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Implementation of Exotic Bird Expert Advisory System using Back Propagation Algorithm with Calming Rate

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Abstract: This paper deals with the design and implementation of an online 'Web Based Exotic Birds Expert Advisory Systems Using Back Propagation Algorithm with Calming Rate'. This exotic bird expert advisory system is aimed at identifying the diseases in exotic birds and advises the pet lovers about the proper curing mechanism through online. By using the back propagation algorithm without calming rate about 3000 to 4000 iterations may be required for finding a disease in an expert system at each time. To overcome this large number of iteration problems, a concept of a calming rate is introduced into the algorithm. With this the numbers of iterations were reduced to nearly 100 to 500 iterations for each time to find the proper matching in the database. This advisory system is designed by using JSP as front end and MYSQL as backend.

Key words: Expert Systems, Neural Networks, Back Propagation Algorithm, Calming Rate, Exotic Birds, JSP & MYSQL.

I. INTRODUCTION

A. Exotic Birds

Exotic birds are popular as pets, but many of them are today endangered in the wild and purchasing an exotic bird may be illegal, especially if the specimen is wild-caught. Some of the famous exotic birds are parrots, cocktails and love birds.

Parrots: Parrots are found in most warm and tropical regions around the world. A vast majority of the species lives in tropical and subtropical regions but a few parrots live in temperate parts of the Southern Hemisphere. The greatest diversity of parrots is found in South America and Australasia.

Cockatiels: The Cockatiel is a small cockatoo endemic to Australia. In addition to cockatiel the bird is also known as Quarrion bird or Weiro bird, and its scientific name is *Nymphicus hollandicus*. The name cockatiel is derived from the Dutch word *kakatielje* which means "little cockatoo". The species name *Nymphicus hollandicus* might seem confusing since this bird is native to Australia, but Australia was once known as New Holland. The cockatiel is today one of the most commonly kept birds in the world. Cockatiels are most commonly found in outback regions of inland Australia and can cause problems for farmers by eating their crops. **Lovebirds:** Lovebird is the common name for nine species of parrot, all belonging to the genus Agapornis. The genus name also means lovebird; it is derived from the Greek words *agape* (love) and *ornis* (bird). The name lovebird probably stems from their strong, monogamous pair bonding. A pair will spend extended periods of time sitting close to each other each day. The German name for these birds is *die Unzertrennlichen* and the French *les inseparables*, both meaning "the inseparables".

B. Expert Systems

Expert systems are computer programs that capture some knowledge and allow its dissemination to others. Neural Networks is the branch of Artificial Intelligence which gives a wide variety of solutions in realistic problems through its algorithms. A neural net is an artificial representation of the human brain that tries to simulate its learning process. An Expert (Knowledge Based) System is a problem solving and decision making system based on knowledge of its task and logical rules or procedures for using knowledge. Both the knowledge and the logic are obtained from the experience of a specialist in the area (Business Expert).

C. Back Propagation Algorithm

A neural net is an artificial representation of the human brain that tries to simulate its learning process. The term "artificial" means that neural nets [3, 4] are implemented in computer programs that are able to handle the large number of necessary calculations during the learning. The Back Propagation Algorithm [1, 3, and 4] is a learning rule for multi-layered neural networks, credited to Rumelhart [ ] and McClelland [ ]. The algorithm gives a prescription for adjusting the initially randomized set of synaptic weights (existing between all pairs of neurons in each successive layer of the network) so as to maximize the difference between the network's output of each input fact and the output with which the given input is known (or desired) to be associated. Back propagation is a supervised learning algorithm and is mainly used by Multi-Layer-Perceptrons to change the weights connected to the net's hidden neuron layer(s).

