Diagnosis and Medical Prescription of Heart Disease Using Support Vector Machine and Feedforward Backpropagation Technique

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Abstract

Expert system are used extensively in many domains. Heart disease diagnosis is a complicated process and requires high level of expertise. This paper describes aiming to develop a expert system for diagnosing of heart disease using support vector machine and feedforward backpropagation technique. Now a days neural network are being used successfully in an increasing number of application areas. This work includes the detailed information about patient and preprocessing was done. The Support Vector Machine (SVM) and feedforward Backpropagation technique have been applied over the data for the expert system. To make the system more authentic and reliable out of 300 patients 250 patients were used for training set and 50 for evaluation process. In conclusion, we have used two neural network techniques but we are getting just 50% to 60% output i.e. not reliable for the patient. This expert system data can also be applied to improve the accuracy the medicine using some other neural network techniques.

Keywords – ***Neural Network, Support Vector Machine (SVM), Feedforward Backpropagation Neural Network (FFBP), Symptoms, Medicine.***

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 proposed methodology uses neural network for classifier. The performance of proposed methodology was evaluated with two different neural network techniques. Moreover, we compared our result with Support Vector Machine and Feedforward Backpropagation neural network technique with original medicines provided by the doctor. We have not obtained that much accuracy from the experiments made on the data set containing 300 samples. The paper is organized as following, in Section II, a brief overview on previous related works and in section III, introduction of Support Vector Machine and Feedforward Backpropagation neural network techniques described. Section IV, the proposed methodology and preparing Data for underlying neural network. Section V, Experimental analysis and how the coding is done with patients as well as medicine data is described. Section VI, Discussion and result of first five patients medicine given by the expert system and is compared with the original medicine. Finally, we concluded this paper in Section VII.

II. Background

Related Works

Up to now, various classification algorithms have been employed on Turkoglu's valvular heart disease data set and high classification accuracies have been reported in the last decade [5-10]. Turkoglu's valvular heart disease data set was obtained from Firat Medical Center. A detailed description for the data set will be given in the next section.

The valvular heart disease data set was firstly utilized in [5] where Turkoglu et al. fulfilled an expert diagnosis system which uses backpropagation artificial neural networks (BP-ANN) classifier. The performance evaluation of the realized system was evaluated by classification accuracy and the correct classification rate was about 94% for normal subjects and 95.9% for abnormal subjects. Later, Turkoglu et al. suggested an intelligent system for detection of heart valve disease based on wavelet packet neural networks (WPNN) [6]. The reported correct classification rate was about 94% for abnormal and normal subjects. Recently, Comak et al. investigated the use of least-square support vector machines (LS-SVM) classifier for improving the performance of the Turkoglu's proposal [7]. They intended to realize a comparative study. Classification rates of the examined classifiers were evaluated by ROC curves based on the terms of sensitivity and specificity. The application results showed that according to the ROC curves, the LS-SVM classifier performance was comparable with ANN, but the training time of LS-SVM is shorter than that of the ANN and it can always converge the same solution while ANN cannot. According to these results, LS-SVM's training time is about 13 times shorter than ANN's training time. This is an important difference. Because, LS-SVMs are trained only depending on support vectors, not by whole training data set. In addition, LS-SVM can overcome the overfitting much successfully than ANN.

More recently, Uguz et al. performed a biomedical system based on Hidden Markov Model for clinical diagnosis and recognition of heart valve disorders [8]. 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. The implementations of the experimental studies were carried out on three different classification systems such as CHMM, FCM–K-means/CHMM and ANN. These experimental results were obtained for specificity and sensitivity rates 92% and 94% for CHMM, 92% and 97.26% for FCM–K-means/CHMM), respectively. Finally, Sengur et al. investigated the use of principal component analysis (PCA), artificial immune system (AIS) and fuzzy *k*-NN to determine the normal and abnormal heart valves from the Doppler heart sounds [9]. For reducing the complexity, PCA was used. In the classification stage, AIS and fuzzy *k*-NN were used. To evaluate the performance of the methodology, a comparative study was realized by using a data set containing 215 samples. The validation of the method was measured by using the sensitivity and specificity parameters; 95.9% sensitivity and 96% specificity rate was obtained. Sengur et al. also investigated the use of Linear Discriminant Analysis (LDA) and Adaptive neuro-fuzzy inference system (ANFIS) for clinical diagnosis and recognition of heart valve disorders [10]. The validation of the method is measured by using the sensitivity and specificity parameters. 95.9% sensitivity and 94% specificity rate was obtained.

