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A STUDY OF EXPERT SYSTEM FOR DETECTION OF VARIOUS DISEASES

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Abstract: In the field of medical regularly handles enormous amounts of data. Handling huge data by conventional methods can affect the results. Algorithms for machine learning can be used to find out facts in medical research, in particular for disease prediction. Expert System with artificial intelligence technology, Data mining technology has also been extensively developed, which has promoted the development of for detection and diagnosis of different diseases. The purpose this study aims to know the detection of brain, heart, kidney etc with the help of different algorithms such as Feedforward Backpropagation, Support Vector Machine, Generalized Regression Neural Network, Radial Basis Function and association rules in data mining. This study introduces the above neural network techniques in detail and experiments on medical data collected from hospital. The experimental results show that the some neural network techniques will detect the disease based on medical data collected from hospital and recommend medicine. Applying neural network techniques and data mining techniques based medical data disease detection has greatly improved the level of medical detections and understandings.
Keywords: Expert System, Data Mining, Association Rule, Medical Data, Neural Network.

I. INTRODUCTION

An expert system is defined as a software that attempts to reproduce the performance of one or more human experts, most commonly in a specific problem domain. It basically uses an inference engine connected to the knowledge base. A wide variety of methods can be used to simulate the performance of the expert however common to most or all are: the creation of a so-called "knowledgebase" which uses some knowledge representation formalism to capture the Subject Matter Expert's (SME) knowledge; a process of gathering that knowledge from the SME and codifying it according to the formalism, which is called knowledge engineering. Expert systems may or may not have learning components but a third common element is that once the system is developed it is proven by being placed in the same real world problem solving situation as the human SME, typically as an aid to human workers or a supplement to some information system. The examples of Expert Systems are explained as following:

- **MYCIN** : To identify bacteria causing severe infections, such as *bacteremia* and *meningitis*, and to recommend antibiotics, with the dosage adjusted for patient's body weight.
- **DENDRAL:** Its primary aim was to help organic chemists in identifying structure of unknown organic molecules, by analyzing their mass spectra and using knowledge of chemistry.
- **SAINT** : To solve problems based on Integral Calculus, and eventually generate simpler expressions for complex functions. A rule-based system is a system to store and manipulate knowledge to interpret information in a useful way. They are often used in artificial intelligence applications and research. Rule-based programming attempts to derive execution instructions from a starting set of data and rules, which is a more indirect method than using a imperative programming language which lists execution steps straightforwardly [1-5].

The development of Information Technology has generated large amount of databases and huge data in various areas. The research in databases and information technology has given rise to an approach to store and manipulate this precious data for further decision making. Data mining is a process of extraction of useful information and patterns from huge data. It is also called as knowledge discovery process, knowledge mining from data, knowledge extraction or data /pattern analysis. Data mining is a logical process that is used to search through large amount of data in order to find useful data [6].The goal of this technique is to find patterns that were previously unknown. Once these patterns are found they can further be used to make certain decisions for development of their businesses.
Three steps involved are

- Exploration, Pattern identification, Deployment.

Exploration: In the first step of data exploration data is cleaned and transformed into another form, and important variables and then nature of data based on the problem are determined.[7] Pattern Identification**:** Once data is explored, refined and defined for the specific variables the second step is to form pattern identification. Identify and choose the patterns which make the best prediction. Deployment: Patterns are deployed for desired outcome [8-9].

