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Neural Network Approaches for Iris Plant Classification

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***Abstract*--Iris dataset is a classification based problem where iris plant species are classified on the basis of some attributes. And for the classification purpose neural network [2] is being used over here. Neural network is a computational model based on neural structure of human brain .The functionality of nurodes in ANN is based upon the neurons in biological neural network. These are parallel distributed processing system made up of highly interconnected neural computing elements that have the ability to learn and thereby acquire knowledge and make it available for use. Various learning mechanisms exist to enable the NN acquire knowledge. NN architectures have been classified into various types based on their learning mechanisms and other features. This learning process is referred to as training and the ability to solve a problem using the knowledge acquired as inference. Different methodologies are used here for classification**

- **Back-propagation[1]**
- **Multilayer feed forward neural network[5]**
- **Radial basis function**
- **Probabilistic neural network**
- **Quantum neural network[3]**
- **Support vector machine**

By observation we analyzed that radial basis function is the most dominating technique among the existing one, discussed here.

Keywords- Iris dataset, back propagation neural network (BPNN), multi layer perceptron, radial basis function, probabilistic neural network, quantum neural network

I. INTRODUCTION

Classification comes under supervised learning method as the classes are determined before examining the data. All Approaches to performing classification assume some knowledge of the data. Usually, a training set is used to. Then testing is performed to determine the class of input datasets. Iris data problem is also concerned to the classification problem and it is the best known databases of the neural network application. The data set contains 3 classes of 50 instances each, where each class refers to a type of iris plant. One class is linearly separable from the other two; the latter are not linearly separable from each other. To solve the classification problem different techniques are used.

A. Back-propagation Neural Network (BPNN):

Back-propagation is a method of training multilayer artificial neural networks which Uses the procedure of supervised learning. Supervised algorithms are error-based learning algorithms which utilize an external reference signal (target) and generate an error signal by comparing the target with the obtained output. Based on error signal, in fig 1, neural network modifies its weights to improve the system performance. In this scheme, it is always assumed that the desired answer is known "a priori"

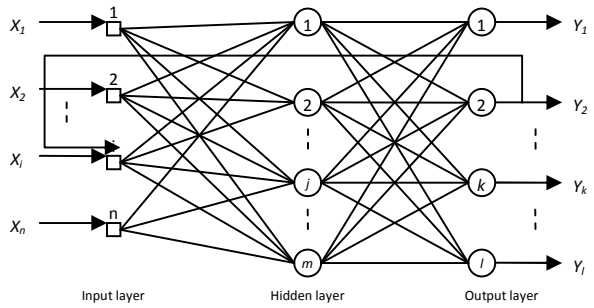

Fig 1. Back propagation learning

B. Feed-forward Neural Network:

Multilayer feed forward neural network is also called as multilayer perceptron. Feed forward networks often have one or more hidden layers of sigmoid neurons followed by an output layer of linear neurons as shown in fig2[9]. Multiple layers of neurons have nonlinear transfer functions that allow the network to learn nonlinear and linear relationships between input and output vectors.

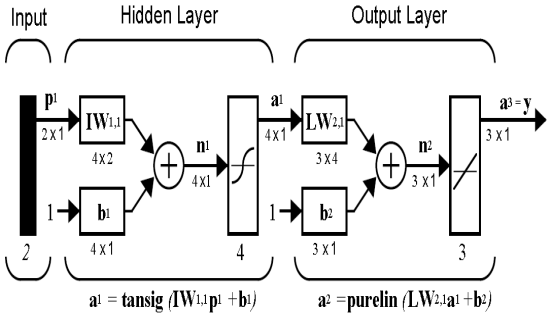

Fig. 2 feed forward neural network

C. Radial Basis Function:

Radial basis function network is a feed forward network. It consists of two layers as shown in fig 3[9]: a hidden radial basis layer and an output linear layer. Each radial basis layer neuron's weighted input is the distance between the input vector and its weight vector. Each radial basis layer neuron's net input is the element-by-element product of its weighted input with its bias. Each neuron's output is its net input passed through radial basis transfer function.

Radial basis function network is created iteratively one neuron at a time. Neurons are added to the network until the sum-squared error falls beneath an error goal or a maximum number of neurons have been reached.

