Artificial neural networks are being used in a variety of fields, such as image processing, medical diagnosis, and more. They can be used to locate previously undetected patterns, control medical devices based on biofeedback, detect characteristics in medical imaginary for model estimation, and classify normal and several heart diseases based on attributes. How many tests must be performed to diagnose a given condition affects the medical history data. Information and knowledge about illnesses can be derived from certain recorded measurements in medical data. Once correctly trained, a neural network aids in the categorization of a given dataset. In a literature review, a variety of methods for heart disease categorization utilizing neural networks were identified. There are still a lot of issues that need to be addressed, despite the tremendous developments in neural networks in recent years. As a result of unstructured surroundings and the actual world, most of the problems are caused by uncertainty. Among these uncertainties include prior knowledge about the environment, perceptually obtained information, restricted range, unfavorable observation data and unexpected input value.

In this research paper using the data mining different techniques namely WAC (weighted associative classifier) and Naïve Bayes. In this system all answers and queries which are the traditional probability fails that the answers. A system which detects the probability of the patient that getting the heart disease. An identification rate of the 85% and 83.51% were acquired from the Naïve Bayes and WAC. So in this research paper used a heart disease diagnosis database that was acquired from a UCI ML repository. Then the database accommodates 13 attributes. That selected 12 features for the investigation work. So in this research continuing the different author that used the different techniques that will combine and

gives the outputs and show the comparison between the techniques.

1.1 Review of Literature

There have been a handful of researches that help to determine Heart Disease Diagnosis by Neural Networks the classification of images by using different algorithms. In previous research papers they used different algorithms which gave different output by using different techniques.

Hwang et al. suggested deep learning techniques in orders to augment the correctness of fall identification systems. The suggested systems make use of the depth of a camera that must be put in the places in houses & nursing homes so that will make films videos & send it to them for the local computers that will reshape them & generate the alarm in the cases of fall observation is identified. To test these systems, a fall observation dataset that contains 264 measures from the 8 different kinds of categories representing the all daily pursuit from the Telecommunication Systems Team (TST) will be used. So the testing consisted of the 5 sudden trials where the 240 videos are for the training that were withdrawn. The preliminary outcomes have manifested that system correctness lies in between the 69.9% & 78.8% in every trial. Nonetheless, after the data enlargement was Applied, the presentation drastically improved as it attained 92.4 to 96.6% correctness. Although the suggested models look encouraging, these are the only preliminary outcomes & the systems that have not been more tested thoroughly (e.g., for the effectiveness of information augmentations). Also, that is dependent on the depth camera, it will share the limitations of vision dependent on human action recognition.

Ebenezer O and colleagues disclosed about the Neural Network Diagnosis of Heart Disease in this investigation work, confabulation must be done by regarding the death rated as an outcome of several types of the cardiovascular heart diseases. The Coronary of heart diseases leads to the population of the people of death in the world that followed by the stroke. The main factor that reasons death from the heart disease is misdiagnosis. In this research paper they using the neural networks for the research to find the heart diseases in this systems are structured on the multilayer neural networks trained with the backpropagation & reproduce on the feedforward

neural networks. The identification of 85% that was obtained by testing the networks.

In previous paper author used different methodologies but due to some reasons they facing some problem to find the proper outputs. So to overcome this problem classifying the other methodology in this paper which helps to find the nearby parameters of neural networks and also help to find the diagnosis of heart disease.

Research Questions

1. What is the need of neural networks and how it will help in heart disease diagnosis?

2. METHODOLOGY

2.1 Design

2.1.1 Network design

In this investigation drudgery, the neural networks for the diagnosis of a heart disease was designed with a heart disease representative obtained from the UCI of ML repository. The set of data is constructed of (13) attributes which may contain 280 representatives. The information set is splitting into the training set & testing sets. The information set was splitting using the ratio in between 70:30 i.e. 70% of the information set for the training & 30% of the information set for the testing of a networks. So this will be a convolutional ratio for dividing the dataset in the machine learning information set. The profitability of this splitting that it supplies adequate information for the training & testing of the systems in the way that will avoid underfunding that may happen if a training information set is will be smaller than the testing information set. It is also, if a training information set is greater than the testing information set, this must result in underfunding of the systems. The Batch training that was engaged in which all the patterns were explained by the neural networks at once. So therefore, at a input layers matrix 13×164 for training all networks with its communicated targets which makes the matrix 2×164 & matrix 13×110 for testing all networks after training that determine the presentation of the networks[5][6].

The numbers of the outcomes neurons that used to design the numbers of the attributes of the heart diseases information set. Therefore, a number of the outcomes neurons for that will the design is 13 & the numbers of the outcomes

neurons in an output layers are 2 neurons, which will be represented whether the heart diseases present (15) or the heart disease is absent (1,0). At the output layer & hidden layer, the sigmoid that activation functions will be using because of the switching soft nature & its nonlinearity catergious. The structural presentation of the neural networks diagnosis of the heart disease and also represent the relationship in between neural networks shown in Fig. 1[1].