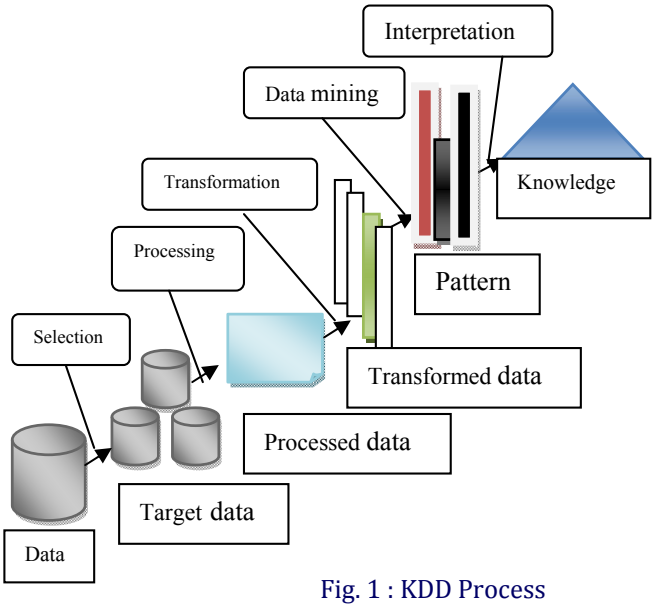

Fig. 1 : KDD Process

II. LITERATURE SURVEY

Artificial neural networks (ANN) have emerged as a re ult of simulation of biological nervous system, such as the brain, on a computer. On the other hand, biological neural networks are much more complicated than the mathematical models used for ANNs. ANN was founded by McCulloch and co-workers beginning in the early 1940s [10]. They built simple neural networks to model simple logic functions. Since it is customary to drop the ‘‘A’’ or the ‘‘artificial’’, NN and ANN will be used interchangeably throughout the rest of the paper to refer to an artificial neural network. Nowadays, neural networks can be applied to problems that do not have algorithmic solutions or problems for which algorithmic solutions are too complex to be found. In other words, it is not easy to formulate a mathematical model that does not have a clear relationship between inputs and outputs for some systems. To overcome this problem, ANN uses the samples to obtain the models of such systems [11]. Their ability to learn by example makes neural networks (NN) very flexible and powerful. Therefore, neural networks have been intensively used for solving regression and classification problems in many fields. In short, neural networks are nonlinear processes that perform learning and classification. Recently neural networks have been used in many areas that require computational techniques such as pattern recognition, optical character recognition, outcome prediction and problem classification. In materials science and engineering fields, the researchers have used neural network techniques to develop prediction models for mechanical properties of materials [12-13].Coronary artery disease (CAD) This occurs when problems arise with the blood vessels due to high cholesterol, diabetes, smoking, high blood pressure and inherit from parents angina is a symptom of CAD, which a chest pain and occurs discomfort in neck, arms, shoulders, back and pain even feels like indigestion [14] Congestive heart failure (CHF) The function of the heart is to pump blood, CHF is found when heart is not pumping a normal level Abnormal heart rhythms This is a problem in the heart with electrical activity, which makes the heart beat too fast or too slow is called Tachycardia or bradycardia. Bad rhythm‘s stops pumping blood in the heart [15].Heart diseases are also called as silent killers because symptoms are very difficult to detect. Some of the common symptoms or risk factor are: shortness of breath, uncontrolled heart palpitations, chest pain, skin discoloration, swelling in legs and dizziness. HD can be diagnosed in many ways based on the doctor‘s recommendation and symptoms. Few of the commonly recommended tests are [16-18]. Heart is IMPORTANT ORGAN OF OUR HUMAN BODY. Heart is a Muscular organ weighing about 300 grams contracting rhythmically around 70 times per minute in which each pulse removed 75 cc of blood into each circuit [20-21]. More than Country affected for heart disease every year some of the Million people for death from heart disease according to World Health Organization (WHO) [22-23]. More recently, Uguz et al. performed a biomedical system based on Hidden Markov Model for clinical diagnosis and recognition of heart valve disorders. The fulfilled methodology was also used the database of Turkoglu et al. In the presented study, continuous HMM (CHMM) classifier system was used. Single Gaussian model was preferred to determine emission probability. The methodology was composed of two stages. At the first stage, the initial values of average and standard deviation were calculated by separating observation symbols into equal segments according to the state number and using observation symbols appropriate to each segment. At the second stage, the initial values of average and standard deviation were calculated by separating observation symbols into the clusters (FCM or K-means algorithms) that have equal number of states and using observation symbols appropriate to the separated clusters [24-25].