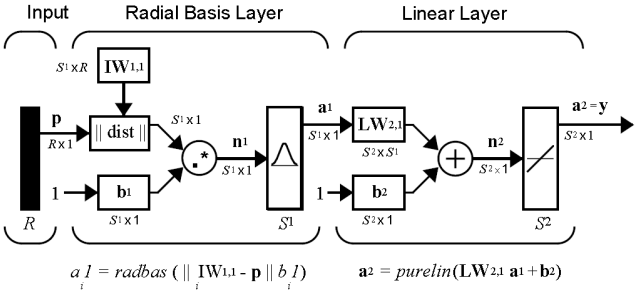

Fig 3 radial basis function

D. Probabilistic Neural Network:

A Probabilistic Neural Network (PNN)[4] is defined as an implementation of statistical algorithm called Kernel discriminate analysis in which the operations are organized into multilayered feed forward network as shown in fig 4[9]. It has four layers: input layer, pattern layer, summation layer and output layer Probabilistic neural network is a feed forward network. It is specialized to classification. When an input is presented, the first layer computes distances from the input vector to the training input vectors and produces a vector whose elements indicate how much training input is close to the input. The second layer sums these values for each class of inputs to produce as its net output a vector of probabilities. Finally, a competitive output layer selects the maximum of these probabilities, and produces a 1 for that class and a 0 for the other classes.

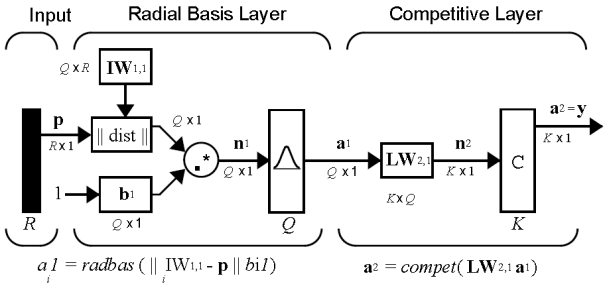

Fig.4 probabilistic neural network

E. Quantum Neural Network:

Quantum neural networks (QNNs) are neural network models which are based on the principles of quantum mechanics. There are two different approaches to QNN research, one exploiting quantum information processing to improve existing neural network models and the other one searching for potential quantum effects in brain.

It belongs to the class of feed forward neural network. In fig5 [8], we have observed that

QNN consists of input units, one hidden layer nodes; each one represents a multi level units and output units. Output units can be linear or sigmoid. Steps

- Update the synaptic weights
- Update the quantum intervals

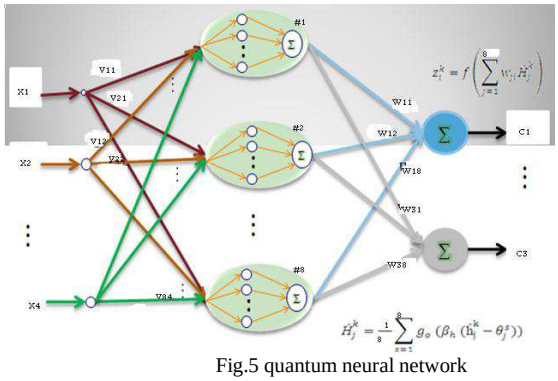

Fig.5 quantum neural network

F. Support Vector Machine

Support Vector Machine (SVM) [6] is a supervised learning model with associated learning algorithms that analyses data and

recognize patterns, used for classification and regression analysis [7]

Procedure
1. Transform data to the format of SVM software
2. Consider simple scaling on the data
3. Choose a suitable kernel function (Gaussian/RBF in our case)
4. Use cross-validation to find the close to optimal parameters
5. Use the parameters to train the model
6. Classify observations from the test data

II. BACKGROUND

Neural networks are those information processing systems, which are constructed and implemented to model human brain the main objective of neural network is to develop a computational device for modeling the brain to perform various computational tasks such as pattern matching, classification, optimization function. Ann's posses large no highly inter connected processing elements called nodes or units or neurons, which usually operate in parallel. Each connection link is associated with weights which contained information about input signal. This information is used by the neuron net to solve a particular problem.

ANNs collective behavior is make it able to learn, recall, and generate training patterns.Each neuron has an internal state of its own. This internal state is called the activation state of neuron, which is the function of the input the neuron receives the activation signal of a neuron is transmitted to other neurons but a neuron can send only one signal at a time, which can be transmitted to several other neurons. For the simple neuron net input can be calculated as

Yin= x1w1+x2w2

x1,x2 are the activations of the input neurons *X1,X2* and output= function (net input, Yin).

This paper makes use of the well known Iris dataset, which refers to 3 classes of 50 instances each, where each class refers to a type of Iris plant. The first of the classes is linearly distinguishable from the remaining two, with the second two not being linearly separable from each other. The 150 instances, which are equally separated between the 3 classes, contain the following four numeric attributes: sepal length and width, petal length and width. A sepal is a protective layer of the flower in bud, and a petal is the divisions of the flower in bloom. In addition to these numeric attributes, each instance also includes an identifying class name, each of which is one of the following: Iris Setosa, Iris Versicolour, or Iris Virginica.