2.2 Sample

In this information sets were taken by the UCI of ML repository. A heart disease dataset thing is made up of the 80 raw attributes from which the 13 attributes were issued. These attributes are very essential in a diagnosis of the heart diseases neural networks. The attributes include the deprivation blood sugar tested which must be indicated 130mg/dl for the patient with the absent test results & test results of 130mg/dl for the patient of that has been heart disease. So, the patient that has serum cholesterol < than 190mg/dl is considered to have heart disease existing[7].

The 13 attributes that must be contemplate in that research works are express below:

- Feature 1: Sex
- Feature 2: Age
- Feature 3: Resting blood pressure.
- Feature 4: Chest pain type 4values.
- Feature 5: Fasting blood sugar 120mg / dl

- Feature 6: Serum cholesterol in mg/dl
- Feature 7: Maximum heart rate achieved
- Feature 8: Resting electrocardiographic result (value 0,1, 2)
- Feature 9: Old peak = ST depression induced by exercise relative to the rest
- Feature 10: Exercise induced angina
- Feature 11: Thal: 3= normal; 6 = fixed defect; 7 = reversible defect
- Feature 12: Number of major vessels (0 - 3) colored by fluoroscopy
- Feature 13: The slope of the peak exercise ST segment

2.3 Instrument

2.3.1 Neural networks

A neural network is a series of algorithms that endeavors to recognize underlying relationships in a set of data through a process that mimics the way the human brain operates. In this sense, neural networks refer to systems of neurons, either organic or artificial in nature.

2.4 Heart Diagnosis

Various tests are used to diagnose heart disease. Your doctor will start by taking your personal and family medical history, recording current and past symptoms, and doing laboratory tests and an electrocardiogram. Based on the results of the assessment and tests, your doctor may order further tests.

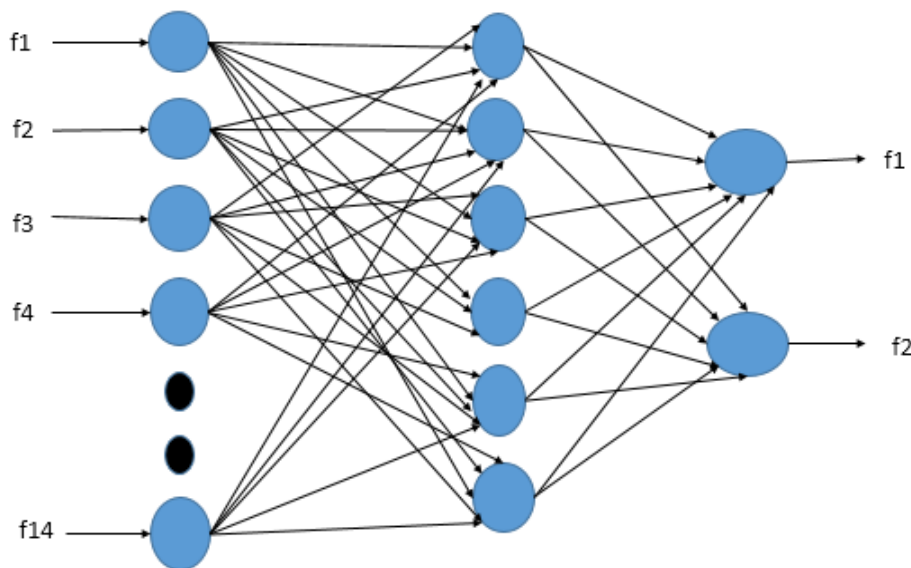


Fig. 1. Diagrammatic representation of the neural networks for the heart diagnosis diseases and it shows the relationship in between the neural networks

2.5 Convolutional Neural Network (CNN)

In deep learning, a convolutional neural network is a class of deep neural networks, most commonly applied to analyzing visual imagery. They are also known as shift invariant or space invariant artificial neural networks, based on their shared-weights architecture and translation invariance characteristics.

2.6 Data Collection

In sequences that increase the performance and stability of the networks. There is the requirement for the preprocessing of the information. In this preprocessing the data it is known as the normalization. Normalization of information metamorphoses the input information to the across that is satisfactory for the networks to learn straightforwardly. The normalization procedure input information to optimally the training consequence the networks which are contemplated as the input preprocessing functions shown in Table.1. Normalization must be completed by dividing every illustrative of the attributes by them communicate highest sample values[1][2].

2.7 Data Analysis

The numbers of neurons that were used in the hidden layers in the research works that were obtained by the experimenting in which the numbers of the neurons will be best representative the design. Also, in the neurons in a hidden layer that diversified, the learning rates in which the learning powers of the networks & the momentum rates which control the speeds of the networks are also diversified to permit the

networks to learn & prevent the networks from the settling at some local minima[3][8].