III. Organization to Expert System

To diagnose the heart failure cause different popular methods used are MRI, Doppler and Expert System. MRI can provide clear three dimensional images of the heart. Doppler technique has gained much more interest since Satomura first demonstrated the application of the Doppler effect to the measurement of blood velocity in 1959[11]. However the factor such as calcified disease or obesity often result in a diagnostically unsatisfactory. Doppler techniques assessment and therefore, it is sometimes necessary to assess the spectrogram of the Doppler Shift signals to elucidate m the degree of the disease [12]. Many studies have been implemented the classify Doppler signals in the pattern recognition field [13-14].

Expert system is a intelligent program which olds the accumulated knowledge of one or more domain experts. There are many types of expert system currently exist. MYCIN expert system is used in medical field for diagnosis of blood disorders. DESIGN ADVISOR is another expert system used in processor chip design to give advice to designer about component placement, minimizing chip size etc. PUFF expert system is also used in medical system for diagnosis of respiratory condition of patient. PROSPECTOR expert system is used by geologists to identify sites for drilling or mining. DENDRAL expert system is used to identify the structure of chemical compounds. LITHIAN expert system gives advice to archaeologists to examiner stone tools. Expert system having three main components knowledge base, inference engine and user interact. Knowledge base is the collection of facts and rules which describe all the knowledge about problem domain. The inference engine is used to choose the appropriate facts and rules to apply during user query. Where as user interface takes the user query in a readable form and passes it to the inference engine. It then displays the result to the user. Based on much more useful but it has some limitation like limited domain, no current updation, no system self learning, no common sense, expert needed to setup and maintain. But even though it is used world wide because they are not always available, can be used anytime anywhere, human experts are not 100% reliable or consistent. Expert may not good for explanation of decisions and cost effective. While using the expert system some legal and ethical issues we need to follow to set the responsibility.[15]

i) Support Vector Machine :

Support Vector Machines(SVMs) are a state of the art pattern recognition techniques whose foundation stem from statistical learning theory. However, the scope of SVMs goes beyond pattern recognition because they can also handle two more learning problems i.e. regression estimation and density estimation. An SVM is a general algorithm based on guaranteed risk bounds of statistical learning theory i.e. the so called structural risk minimization principle. It is a learning machine capable of implementing s set of functions that approximate best the supervisor's response with an expected risk bounded by the sum of the empirical risk and Vapnik – Chevonenkis (VC) confidence. Recent advances in statistics, generalization theory, computational learning theory, machine learning and complexity have provided new guidelines and deep insights into the general characteristics and nature of the model building/learning/fitting process [16]. Some researchers have pointed out that statistical and machine learning models are not all that different conceptually [17,18]. Many of the new computational and machine learning methods generalize the idea of parameter estimation in statistics. Among these new methods, Support Vector Machines have attracted most interest in the last few years.

Support vector machine (SVM) is a novel learning machine introduced first by Vapnik [19]. It is based on the Structural Risk Minimization principle from computational learning theory. Hearst et al. [20] positioned the SVM algorithm at the intersection of learning theory and practice: ''it contains a large class of neural nets, radial basis function (RBF) nets, and polynomial classifiers as special cases. Yet it is simple enough to be analyzed mathematically, because it can be shown to correspond to a linear method in a high dimensional feature space nonlinearly related to input space.'' In this sense, support vector machines can be a good candidate for combining the strengths of more theory-driven and easy to be analyzed conventional statistical methods and more data-driven, distribution free and robust machine learning methods.

