

THE BLOOD INFLAMMATION DIAGNOSIS BASED ON SOME INTELLIGENT TECHNIQUES

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ملخص البحث:

يقدم هذا البحث طرق جديدة لتشخيص التهاب الدم والذي يكون سببه أمراض معينة لا يمكن معرفتها قبل التأكد من عدد كريات الدم البيضاء والحمراء والتي تعتمد على مجال محدد يشير إلى حالة الشخص الذي يخضع للفحص وتحديد هل هناك مرض أم لا وإلى أي مدى قد تمكن المرض من صاحبه (إن وجد). ولتحقيق ذلك فقد قمنا بهذه الورقة من استخدام المنطق الضبابي والشبكات الصناعية و توظيف مقدره كل واحدة منها في هذا التشخيص .

ABSTRACT

This research provides new methods to diagnose inflammation of the blood, which is caused by certain diseases which can not be known before ascertaining the number of red and white blood cells that depend on a specific area that refers to the case of a person who is subject to the test and determine whether there is illness or not and to what extent the disease has mastered him (if found). To achieve this we have done this paper by using fuzzy logic, Neural Network and by recruiting the ability of each one of them in this diagnosis

KEYWORDS

Fuzzy Logic, Neural Networks, Diagnosis.

INTRODUCTION

Artificial Intelligence elements like, Fuzzy logic, Data Mining, Expert Systems, Artificial Neural Networks Genetic Algorithms, SVM, Machine Learning, etc. are tend to emulate the human brain.

Using the Neural Networks , Fuzzy System, Genetic Algorithms, Machine Learning Techniques , Expert Systems, Data Mining and SVMs were first suggested from concepts of structural risk minimization , statistical learning theory, quantitative methods, qualitative methods and support vector classifier formulation.

Medical Diagnosis is considered one of the main interests of the researches nowadays.

IN Fuzzy Logic the process of formulating the mapping from input to an output is known as fuzzy inference. One of the main functions of fuzzy logic systems is to give us much precision and to display the ambiguous in the results of done experiment, so we can say that Fuzzy Logic system can be a very powerful tool for dealing quickly and efficiently with imprecision and nonlinearity , Fuzzy logic can be used in diagnosis some bioinformatics problems. Recently NNs have been used in a range of problems including bioinformatics[3], text categorization , classification , since provide a robust approach to approximating real-valued, discrete-valued and vector-valued target functions., Neural Networks are among the most effective learning methods used in medical diagnosis. So The objective of this paper is to diagnose blood inflammation through the use of Fuzzy logic and Neural Networks . Some problems Need not only to get pattern Classification ,but need either to get much precision and to display the ambiguous in the results, so for that we use fuzzy logic[8] [9][11]

EXPERIMENTS DESIGN

We have used Matlab 7.0.1 package for Fuzzy logic f and self made code for back-propagation method .

the datasets of blood inflammation test used in this study were obtained from the archives of dr. Ali Alzaazai . Since measures parameter are WBC, Neutrophil, Lymphocytes to detect blood inflammation as follow:

WBC is parameter to test if there is inflammation in blood, normal range [4 -10) and out of normal rang in ([11..30]). Since out of normal range denotes that there is inflammation.

Neutrophile is parameter to test if found Bacteria , normal range [40 - 70]% and out of normal rang (>70 %). Since, normal range denote that no bacteria and out of normal range denote that bacteria is found.

Lymphocytes is parameter to test if found Virus , normal range [20 - 40]% and out of normal rang (>70 %). Since, normal range denote that no Virus and out of normal range denote that Virus is found.

Absolute Neutrophile (when WBC >10 and Neutrophile >70),it means that High Bacteria is found.

Absolute Lymphocytes (when WBC >10 and Lymphocytes >40),it means that High Virus is found.

collected amount of data (n= 100 , 70 for learning and 30 for testing) [2] [5][6]

RESEARCH METHODS

ARTIFICIAL NEURAL NETWORKS

In practices specially in medical diagnosis , the new methods of nns like Radial back propagation neural network is one of high ability popular methods which provides a powerful linear, capable of nonlinear mapping[1][4].

The simplest implementation of neural network uses two classes, class denote negative diagnosis and another class denote positive diagnosis . In our paper we means that if there is no blood inflammation then class with 0 is appear to represent negative diagnosis ,reverse to class with 1 or class with -1 which mean that found blood inflammation.

In this paper The designed neural Network, has been trained by using Back propagation algorithm., learned neural network has been used to check and classify peoples with blood inflammation.

Each layer consists of a number of neurons which depends on the cases to be solved[7][10][12]. The proposed model shown in fig.1. is a three -layer NN that consists of:

- an input layer with three neurons represents input features (measurement of labs Testing for Neutrophile. , Lymphocytes. , WBC)
- a hidden layer with 2 neurons.
- an output layer with one neuron activated by logistic function, which determine if there are blood inflammation or not.