III. ANALYSIS AND DISCUSSION

In neural network 50% data is used for training and 50% is used for testing purpose. By observing table 1 given below, we can say that radial basis function provides best results with 99.225% training accuracy and 100% testing accuracy and after that quantum neural network provides enough good result. The mapminmax processing function is used for normalization so that all the inputs fall in the range [-1, 1]. Neural network architecture for FNN, Radial, probabilistic is 4-16-3 i.e. Input layer have 4 neurons, 1hidden layer with 16 no of neurons and output layer has 3 neurons. Learning rate is chosen by trial and error for weigh adjusting is set to (0.01) MATLAB programming test, the number of iteration (epochs) is set to 1500.For support vector machine RBF kernel function was as high as 99.5% when rbf_sigma and box-constraint

Table1 comparison of neural network methods

Set of inputs	***Neural network***					
	Multilayer perception	Radial-Basis Function	Probabilistic NN	Quantum NN	SVM	BPNN
Training%	99.483	99.225	98.45	97.15	100	98.3
Testing%	96.82	100	96.238	97.5	97.14	95.8

were .0373 and .0099 that give the classification accuracy=97.14%.The structure is 4-8-3 for the quantum neural network that is no of input neurons is 4, no of neurons for the hidden layer is 8 and no of output neurons is 3. The learning rate (learning ratio) for weight adjusting is set to (0.07) training by MATLAB test, and the learning rate for quantum interval adjusting is set to (0.001), and slop factor for unit at hidden layer is 2 , but for output layer slop factor is 1.5 , the number of iteration (epochs) is set to (300). If we talk about back-propagation this technique includes 4 network architecture i.e. row-normalization, column- normalization, sigmoid normalization, Column constrained sigmoid normalization and after comparing we observe that column normalization provides the best result and as the no of epoch increases the result also improved for some limit. The architecture uses 1 hidden layer with 9 hidden layer neurons, a step width of 0.15, a maximum non-propagated error of 0.1, and a value of 1 for the number of update steps.

IV. CONCLUSION

Iris plant classification problem is solved by multiple neural network based techniques. We observe that radial basis function is the most dominating technique among the existing ones. It provides best results with 99.225% training accuracy and 100% testing accuracy having 4 neurons in input layer, 16 neurons in hidden layer and 3 neurons in output Layer. Learning rate applied in that process is .01 and input fall in the range [-1, 1] after normalization process. Second best technique is quantum neural Network after that support vector machine for the classification of iris dataset.

REFERENCES

[1] Pai, G. V and Rajasekaran, S, 'Neural Networks, Fuzzy Logic and Genetic Algorithms Synthesis and Applications', 2006, 6th Ed, Prentice Hall of India Pvt. Ltd.

[2] Aqel, M.M., Jena, R.K., Mahanti, P.K. and Srivastava 'Soft Computing Methodologies in Bioinformatics', European Journal of Scientific Research, vol.26, no 2, pp.189-203, 2009.

[3] Gopathy Purushothaman and Nicolas .B.Karayiannis,QuantumNeural *Networks (QNNs): Inherently Fuzzy Feed forward Neural Networks*, IEEE Transactions On Neural Networks, Vol.2, pp. 1085-1090, 1996.

[4] Ibrahiem M.M.EI Emary and S. Ramakrishnan, \On the application of various probabilistic neural networks in solving different pattern classification problems", World Applied Sciences Journal, Vol.4, 6th Ed, pp.772- 780, 2008.

[5] Dr. Hapudeniya, Muditha M.MBBS, Artificial Neural Networks in Bioinformatics Medical officer and postgraduate trainee in Biomedical Informatics, Postgraduate Institute of Medicine, University of Colombo,Sri Lanka, vol.1, no 2,pp.104-111, 2010.

[6] C. J. Burges , U. Fayyad,Ed. Kluwer "A tutorial on support vector machines for pattern recognition," in Data mining and knowledge discovery, Academic pp. 1–43, 1998,

[7] S.V.S Prasad, Dr. T. Satya Savitri, Dr. I.V. Murali Krishna, "Classification of Multispectral Satellite Images using Clustering with SVM Classifier", International Journal of Computer Applications Vol.35, No.5,pp.0975 – 8887, 2011.

[8] Research Article- "Data Classification using Quantum Neural Network" Dr. Ghassan H. Abd Al- Majeed Professor, Dr. Zainab T. Alisa, and Assistant Professor. Baghdad University Baghdad, Iraq No 4 - April Volume 20 - 2014 Journal of Engineering.

[9] Research Article- "Classification of Iris data set" Mentor: Assist. prof. Primož Potočnik Student: Vitaly Borovinskiy Ljubljana, 2009