In the last few years, there have been substantial developments in different aspects of support vector machine. These aspects include theoretical understanding, algorithmic strategies for implementation and reallife applications. S VM has yielded excellent generalization performance on a wide range of problems including bioinformatics [21,22,23], text categorization [24], image detection [25], etc. These application domains typically have involved high-dimensional input space, and the good performance is also related to the fact that SVM's learning ability can be independent of the dimensionality of the feature space.

The SVM approach has been applied in several financial applications recently, mainly in the area of time series prediction and classification [26,27]. A recent study closely related to our work investigated the use of the SVM approach to select bankruptcy predictors. They reported that SVM was competitive and outperformed other classifiers (including neural networks and linear discriminant classifier) in terms of generalization performance [28]. In this study, we are interested in evaluating the performance of the SVM approach in the domain of heart disease in comparison with that of Radial Basis Function in neural networks.

Let us define labeled training examples [xi, yi], an input vector $x_i \in R^n$ a class value $y_i \in \{-1,1\}, i = 1,....., l$ For the linearly separable case, the decision rules defined by an optimal hyperplane separating the binary decision classes is given as the following equation in terms of the support vectors

$$Y = \operatorname{sign}\left(\sum_{i=1}^{N} y_i \alpha_i (\mathbf{x} \cdot \mathbf{x}_i) + b\right) \qquad (1)$$

where Y is the outcome, yi is the class value of the training example xi, and . represents the inner product. The vector x =(x1,x2,.,xn) corresponds to an input and the vectors xi, i=1,.,N, are the support vectors. In Eq. (1), b and α_i are parameters that determine the hyperplane.

For the non-linearly separable case, a high-dimensional version of Eq. (1) is given as follows:

$$Y = \operatorname{sign}\left(\sum_{i=1}^{N} y_i \alpha_i K(\mathbf{x}, \mathbf{x}_i) + b\right) \qquad (2)$$

The function K(x,xi) is defined as the kernel function for generating the inner products to construct machines with different types of non-linear decision surfaces in the input space.

ii) Feedforward Backpropagation (FFBP)

The Feedforward Backpropagation is one of the most studied neural network by the scientific community and the most common used in many medical applications. The feedforward, back-propagation architecture was developed in the early 1970's by several independent sources (Werbor; Parker; Rumelhart, Hinton and Williams) [29]. This independent co-development was the result of a proliferation of articles and talks at various conferences which stimulated the entire industry. Currently, this synergistically developed back-propagation architecture is the most popular, effective, and easy to earn model for complex, multi-layered networks[30]

This network is used more than all other combined. It is used in many different types of applications. This architecture has spawned a large class of network types with many different topologies and training methods. Its greatest strength is in non-linear solutions to ill-defined problems [31,32]. The typical back-propagation network has an input layer, an output layer, and at least one hidden layer. There is no theoretical limit on the number of hidden layers but typically there is just one or two [33]. Some work has been done which indicates that a minimum of four layers (three hidden layers plus an output layer) are required to solve problems of any complexity. Each layer is fully connected to the succeeding layer, as shown in Figure 1[34].