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A tumor can be defined as a mass which grows without any control of normal forces or simply a brain tumor is a mass or growth of abnormal cells in your brain. Brain cancer is a very serious type of malignancy that occurs when there is an uncontrolled growth of cancer cells in the brain. Any brain tumor is inherently serious and life-threatening because of its invasive and infiltrative character in the limited space of the intracranial cavity. The brain is a complex organ as it contains 50-100 billions neurons forming a gigantic network. Brain tumor is a group of abnormal cells that grows inside of the brain or around the brain. Brain tumor can be benign or malignant, benign being non cancerous and malignant are cancerous. Malignant tumors are classified into two types, primary and secondary tumors benign tumor is less harmful than malignant as in malignant tumor it spreads rapidly invading other tissues of brain, progressively worsening the condition causing death. Brain tumor detection is very challenging problem due to complex structure of brain[26-27]. Heart disease or coronary artery disease (CAD) or coronary heart disease (CHD) or ischemic heart disease (IHD) is a broad term that can refer to any condition that affects the heart. For developing clinical decision support systems, literature presents a number of researches that have made use of artificial intelligence and data mining techniques. Till now, several studies have been reported on heart disease diagnosis. These studies have applied different approaches to the given problem and achieved high classification accuracies, of 77% or higher, using the dataset taken from the UCI machine learning repository. Experimental results showed a correct classification accuracy of approximately 77% with a logistic-regression-derived discriminate function. The John Gennari LASSIT conceptual clustering system achieved a 78.9% accuracy on the Cleveland database. A Fuzzy Support Vector Clustering to identify heart disease was used in. Resul Das introduced a methodology that uses SAS base software 9.13 for diagnosing heart disease. Zheng Yao applied a new model called R-C4.5 which improved the efficiency of attribution selection and partitioning models. Gang Kou partition applied data separation-based techniques to preserve privacy in the classification of medical data [28].
Karolis M.A. et.at has developed a data mining system for the assessment of heart event related risk factors targeting in the reduction in the reduction of CHD events using the risk factors i) Before the event a) non modifiable – age, sex etc. The analysis was carried out using C4.5 decision tree algorithm for the mentioned three events using five different splitting criteria. The highest percentage of correct classification archived were 66%, 75% and 75% for the myocardial Infarction (MI) Percutaneous Coronary Intervention (PCI) and Coronary Artery Bypass Graft Surgery (CABG) [29-30].

III. METHODOLOGIES USED FOR VARIOUS DISEASES

The previous studies related to heart disease classification using supervised machine learning algorithm, such as SVM, Random Forest and Decision Tree is discussed. The literature reviews [31] are discussed the following sections. A heart disease classifier works once the heart disease features are extracted using feature extraction method. Heart disease diagnosis using supervised machine learning algorithms is becoming a greater demand as a classification problem is automated using such algorithms to simplify the classification process and ensure better accuracy in classification avoiding human errors and saves time. A Support vector Machine is one of the simplest supervised machine learning algorithms used in disease classification [32-33]. In [34], a comparative study on heart disease classification algorithms was conducted and the accuracy of the Decision Tree, linear SVM and quadratic SVM was reported in the study. Linear SVM has better accuracy compared to other classification algorithms with an accuracy score of 65.3% and the quadratic SVM performed well next to the linear SVM. The Decision Tree has least accuracy compared to all of the classifiers the SVM, ensemble space Discriminant methods. EEG beat classification using vector supporting vector optimization particle swarm [35], initial ECG rhythmic classification system, power spectral-based topography and supply vector machine (SVM) classification [7]. The procedure removes the ghostly and three intermission characteristics of the electrocardiogram. Methods of calculating non-parametric power spectral density (PSD) are discharged to eliminate haunted characteristics. By using a neural network algorithm, the proposed method is optimised by optimising the appropriate parameters of the SVM classification system (PSO). These limits are SVM classifier penalty limit for the Gaussian Radial Basis (GRBF) kernel critiques. ECG Arrhythmia Classification Applies to modern approaches to distinguish arrhythmias from ECG indices through the use of time and incidence field methods using R-Peak, Binary Particle Swarm Optimization, and Absolute Euclidean Classifying [36]. Fast Fourier Transform pre-processes the ECG signal. After hearing the R-peaks, it is then separated into beats. For the extraction of the eye most detail is used in a few constants with the Discrete Cosine Transform (DCT) and Discrete Wavelet Transform (DWT) [37]. Methodology is a method of accomplishing the proposed work with the proposed algorithm. In this paper the Multilayer Perceptron Back Propagation Algorithm of Neural Network is used Back Propagation Algorithm is also called as „Back Propagation of Errors Algorithm", is a popular method that produce an effective ANN (Artificial Neural Network) training in conjunction with some optimization techniques like gradient desent. The method computes the depth of the loss function in the input data with respects to all the weights in the network. The gradient techniques are then applied to the optimization methods to adjust the weights to minimize the loss function in the network. Hence, the algorithm requires a known and a desired output for all inputs in order to compute the gradient of loss function. Usually, the generalization of Multilayer Feed Forward Networks is done using delta rule which possibly makes a chain of iterative rules to compute gradients for each layer. Back Propagation Algorithm necessitates the activation function to be different between the neurons. The ongoing researches on parallel, distributed computing and computational neuroscience are currently implemented with the concepts of Multilayer Perceptron using a Back Propagation Algorithm.

