



International Journal of Control Theory and Applications

ISSN : 0974-5572

© International Science Press

Volume 9 • Number 45 • 2016

Clustering of Neurons Using Membership Function of Fuzzy

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Abstract: Researcher dealing with big data but having very poor knowledge about it. In Real World data is complex and it is very difficult to extract valid information from the same. In this research paper mining of neural network is discussed. Many of the Researcher and organization have been collected the data from past many years and still they are doing the same task. Most of the company focuses on data mining. They discover information within data that queries and reports can't effectively. This research paper includes methods of data mining like classification, clustering, association rule and data mining based on neural network. It contains Back propagation algorithm, Genetic algorithm & some techniques to improve the artificial neural network. This research paper focused on dealing with membership functions of fuzzy logic, Zone wise clustering, Fuzzy Rules. To achieve the accuracy rate, sample data of neural network trained.

Keywords: Membership functions, Zoning, α -cut.

1. INTRODUCTION

This section focus on data mining, Process of data mining, Neural Network and Fuzzy Logic. In Neural Network there are many nodes. Each node is connected with every node. Neural Network works on Feed Forward pattern. There are mainly three types of Layers:

1. **Input Layer :** It is source node and it can be number of source nodes. It is similar with dendrites in biological neural network.
2. **Hidden Layer :** It is similar like axon in biological neural network which is used to transfer the information from one node to another node and provides connection between two nodes.
3. **Output Layer :** It is similar like synapses which provide output.

This research work focused on collection of samples from the neural network to find the efficiency and robustness of neural network. And fuzzy logic is used for the same to extract the samples. The sample mining is done with neural network. The selected network zone is divided into zones on the basis of alpha cut. After that we have to find the similarity between adjacent nodes. Keep all the similar elements in one group. It is the concept of data mining known as clustering. But we can extract the sample by using fuzzy logic and its member function. Mainly we should have pattern shape triangle and square. If we don't have these shapes, we will consider the network as a graph. Then we will find the MAX-MIN composition and then make clusters.

1.1. Advantages of Neural Network

1. **High accuracy:** It gives optimal solution for feature selection. This will give exact output of any problem.
2. **Noise tolerance**
3. **Speed:** Neural network basically works on parallel mechanism. That's why it's too fast.
4. **Finding irregularities:** Basically it deals to find problems in running system via parallel mechanism.
5. **Finance:** It deals with:
 - a) Risk management.
 - b) Bankruptcy Prediction
 - c) Loan Approval
 - d) In Marketing it is used to analysis of new product

Artificial Neural Network:

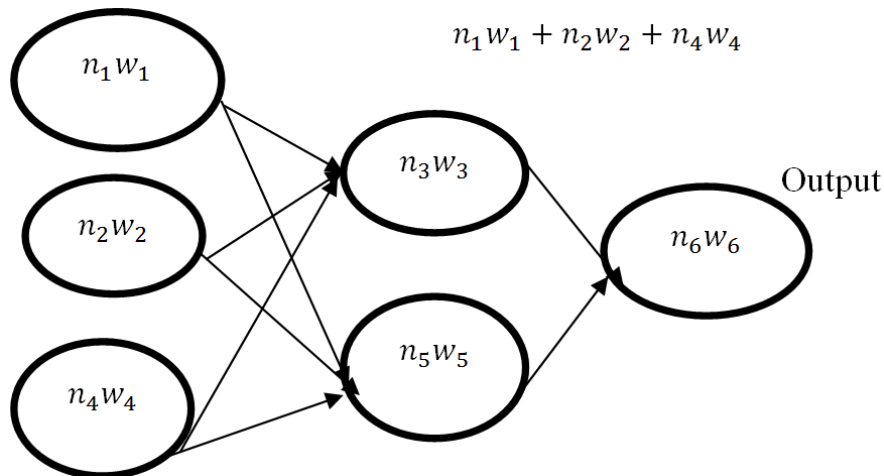


Figure 1: Artificial Neural Network

2. LITERATURE REVIEW

This research work focused on the working of complex data by using some mathematical models and equations¹. In this paper they are developing an expert system by using Fuzzy logic. They are discussing about fuzzy set theory, Membership functions and similarity function etc. Some functions are used in this paper like, to find out the similarity between adjacent nodes.