III. PROPOSED EXOTIC BIRD EXPERT SYSTEM

An exotic bird expert advisory system had been developed by using the back propagation Algorithm with calming rate. The system consists of a user interface for submitting the observed symptoms by the user to the system. The user selects the symptoms which were observed by him in the exotic birds. The system processes the information submitted by the user to the system and gives the appropriate disease and cure details to that particular disease to the user. The system is as follows,

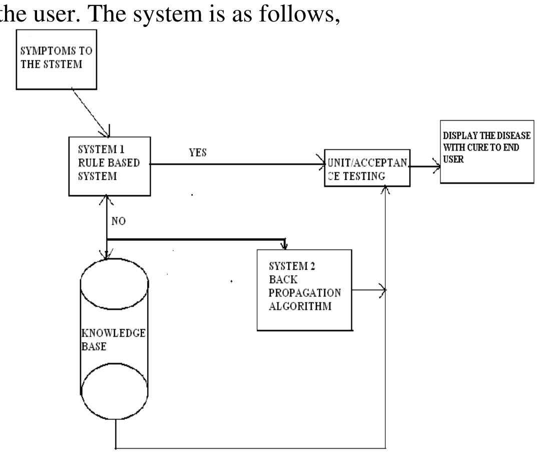

Figure.1The Architecture model of EBAS

IV. PROPOSED ALGORITHM

A.Back Propagation Algorithm

The Back Propagation Algorithm [3, 4] is a learning rule for multi-layered neural networks, credited to Rumelhart [] and McClelland []. The algorithm gives a prescription for adjusting the initially randomized set of synaptic weights (existing between all pairs of neurons in each successive layer of the network) so as to maximize the difference between the network's output of each input fact and the output with which the given input is known (or desired) to be associated. Back propagation is a supervised learning algorithm and is mainly used by Multi-Layer-Perceptrons to change the weights connected to the net's hidden neuron layer(s). The back propagation algorithm uses a computed output error to change the weight values in backward direction. To get this net error, a forward propagation phase must have been done before. While propagating in forward direction, the neurons are being activated using the sigmoid activation function.

The formula of **sigmoid activation** [3] is:

$$f(x) = 1 + e^{-input}$$

The algorithm is described in the following steps. It is divided into two parts.

Step 1. Perform the forward propagation phase for an input pattern and calculate the output error

Step 2. Change all weight values of each weight matrix using the formula weight (new) = weight (old) + learning rate * output error * output (neurons i) * output (neurons i+1) * (1 - output (neurons i+1)) ---- (2)

Step 3. Go to step 1 until all output patterns match their target patterns

The first input pattern had been propagated through the net. The same procedure is used for the next input pattern, but then with the changed weight values. After the forward and backward propagation of the second pattern, one learning step is complete and the net error can be calculated by adding up the squared output errors of each pattern. By performing this procedure repeatedly, this error value gets smaller and smaller. The algorithm is successfully finished, if the net error is zero (perfect) or approximately zero. Note that this algorithm is also applicable for Multi-Layer-Perceptrons with more than one hidden layer.

B. Drawbacks

One of the major drawbacks of the back propagation algorithm is its slow rate of convergence. Researchers have tried several different approaches to speed up the convergence of back propagation learning. One such technique is introduction of a parameter known as calming rate [6]. Calming rate is usually initialized to a value between 0.0 and 1.0.In general the learning rate which is used in updating phase of the back propagation algorithm is constant through out the algorithm but with the introduction of the calming rate, learning rate becomes dynamic in nature which contributes in reducing the number of iterations required thus saving the execution time of the algorithm

Formula to calculate learning rate based on calming rate

Learning rate (i+1) =

*learning (i)*calming rate if i >=1*

Constant value if i=0

---- (3)

Where i is the number of iterations

C. Back Propagation Algorithm with Calming Rate

1) Initialize weights, calming rate
2) Perform forward phase for an input pattern and calculate absolute error
3) Change all weight values of each weight matrix using the formula
weight (new) = weight (old) + learning rate * output error * output (neurons i) * output (neurons i+1) * (1 - output (neurons i+1))
4) Change learning rate using the formula learning rate (new) =
learning rate(old)* calming rate --- (4)
Where calming rate is between 0.0 and 1.0 and if calming rate is 1.0 then learning rate is constant
5) The algorithm ends, if all output patterns match their target patterns.
6) ---- (1)

D. Database Generation

In this section, the setup for production rules in the knowledge base is presented. Generally the rules are of the form,

Rule 1: S1=1,S2= 0,S3= 0,S4= 0, S5=0,S6= 1,S7= 0,S8=1, S9= 0,S10= 0,S11= 0,S12= 0
Resultant disease may be D1

Rule 2: S1= 1,S2=1 ,S3= 0 ,S4= 0, S5= 0,S6= 0 ,S7=1,S8= 0 ,S9= 0 ,S10= 0 ,S11=0,S12= 1Resultant disease may be D2

Rule 3: S1= 0,S2= 1 ,S3= 0 ,S4= 0 , S5= 1,S6= 1 ,S7= 0,S8= 0 ,S9= 0 ,S10=1 ,S11=0 ,S12= 0 Resultant disease may be D3.