A neuron in a hidden layer was investigated from four neurons until that it will reach six neurons in which the faultless hidden neurons in which they can represented the pattern correctly for the systems to having the better performance shown in Table 2. A learning rate & momentum rates that was completely used for a networks were 0.38&0.80 respectively. The presentation of the convolutional neural networks and the minimum squares miscalculation against the all number of the iteration[9].

3. RESULTS AND DISCUSSION

The identification rate of the given research works was juxtaposed with the past work on a diagnosis of the heart diseases using the different neural networks. The highest identification rate that compared to the different algorithms that are used by the different authors considering the common UCI for machine learning of the heart diseases database. This shows that CNN is much effective & accurate in the diagnosis of a heart diseases in the medical field as juxtaposed with different algorithms in the past applied[7], [10]. After using different neural networks or different methodologies convolutional gives more accurate results. k-nearest neighbors (KNN), NAÏVE BAYES, DECISION TREE, and WAC are other approaches for diagnosis and the highest recognition rate compared to other algorithms used by other author considering the same UCI machine learning heart disease database shown in Table 3 and Fig 2.

Table 1. Representation of the normalized form of the neural networks

| Features | Sample | | | | |
|------------------------|--------|--------|--------|--------|--------|
| Gender | 0 | 1 | 1 | 1 | 1 |
| Age | 0.9190 | 0.8702 | 0.7468 | 0.8318 | 0.9615 |
| Resting blood pressure | 0.6510 | 0.5850 | 0.6300 | 0.6300 | 0.6000 |
| Serum cholesterol | 0.5801 | 1 | 0.4629 | 0.4664 | 0.4779 |
| Chest pain type | 2 | 0.7600 | 0.5100 | 1 | 0.5100 |

Table 2. Representation of neural networks performance

| | | | |
|------------------------|-------|------------------------|------|
| Number of output layer | 2 | Momentum rate | 0.80 |
| Number of input | 13 | Number of hidden layer | 6 |
| Performance | 0.210 | Recognition rate | 89% |
| Learning rate | 0.38 | Epoch | 3000 |

Table 3. Representation of shows the comparisons of the different techniques

| S. No | Different Algorithms which is used for diagnosis of heart diseases | The recognition rate in %. |
|-------|--|----------------------------|
| 1. | KNN | 46.75% |
| 2. | NAÏVE BAYES | 83.51% |
| 3. | DECISION TREE | 85.87% |
| 4. | CNN | 89% |
| 5. | WAC | 85% |

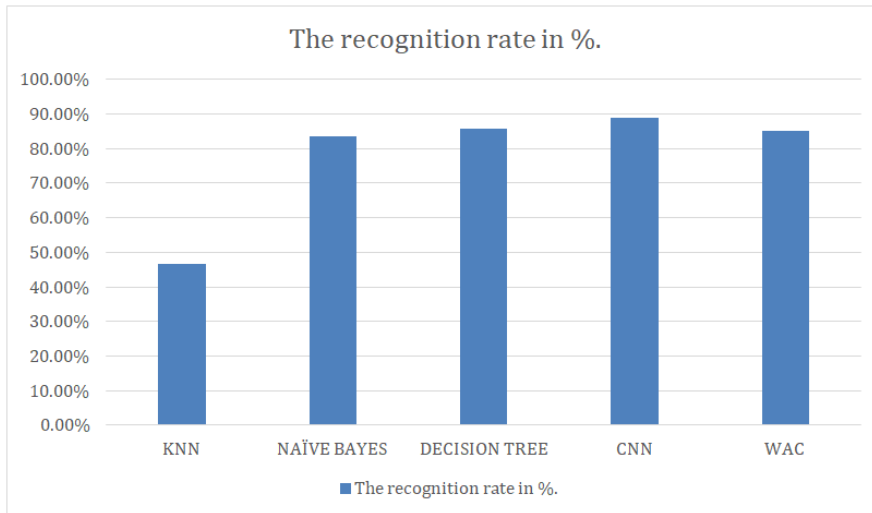


Fig. 2. In the given graph shows the recognition rate by using the different techniques

4. CONCLUSION

In this paper the work, confabulation that has been ready regarding the death rates as the results of several types of the cardiovascular of heart disease. The Coronary of heart disease that leads to the populations of a demise in the worlds followed by the stroke. The main component that sources the deaths from the heart disease of a misdiagnosis. Therefore, intelligent systems have been prototype which will avert misdiagnosis of the heart disease.

In this paper the work identification rate of 89% was obtained & this outcome was juxtaposed with different algorithms to discover the good algorithms with the good result. The Multilayer of neural networks that trained with convolutional neural networks were explored that have the good results that are suitable for the diagnosis of the heart diseases without misdiagnosis.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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