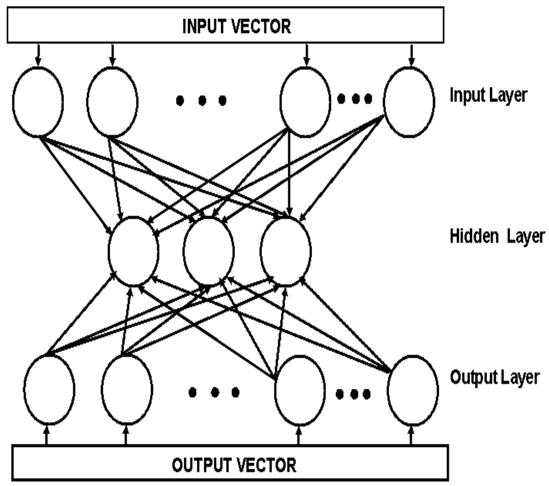


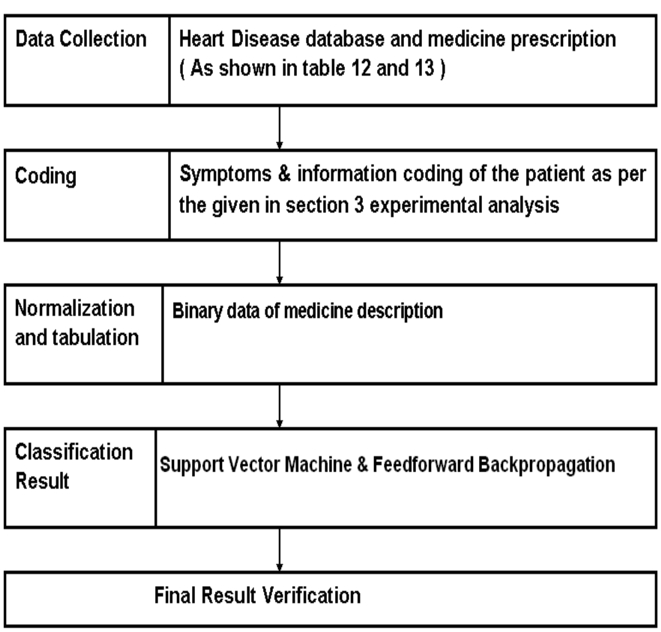
Figure 1 An example of Feedforward Backpropagation Network

The in and out layers indicate the flow of information during recall. Recall is the process of putting input data into a trained network and receiving the answer. Back- propagation is not used during recall, but only when the network is learning a training set. The number of layers and the number of processing element per layer are important decisions. These parameters to a feedforward, back -propagation topology are also the most ethereal. They are the art of the network designer. There is no quantifiable, best answer to the layout of the network for any particular application. There are only general rules picked up over time and followed by most researchers and engineers applying this architecture of their problems[36][37].

Typical feedforward, back-propagation applications include speech synthesis from text, robot arms, evaluation of bank loans, image processing, knowledge representation, forecasting and prediction, and multi-target tracking. Each month more back-propagation solutions are announced in the trade journals[35].

IV. Methodology

i) Proposed methodology and implementation of with SVM and FFBP



ii) Preparing Data for underlying neural network:

The data is collected from daily OPD session while doctor examining the patients. The symptoms and information about patients details like Previous History(p1), Present History(p2), Personnel History(p3), Physical Examination(p4), Cardio Vascular System(CVS), Respiratory Rate(RS), Per Abdomen(PA), Central Nervous system(CVS), ECG and Blood Investigation(BI). The main point is ECG from which the patient can easily diagnose whether the patient is having heart problem or not.

All 300 patients data collected regarding heart disease and the data are prepared in different Excel Sheets which contains codes of each individual disease, history and symptoms. In one excel file 13 sub-sheets are taken for each field of information such as for Previous History (p1), for Present History the second sub-sheet and the name is given (P2), for Personnel History (P3) the third sub-sheet is taken, like this the data collection has 13 different sub-sheets for different fields. All the fields are taken under the supervision of the Cardiologist

The code is given to each symptoms, physical examination parameter or diseases in each sub-sheet for experimental work. On this data some pre-processing i.e. normalization, coding and decoding methods are applied for the expected output.

In table 1, the Previous History (P1) has represented with 1 to 18 different diseases of total 300 heart patients and represents the codes respectively from 1 to 18. The code 1 which represents Hypertension, Code 2 represents Diabetes Mallitus like this it contains 18 different diseases. Some of them are as shown in Table 1.

Code	Name of Disease
1	Hypertension
2	Diabetes Mallitus
3	TB
4	Bronchial Asthama
5	Hyperthyroidism

Table 1 : Previous History of Patients

In table 2, Present History (P2) and the symptoms present in P2 are represented by Codes. The Code 1 which represents Chest Pain/Discomfort, Code 2 represents Retrosternal Pain like this it contains 29 different symptoms. Some of the symptoms are shown in table 2.