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MLP Back Propagation Algorithm has also gained focus in pattern recognition domain. They are so convenient in research, because of their ability in solving complex problems, and also for their fitness approximation results even with critical predictions. MLP is one of the Neural Network models, has the same architecture of Feed-Forward back Propagation for Supervised training [38-39].

IV. RESULT AND DISCUSSION

1. Processing of Medical data representation for Neural Network

In this study, the author has collected from Hospital, under supervision of Doctor. The author has collected the symptoms and information about patients' details like Previous History, Present History, Personnel History, Physical Examination, Cardio Vascular System, Respiratory rate, Per Abdomen, Central Nervous system, ECG, and Blood Investigation. The collected data contains all the information about the patient such as patient's previous disease, present condition, some personnel bad habits (smoking, tobacco, alcohol), physical examination (blood pressure, respiratory rate) etc. and the main point is ECG from which the patient can easily diagnose whether the patient is having heart problem or not. In ECG we have taken 21 different points which we have represented by codes. For each finding of the ECG doctor is deciding the patient is having which type of heart problem. The all 150 data collected regarding heart patients and all the data are prepared in different Excel Sheets which contains codes of each individual disease, history and symptoms. In one excel sheet I have taken 13 sub-sheets for each field of information such as for Previous History one sub-sheet has taken and given the name is given (P1), for Present History the second sub-sheet and the name is given (P2), for Personnel History the third sheet is taken and the name is given (P3), like this we have taken 13 different sheet for different fields. All the fields are taken under the supervision of the expert Cardiologist.

The table 1 represents the all collected data with symptoms number. All this data is then converted in 0 and 1 format as 0 represents the absence of code and 1 represents the present symptoms. For further training of neural network process the proposed information is coded in binary form (0 or 1). If the symptom is present in the patients at particular position at that point it is defined by one (1) and if the symptoms or disease is not present at that position it is placed by Zero (0). Suppose for example in the field P2 (present history) there are total 29 symptoms present and the patient no 1 is having the symptom 1,2,5 and 13 so these locations are defined by 1 (one) and all other symptoms are 0 (zero). In such a way all the fields are defined. All the parameter that we consider in medical prescription like Sr. No., ,age , P1, P2,P3,P4,CVS, RS, PA, CNS, ECG and BT are converted in binary number where this is used in neural network for train the neurons for achieving better result.

Age **P1** **P2**
00110111 0100000000000000 11001000000010000000000000000
P3 **P4** **CVS** **RS** **PA** **CNS**
0001 00000010010000000000000000 00000001 00010 000010 00010
ECG **BI**
10100000000000000000 00000000000010000000000;

Symptoms and Information Coding of the patient 1.

V. CONCLUSION

In this research work neural network is used to classify the patient's data for diagnosing proper disease and based on that it gives medicine prescription. In the experimental work, a total of 300 patient's data has been collected and initially classified into 11 different preliminary headings. Each preliminary hearing is further divided into minimum 4 and maximum 29 sub headings. The Binary transform of patient's coding is used as input for neural network techniques, like Feed forward Backpropagation, Generalized Regression Neural Network, Radial Basis Function and Support Vector Machine and data mining techniques. In this experimental process each of these neural network techniques are used to generate the neural network classification results. It is revealed that out of these techniques Radial basis function is more prominent technique that gives 97% accuracy in medical prescriptions.

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