Formula: Similarity:

$$s_i = 1 - \text{difference} / c * \sigma \quad (1)$$

Control value(c): 4

Standard deviation (σ): 145.69

This research paper focused on Fuzzy Model that contains from neural network². To build a new fuzzy model, clustering techniques are used. This method is purposed for good computing efficiency. Genetic algorithm is used here. To purpose this method hierarchy neural network is used. This is implemented on the basis of sub-clustering. In this first input is to be selected by applying some fuzzy rules. Self-organizing neural network is used there.

This research paper gives an overview is given about feature space³. The purposed system is assuming basically fuzzy clusters are present in the feature space. This system provides the information about the value of membership function of fuzzy. In this paper MF-ARTMAP approach is used because readability of neural network is easy by using this approach. Basically work has to be done on real world data. Fuzzy classes are also used with fuzzy clusters.

In this research paper author discussed about RBF neural network has been discussed⁴. A new clustering algorithm is designed for creation of Multiple Shape Basis Function (MSBF) automatically. For Clustering Fuzzy rules has been used. It shows the RBF network which has different shapes and sizes of clusters. Mainly neurons which represent fuzzy rules are from hidden layer. This neuro-fuzzy system can adjust hidden neuron also with technique of clustering.

This research paper gives us about an Overview about Face Recognition⁵. This is implemented by neuron fuzzy system. The technique is used for Face Recognition is clustering. Neural Network method is appropriate for this. Extract the number of Facial regions then normalized into the form of 32 pixels. Now the face region is divided into sub regions and uses Fuzzy c-mean algorithm. 98% this method gives exact output.

This research paper discussed about Artificial Neural Network (ANN) and Membership Function of Fuzzy Logic is used to solve real world Problems⁶. This paper deals with the cosmetic inspection. A new system is purposed which determines the non-uniform region based on images. Fuzzy Clustering technique is used for segmentation. All these cosmetic detection is done by clustering of neurons.

In this research paper author discussed about clustering and pruning techniques⁷. They discussed about Divisive Artificial Neural Network Algorithm. They discussed about classification and learning. Data set was taken from E. coli bacteria. They showed the results before pruning and after pruning and tells us the formula to find out the number of hidden neurons.

This research paper discussed about cluster analysis and Kohonen neural network and used Fuzzy Logics to find out the results⁸. They found the distance between adjacent nodes by using Euclidean distance.

$$D_j(w_j, x_p) = w_j - x_p \quad (2)$$

Or Spherical distance:
$$D_j(w_j, x_p) = 1 - w_j * x_p \quad (3)$$

For adjustment of weight:
$$w_j^{new} = w_j^{old} (1 - \alpha) + \alpha x_p \quad (4)$$

Clustering Algorithm is used here. In this a node which is known to all the nodes consider as a cluster head. Budget based algorithm is used to send information to all the nodes. This system uses limited number of resources and it save energy. It reduces bandwidth, provides robustness and scalability to network. A new Algorithm is purposed for clustering by using Fuzzy Rules (IF-THEN). This System does not work on location based clustering, this is just enhancing the operational efficiency. By using this technique communication will be easy. transfer the information to neighbor node will be easy like cluster heads will communicate and rest nodes will get information from cluster head. It reduces time and system complexity.

In this research paper author discussed about self-generating neural network which is another best solution for solving the real world problems⁹. A new method is designed named as Growing Self Organizing Map(GSOM). For cluster detection unsupervised learning has been used. In traditional neural network has been used where we can adjust the weight by interconnection between neurons. If once the has been fixed, we cannot change the architecture of network. Self-Nearest Clustering prototype technique is used.