Code	Symptoms
1	Chest Pain/Discomfort
2	Retrosternal Pain
3	Palpitation
4	Breathlessness
5	sweating

Table 2 : Present History of patients

In table 3, Personnel History (P3) and the information present in P3 are represented by codes for different bad habits. The Code 1 which represents Smoking, Code 2 represents Tobacco like this 4 different bad habits are taken and specified by 1 to 4 codes. Some of the personnel history parameters are given below.

Code	Personnel History
1	Smoking
2	Tobacco
3	Alcohol
4	Nil

Table 3 : Personnel History

In table 4, Physical Examination (P4) and the information present in P4 are represented by codes for different physical parameters. The Code 1 which represents Consciousness, Code 2 represents Orientation like these 25 different physical parameters and specified by 1 to 25 codes for each parameter. Some are as shown below in table 4.

Code	Physical Examination
1	Altered Consciousness
2	Orientation
3	Dyspnoea
4	Fever
5	Low Pulse Rate

Table 4 : Physical Examination

In table 5, Cardio Vascular System (CVS) and the information present in CVS are represented by codes for different symptoms. The Code 1 which represents Heart Sound, Code 2 represents Normal Heart Rate like this 8 different symptoms and specified by 1 to 8 codes for each symptom. Some are as shown below in table 5.

Code	Symptoms
1	Heart Sounds
2	Normal Heart Rate
3	Tachycardia
4	Bradycardia
5	Regular Heart Rhythm

Table 5 : Cardio Vascular System

In table 6, Respiratory System (RS) and the information present in RS are represented by codes for different symptoms. The Code 1 which represents Breath Sound preserved, Code 2 represents Breath Sound Reduced like this 5 different symptoms are found and specified as shown in table 6.

Code	Symptoms
1	Breath Sounds Preserved
2	Breath Sound Reduced
3	Basal Crepts
4	No Abnormality Detected (NAD)
5	Ranchi

Table 6 : Respiratory System

In table 7, Per-Abdomen (PA) and the information present in PA are represented by codes for different symptoms. The Code 1 which represents Liver (Hepatomegaly), Code 2 represents Spleen (Splenomegaly) like these 6 different symptoms have found and specified by 1 to 6 codes for each symptom. Some are as shown below in table 7.

Code	Symptoms
1	Liver(Hepatomegaly)
2	Spleen (Splenomegaly)
3	Free Fluid Present
4	Abdominal Distension
5	No Abnormality Detected (NAD)

Table 7 : Per Abdomen

In table 7, Central Nervous System (CNS) and the information present in CNS are represented by codes for different symptoms. The Code 1 which represents Consciousness, Code 2 represents Orientation like this 5 different symptoms are found and specified by 1 to 5 codes for each symptom. Some are as shown below in table 8.

Code	Symptoms
1	Consciousness
2	Orientation
3	Focal Deficit
4	No Abnormality Detected (NAD)
5	Restlessness

Table 8 : Central Nervous System

In table 8, Electro Cardio Gram (ECG) and the information present in ECG are represented through codes for different finding which points to different problems of heart. The Code 1 which represents ST Elevation, Code 2 represents Anterior Wall like this 21 different heart findings are found and specified by 1 to 21 codes for each finding. Some are as shown below in table 9.

Code	ECG Point
1	ST Elevation
2	Anterior Wall
3	Antero Septal
4	Inferior
5	Infero Posterior

Table 9 : Electro Cardio Gram (ECG)

In table 10, Blood Investigation (BI) and the information present in BI are represented through codes for blood investigation. The Code 1 which represents Cardiac Enzymes (High), Code 2 represents Blood Sugar Test like this 24 different investigations has found and specified by 1 to 24 codes for each investigation in all patient. Some are as shown below in table 10.

Code	Symptoms
6	Lipid Profile normal
7	Lipid Profile Abnormal
8	Complete Blood Count Normal
9	Leucocytosis
10	Anaemia

Table 10 : Blood Investigation

In table 11, all the medicines names along with their codes i.e. MID which are prescribed by the doctor to the patients. The medicine sheet contains 52 different medicines which are prescribed by the doctor in different 300 stages. Some are as shown below in table 11.