Net was in stability stage with next parameters :

Learning Rule : Standard Delta Rule, Learning Rate: 0.3 Transfer Function : logsig Iteration=9000,Performanc=0.003

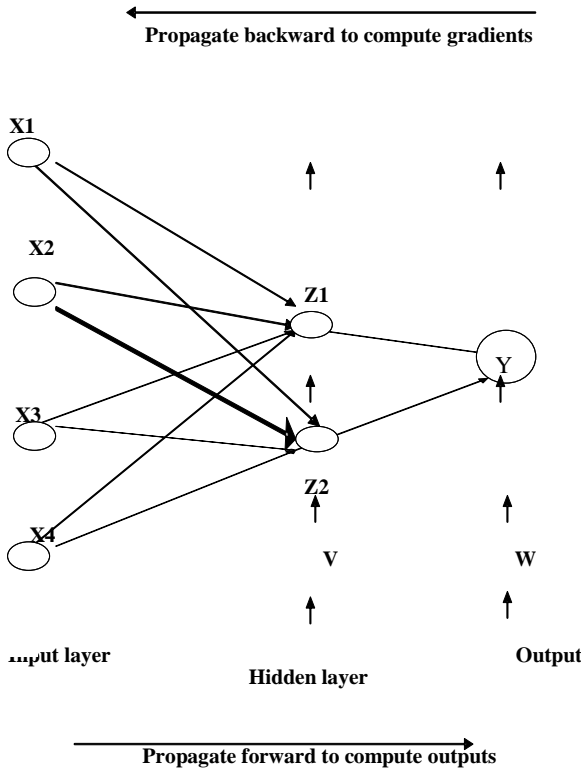


Fig.1 BP Structur

FUZZY LOGIC

Fuzzy Logic systems address the imprecision of the input and output variables directly by defining the with fuzzy numbers and fuzzy sets that can be expressed in linguistic terms. Furthermore, the allow far greater flexibility in formulating system descriptions at the appropriate level of detail. Fuzzy inference systems are two types , Mamdani and Sugeneo]. Fuzzy inference system used in our paper is type of Mamdani .

The main point of Fuzzy logic is to map an input space to an output space and If –Then rules refer to variables and the adjectives that describe those variables. If –Then rules is the main mechanism for doing this. A member function defines how each point in the input space is mapped to a membership value in [0 1]range. Also member function associate with a given fuzzy set maps an input

value to its appropriate membership values. So the input parameters are fuzzified to obtain the membership values corresponding to the measured parameter values ,then the membership values are fed to a fuzzy rule base ,the implication relation of these rules is modelled through Mamdani min implication operator to provide the output membership values. These output membership values are then defuzzified using the centroid defuzzification technique , to obtain a crisp output value. Whereas The fuzzy rule base converts the given input functions into outputs[9] [11][13], as we see in tab.2, since this table defines all possible corresponding actions of input fuzzy sets combinations . The conjunction based on AND fuzzy math In our paper.

Fuzzy rule base:

Formulated Rules are appropriate to inputs (WBC, Neutrophile, Lymphocytes) and output. variables have been divided according to medicine diagnosis range in to several fuzzy regions (Norm ,Bacterial, Viral, H. Bacterial, H. Viral) as shown in tab.1
The membership functions in our research ,which verifies required results according to diagnosis range is SMF .

Tab.1 Fuzzy Rule Base

RESULT AND DISCUSSION

Blood State	Testing result	Target
Inflammation (bacterial)	0.899- -0.998 -1.268 -0.963 -1,112	-1
Normal	0.021 0.076 -0.018 0.041 -0.012	0

Inflammation (viral)	0.913	1
	0.971	
	1.064	
	1.072	
	0.977	

WBC		Normal (in range [4.. 10])	[10 .. 30]
Inflammation			
Neutrophile	Lymphocytes	Normal	—
Normal	Normal		
Normal	>40	Viral	H. Viral
>70	Normal	Bacterial	H. bacterial

Tab.2 Some samples of the blood testing by NNs

Tab.2 contain Some samples of blood testing verified by NNs In the output column of tab.2 there is various results , depending on input values of WBC, Neutrophile and lymphocytes. Shown here that the diagnosis of output throw classification by NNs has proved the existence of the Bacterial or Viral or Normal state depending on data for testing

Data for Testing			Output	Blood Diagnosis
WBC	Neut.	Lym.		
9.18	46.3	37	51.5	Normal
8.96	74.2	38.7	56.9	Bacterial
26.4	89.4	35.3	70.1	H. Bacterial
9.4	48	50.5	58.1	Viral
21.3	48	66.6	65.7	H. Viral

Tab.3 Some samples of the blood testing by fuzzy logic inference system

In the output column of tab.3 there is various results , depending on input variables WBC, Neutrophile and lymphocytes. Shown here that the diagnosis of output for each of WBC, Neutrophile, lymphocytes has proved the existence of the Bacterial or Viral depending on the signals of data for testing in the first column, which consist three columns represents mentioned above input variables , and not only this, but showed also the degree of Bacterial and Viral (if found) . This function which can not done by Neural Networks ,so when the values approach from .5 ,it indicates no bacteria and no virus is found in diagnosis, this is opposite to far values from .5, which indicates that there is Bacteria or Virus in various high degrees .

In this section , we test both of designed Fuzzy Logic System and Artificial Neural Networks. The ability of fuzzy logic and neural networks to approximate and classify the blood inflammation testing (bacterial, H. Bacterial, Viral ,H. Viral or normal) as shown in tab.2 and tab.3. The NNs have got 90% rightness classification for normal ,Viral, Bacterial (see tab.2) , but NNs can't determine the ambiguous state of Viral, Bacterial precisely in quantities ,

so in this study the fuzzy logic system as addition step provides us with the ability to verify precisely the degree of inflammation see (tab.3). All of this can help competent physician to take the appropriate decision.

CONCLUSION:

This paper represents very important achievement of selecting and using several methods of AI fields, like Fuzzy Logic , and Neural network to diagnose the blood inflammation state. In similar applications to our research using Fuzzy Logic is very important , because of it's capability not only in classification but it's powerful to make ambiguous things realized precisely. Some times require to use several methods to get the clear and the best sure result.

Neural networks have been applied on the task of classifying blood inflammation whereas fuzzy logic based system in this study offers powerful tool for precisely diagnosis .

FUTURE WORK

we try to use Hybrid Neuro-Fuzzy system to diagnose the same above for blood inflammation .

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