On the basis of literature review, this research work concludes that there is a problem to mine the large pattern. There are so many algorithms where clustering technique is used. They tried to extract optimal sample or we can say cluster from large pattern but it's very difficult for any system. It will take very large time and slow speed. In SOM technology if error is there, they adjust the weights. To solve this problem, this research paper is dealing with zone wise clustering. Clustering is performed on Neural network via membership functions of fuzzy logics because Neural network works on parallel mechanism and its speed is too fast.

3. PROPOSED SYSTEM

This research work deals with database which is very complex. So extract the meaningful information there are extracting a cluster from neural network by using fuzzy logic. First We have to train the machine.

Figure 1.2 shows the purpose methodology. Its various steps for the same are:

1. Training sample Let us assume Sample A.
2. Sample A has mainly two values first value is input and second value is weight of neuron.
3. After that sort our training sample on the basis of membership function.
4. On this sample, apply alpha-cut function for making zone of patterns.
5. To find out the similarity formula is used:

$$s_i = 1 - \frac{\text{difference}}{c * \sigma}$$

6. Calculate the difference between two adjacent nodes. Control value and standard deviation constraints are there.
7. If the value of all nodes lies in same manner, then keeps all these nodes into same group otherwise keep in different group.
8. Now we have clusters but we have to select optimal sample.
9. Now select zone and then use equation:

$$\sum_i^n w_i * n_i \tag{5}$$

10. Maximum Value of the Zone will be selected.

Note: We will make maximum zones by Using α -cut. If here is minimum value of α -cut will make zones and extract cluster.

3.1. Algorithm

Cluster (n, w, f, α)

Step 1: give input to pattern with weights.

Step 2: α -cut = $\{n, u(w) | \alpha \geq \alpha\}$

Step 3: for $(i = 0 \text{ to } w)$

Extract max (α -cut)

Step 4: Apply: $s_i = 1 - \frac{\text{difference}}{c * \sigma}$

Step 5: Apply: $f = \text{Max} (\sum_i^d n_i * w_i)$

Step 6: Extract Max (f)

End

We have Input, Weight and their membership functions:

Input (Training set) A = $\{(2000,0.2), (2200,0.4), (2100,0.6), (2300,0.8)$
 $(2800,0.9), (2500,1.0)\}$