Code	Medicine Name
1	Alprazolam
2	Amlodepine
3	Aspirin
4	Atenolol
5	Atorvastatin

Table 11 : Medicine Names

In table 12, all Patients information such as previous history(P1), P2(Present History), P3(personnel History), P4(Physical Examination), CVS(Cardio Vascular System), RS(Respiratory System), PA(Per Abdomen), CNS(Central Nervous System), ECG(Electrocardiography) and BI(Blood Investigation) which contains all the represented codes that are present in the individual patients.

Sr. No.	Patient Name	Symptoms and Findings										
		Age	P1	P2	P3	P4	CVS	RS	PA	CNS	ECG	BT
1	A	55M	2	1,2,5,13	4	7,10	8	4	5	4	1,3	14
2	B	58 M	2	1,2,8	2	7,8,13,14	8	4	5	4	2	7
3	C	60M	8	5,7,13	4	1,6,12	8	4	5	4	9	14
4	D	60M	1,2	4,5	4	1,2,7,13,14	3,5	3	5	4	12	4
5	E	56F	1	15,16	4	6,9,12	8	4	5	4	10	2

Table 12 : collection of different details of the individual Heart Patients

In table 13, different 52 medicines were used by the doctor on total 300 patients. All the medicines are prescribed by the doctor. In this table the medicines codes are used as the description given in the table 11.

Sr. No.	Patient Name	MID 1	MID 2	MID 3	MID 4	MID 5	MID 6	MID 7	MID 8	MID 9	MID 10	MID 11	MID 12	MID 13
1	A	2	3	5	6	14	17	19	21	23	25	26	27,29	36
2	B	2	3	5	6	14	16	17	21	23	25	26	27	28
3	C	1	5	6	14	25								
4	D	3	5	7	10	11	13	14	17	19	30			
5	E	5	14	15	19									

Table 13 : All the Medicine codes provided by the doctor to the individual patients.

V. Experimental Analysis

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.

The individual data of the patient no 1 is defined in binary form as :

Sr No **Age** **P1** **P2** **P3**
00000001 0110111 010000000000000000 11001000000010000000000000000 0001
P4 **CVS** **RS** **PA** **CNS** **ECG**
0000001001000000000000000 00000001 00010 000010 00010 101000000000000000000
BT
000000000000010000000000;

Symptoms and Information Coding of the patient 1.

Using this sequence of binary format we were not getting appropriate result. Therefore we have change the order of fields as per suggestion of the doctor because the doctors are prescribing the medicines on the basis of the ECG and blood investigation. So the order of ECG is changed from field no. 9 to field no. 1 and after ECG we have taken Blood Investigation and rest of the fields are same and at last age is placed. Due of reshuffling of the fields we got satisfactory result upto 97%.

For this expert system total 52 different medicine are prescribed by the Doctor and if the medicine is present at that position it is defined by one (1) and if it is absent at that position it is defined by Zero(0). Similarly for patient one the prescribed medicine are defined as :

0 1 1 0 1 1 0 0 0 0 0 0 0 1 0 0 1 0 1 0 1 0 1 0 1 1 1 0 1 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0;

Medicine Coding of the patient 1.