Rule 4: S1= 0,S2=1 ,S3= 1 ,S4= 0, S5= 1,S6= 0 ,S7=1,S8= 1 ,S9= 0 ,S10= 1 ,S11=0,S12= 1Resultant disease may be D4

Rule 5: S1= 0,S2=0 ,S3= 1 ,S4= 1, S5= 1,S6= 1 ,S7=0,S8= 1 ,S9= 1 ,S10= 0 ,S11=0,S12= 1Resultant disease may be D2

Rule 6: S1= 0,S2=1 ,S3= 1 ,S4= 1, S5= 1,S6= 1 ,S7=0,S8= 0 ,S9= 1 ,S10= 1 ,S11=1,S12= 1Resultant disease may be D4

Disease	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	Cure
D1	1	1	0	0	0	0	0	0	0	0	0	0	0	C1
D2	0	0	1	0	1	1	0	0	0	0	0	0	0	C2
D3	0	0	0	1	0	0	1	1	0	0	0	0	0	C3
D4	0	0	1	0	0	0	1	1	0	0	1	0	0	C4
D5	0	0	0	0	0	0	0	0	1	1	0	1	0	C5
D6	0	0	0	0	0	0	0	0	0	0	1	1	1	C6

V. TEST RESULTS

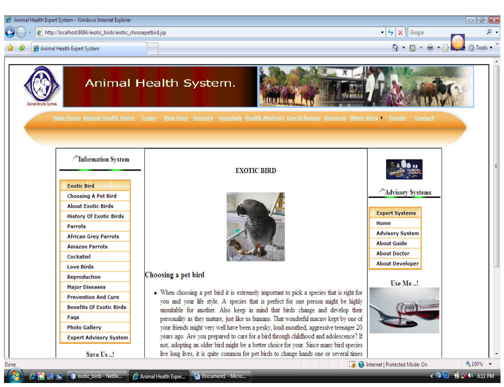

Figure.2 About Exotic birds

This Screen shot describes about the information about exotic birds

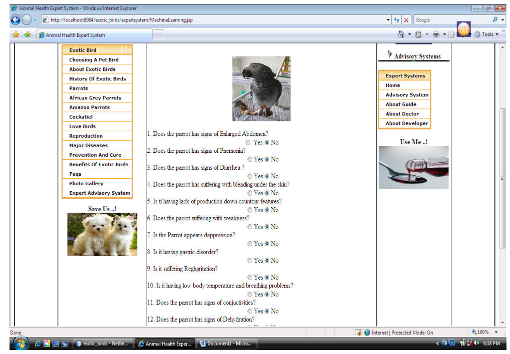

Figure.3 Symptom selection

This Screen shot gives the user an interface to connect to the system. By this screen, the user can submit the symptoms to the system.

Figure.4 Displaying disease with cure

In this screen shot the user can see the final disease "Aspergillosis" with cure to that particular disease.

VI. CONCLUSIONS

In the present investigation it was found that, the Back Propagation Algorithm with calming rate gives a better decision, though we have robust production rules. During preprocessing the common symptoms were efficiently recognized that converge to best solution. Thus, the implementation of the proposed system gradually reduces the processing time of rules in comparison with the general back propagation algorithm. The algorithm used in the system can be treated as quite effective, in most cases it finds a solution which represents a good approximation to the optimal one and fast enough for the number of iterations. By the thorough interaction with the users and beneficiaries the functionality of the system can be extended further to many more areas for exotic birds in and around the world. The Back propagation algorithm can be further improved for more complex test problems and applications that subject to extended work.

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