$\alpha^{0.2} = (6, 0.2),$

$\alpha^{0.8} = (3, 0.8)$

$\alpha^{0.4} = (5, 0.4)$

$$\alpha^{0.9} = (2, 0.9)$$

$$\alpha^{0.6} = (4, 0.6)$$

$$\alpha^{1.0} = (1, 1.0)$$

α -cut: {(6,0.2), (5,0.4), (4,0.3), (3,0.8), (2,0.9) (1,1.0)}

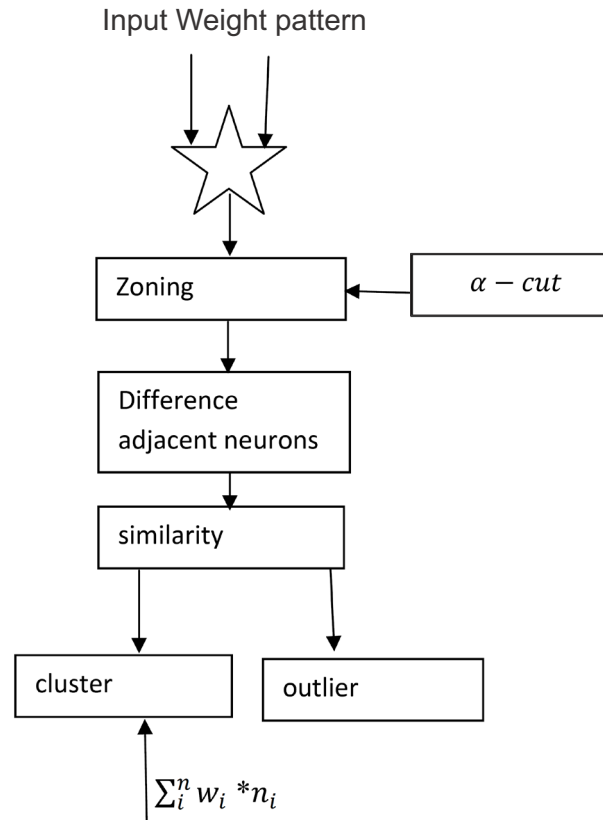


Figure 1: Methodology

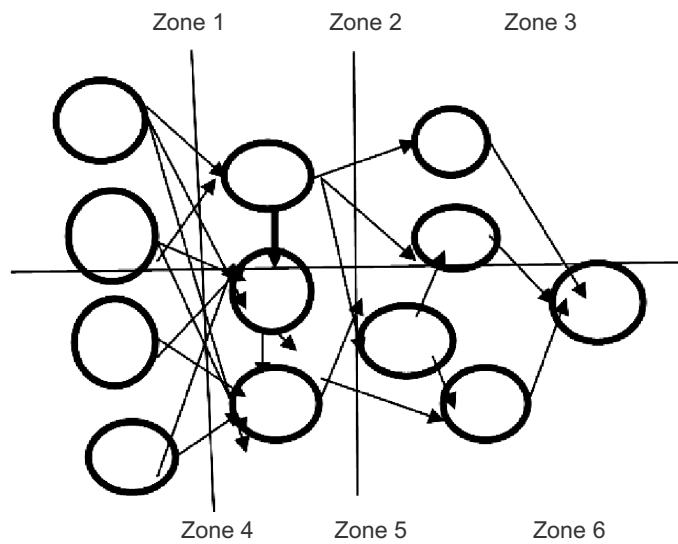


Figure 2: Zoning

To find out the cluster find out the similarity between the adjacent nodes.

From Equation (1):

$$f(x) = \begin{cases} 1 - \text{diff}, & \text{\& for difference} \leq c * \sigma \\ 0, & \text{\& otherwise} \end{cases}$$

Similarity:

$$s_i = 1 - \text{difference} / c * \sigma$$

Control value(c): 4

Standard deviation (σ): 145.69

$$\begin{aligned} s_1 : 1 - (2000-2200)/4*145.69 &= 1-200/582.76 \\ &= \text{mod} (0.657) \\ &= 0.657 \end{aligned}$$

$$\begin{aligned} s_2 : 1-(2000-2100)/4*145.69 &= \text{mod} (0.829) \\ &= 0.829 \end{aligned}$$

$$s_3 : 1-(2200-2100)/4*145.69 = 0.829$$

$$s_4 : 1-(2300-2500)/4*145.69 = 0.657$$

$$s_5 : 1-(2300-2800)/4*145.69 = 0.15$$

$$s_6 : 1-(2800-2500)/4*145.69 = 0.49$$

Now this similarity becomes input and use equation to find out final cluster

Equation: $\text{Max} (\sum_i^d n_i * w_i + b)$

Equation:

$$\text{value} = \text{Max} (\sum_i^d n_i * w_i)$$

$$v_1 : 0.657*0.2 = 0.13$$

$$v_2 : 0.89*0.4 = 0.356$$

$$v_3 : 0.89*0.6 = 0.534$$

$$\text{Value is: } 0.13 + 0.356 + 0.534 = 1.02$$

From equation (5):

$$v_4 : 0.657*0.8 = 0.525$$

$$v_5 : 0.15*0.9 = 0.135$$

$$v_6 : 0.49*1.0 = 0.49$$

From equation (5):

$$\text{Value is: } 0.525 + 0.135 + 0.49 = 1.15$$

Maximum:1.15

Maximum will be selected.

4. CONCLUSION

This research work discussed about mining of complex data. This research work we used finding the cluster by using membership functions of Fuzzy Logic. We are using alpha-cut to find out the Zones in neural network. This system helps to extract the cluster of any expert System like Robot.Zoning helps our system to extract cluster easily and will make easy to Understand the pattern.

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