MID	Patient from A to I								
	A	B	C	D	E	F	G	H	I
1	1	1	1	1	1	1	1	1	0
2	0	0	0	0	1	0	1	1	1
3	1	1	1	1	1	0	1	1	1
4	0	0	0	0	0	0	1	0	0
5	1	1	1	1	1	1	1	1	1
6	1	1	1	1	0	1	1	0	1
7	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0
11	0	0	1	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0
13	0	0	0	1	0	0	0	0	0
14	0	0	1	1	1	0	1	1	0
15	0	0	0	0	0	0	0	0	0
16	1	1	0	0	0	1	0	0	1
17	1	1	0	1	0	1	1	0	1
18	1	1	0	0	0	0	0	0	0
19	1	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0
21	1	1	1	1	0	1	0	0	0
22	0	0	1	1	0	0	0	0	0
23	1	1	1	1	0	1	0	0	0
24	0	0	1	0	0	0	0	0	0
25	1	1	1	1	0	1	0	0	1
26	1	1	1	1	0	0	0	0	0
27	1	1	1	1	0	0	0	0	0
28	1	1	0	1	0	0	0	0	0
29	1	1	0	0	0	1	0	0	1
30	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	1	0	0	0
32	0	0	0	0	0	0	0	0	0
33	0	0	0	0	0	0	0	0	0
34	0	0	0	0	0	0	0	0	0
35	0	0	0	0	0	0	0	0	0
36	0	0	1	0	0	1	0	0	0
37	0	0	0	0	0	0	0	0	0
38	0	0	0	0	0	0	0	0	0
39	0	0	0	0	0	0	0	0	0
40	0	0	0	0	0	0	0	0	0
41	0	0	0	0	0	0	0	0	0
42	0	0	0	0	0	0	0	0	0
43	0	0	0	0	0	0	0	0	0
44	0	0	0	0	0	0	0	0	0
45	0	0	0	0	0	0	0	0	0
46	0	0	0	0	0	0	0	0	0
47	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0
49	0	0	0	0	0	0	0	0	0
50	0	0	0	0	0	0	0	0	0
51	0	0	0	0	0	0	0	0	0
52	0	0	0	0	0	0	0	0	0

Table 14 shows the Result of the first nine patient after training using SVM

MID	Patient from A to I								
	A	B	C	D	E	F	G	H	I
1	1	1	1	1	1	1	1	1	1
2	0	0	0	0	0	0	0	0	0
3	1	1	1	1	1	1	1	1	1
4	0	0	0	0	0	0	0	0	0
5	1	1	1	1	1	1	1	1	1
6	1	1	1	1	1	1	1	1	1
7	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0
14	1	1	1	1	1	1	1	1	1
15	0	0	0	0	0	0	0	0	0
16	1	0	0	0	0	0	0	0	0
17	1	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0
21	1	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0
23	1	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0
25	1	1	1	1	1	1	1	1	1
26	1	0	0	0	0	0	0	0	0
27	1	0	0	0	0	0	0	0	0
28	1	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0
33	0	0	0	0	0	0	0	0	0
34	0	0	0	0	0	0	0	0	0
35	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0
37	0	0	0	0	0	0	0	0	0
38	0	0	0	0	0	0	0	0	0
39	0	0	0	0	0	0	0	0	0
40	0	0	0	0	0	0	0	0	0
41	0	0	0	0	0	0	0	0	0
42	0	0	0	0	0	0	0	0	0
43	0	0	0	0	0	0	0	0	0
44	0	0	0	0	0	0	0	0	0
45	0	0	0	0	0	0	0	0	0
46	0	0	0	0	0	0	0	0	0
47	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0
49	0	0	0	0	0	0	0	0	0
50	0	0	0	0	0	0	0	0	0
51	0	0	0	0	0	0	0	0	0
52	0	0	0	0	0	0	0	0	0

Table 15 shows Result of the first nine patient after training using FFBP

MID	Patient from A to I								
	A	B	C	D	E	F	G	H	I
1	1	0	1	0	0	1	1	1	0
2	0	1	0	0	0	0	0	0	0
3	1	1	0	1	1	1	1	1	0
4	0	0	0	0	0	0	0	0	0
5	1	1	1	1	0	1	1	1	0
6	1	1	1	0	0	1	1	0	0
7	0	0	0	1	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0
10	0	0	0	1	0	0	0	0	0
11	0	0	0	1	0	0	0	0	1
12	0	0	0	0	0	0	0	0	0
13	0	1	0	1	0	0	0	0	0
14	1	1	1	1	1	0	1	0	1
15	0	0	0	0	1	0	0	0	0
16	0	0	0	0	0	1	0	1	0
17	1	1	0	1	0	1	0	1	0
18	0	0	0	0	0	0	0	0	0
19	1	1	0	1	1	0	0	0	0
20	0	0	0	0	0	0	0	0	1
21	1	1	0	0	0	1	0	0	0
22	0	0	0	0	0	0	0	0	0
23	1	1	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	1	0
25	1	1	1	0	0	1	0	1	0
26	1	1	0	0	0	0	1	0	0
27	1	1	0	0	0	0	0	1	0
28	0	0	0	0	0	0	0	0	0
29	1	1	0	1	0	1	0	1	0
30	0	0	0	1	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	1
33	0	0	0	0	0	0	0	0	1
34	0	0	0	0	0	0	0	0	0
35	0	0	0	0	0	0	0	0	0
36	1	1	0	0	0	0	0	0	0
37	0	0	0	0	0	0	0	0	0
38	0	0	0	0	0	0	0	0	0
39	0	0	0	0	0	0	0	0	0
40	0	0	0	0	0	0	0	0	0
41	0	0	0	0	0	0	0	0	0
42	0	0	0	0	0	0	0	0	0
43	0	0	0	0	0	0	0	0	0
44	0	0	0	0	0	0	0	0	0
45	0	0	0	0	0	0	0	0	0
46	0	0	0	0	0	0	0	0	0
47	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0
49	0	0	0	0	0	0	0	0	0
50	0	0	0	0	0	0	0	0	0
51	0	0	0	0	0	0	0	0	0
52	0	0	0	0	0	0	0	0	0

Table 16 Original medicine prescribed by the doctor.

VI. Discussion of First five patients results with doctor:

Original Medicines given by doctor:

A) 1,3,5,6,14.17,19,21,23,25,26,27,29,36
B) 2,3,5,6,14,16,17,21,23,25,26,27,28
C) 1,5,6,14,25
D) 3,5,7,10,11,13,14,17,19,30
E) 3,14,15,19

Medicines given by the Expert system using SVM

A) 1,3,5,6, 16,1718,21,23,25,26,27,28,29
B) 1,3,5,6,16,17,18,21,23,25,26,27,28,29
C) 1,3,5,6,11,14,21,22,23,24,25,26,27
D) 1,3,5,6,13,14,17,2122,23,25,26,27,28
E) 1,2,3,5,14.

Medicines given by Expert System using FFBP :

Medicines given by the Expert system using FFBP

A) 1,3,5,6, 14, 16, 17,21,23,25,26,27,28
B) 1,3,5,6,14,25
C) 1,3,5,6,14,25
D) 1,3,5,6,14,25
E) 1,3,5,6,14,25

i) Comparative studies of SVM and FFBP methods for medical prescription for heart disease patient

SVM networks and FFBP NN both are examples of non-linear layered feed-forward networks and they are universal approximations. The basic comparison of SVM and FFBP NN for the medical prescription for heart disease patient presented in table 14 and table 15.

1) In both the NN model 250 data samples has given as input.
2) The FFNN model takes 10,000 epochs to train it while SVM NN model takes only 250 epochs for the training of the model.
3) If the training performance error is compared FFBP NN and SVM are both gives less result.
4) The time taken by FFBP NN to train the model is near about 40-45 minutes while SVM NN model takes only 5-10 seconds.

So Medicines given by the expert system using FFBP and SVM is not producing the appropriate result.

VII. Conclusion

In this paper, around 300 patient's information is collected from Sahara Hospital, under supervision of Dr. Abdul Jabbar, (MD Medicine) Sahara Hospital, Roshan Gate, Aurangabad. The collected information is coded, normalized and entered into 13 different excel sub-sheets. All the patients data is trained by using SVM and FFBP. Around 50 samples were tested with these two techniques. If the more data set is used for the training the NN model gives more robust results. The analysis model by using SVM and FFBPof ANN gives less appropriate result for medical prescription for heart disease patient. However, there are several techniques that can improve the speed and performance of the back propagation algorithm, weight initialization, use of momentum and adaptive learning rate. It is found that the result of testing data by using SVM and FFBP is not satisfactory as per the result verified by the doctor. In future, this work may be extend using Radial Basis Function or Regression technique to improve the accuracy and to improve the performance of the expert system.

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