Volume 5, Issue 3, March 2015 ISSN: 2277 128X
International Journal of Advanced Research in Computer Science and Software Engineering
Research Paper
Available online at: www.ijarcsse.com

Survey on Training Neural Networks

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Abstract- An Artificial Neural Network (ANN) is an information processing paradigm that is inspired by biological nervous systems. It is composed of a large number of highly interconnected processing elements called neurons. An ANN is configured for a specific application, such as pattern recognition or data classification Infertility is recognized as a major problem of modern society and it is applied in many situations. Artificial neural networks system can be used as a decision-making support system in ram hospitals as well as other industries. This paper explores about the different techniques for application of Neural networks and discussed their present limitations and scope for future research in neural networks

Keywords: In-Vitro Fertilization, Artificial neural networks, crop yield production, rough set theory and hidden layer

I. INTRODUCTION

Nowadays, by developing technology and information in medical sciences, the computer science professionals are capable of providing expert systems to diagnose different kinds of diseases with high accuracy. The medical professionals are made to use these systems due to the some possible occurred errors during diagnosis process [1, 2].These systems are based on artificial intelligence which helps the physician to minimize the costs and time and expert in effective diagnoses [4]. Among these, ANN is a family of artificial intelligence, the researchers could reach to the big success using them in diagnosing diseases such as Diabetes, Heart disease, Thyroid and so on [5,6,7]. ANNs due to advantages such as self-learning, associative memory, high parallelism strength and high speed and error tolerance against noises which might be in parameters and also their cheapness in reuse of available solutions is the best option to do this [8]. The ANN called connection-oriented networks which include a set of processors act as parallel, take the sets of input in a time and produce output based on processing algorithm [9].

The basic building block of all biological brains is a nerve cell, or a neuron as shown in the Fig. 1. Each neuron acts as a simplified numerical processing unit. In essence, the brain is a bundle of many billions of these biological processing units, all heavily interconnected and operating in parallel. In the brain, each neuron takes several input values from other neurons, applies a transfer function and sends its output on to the next layer of these neurons. These neurons in turn send their output to the other layers of neurons in a cascading fashion.

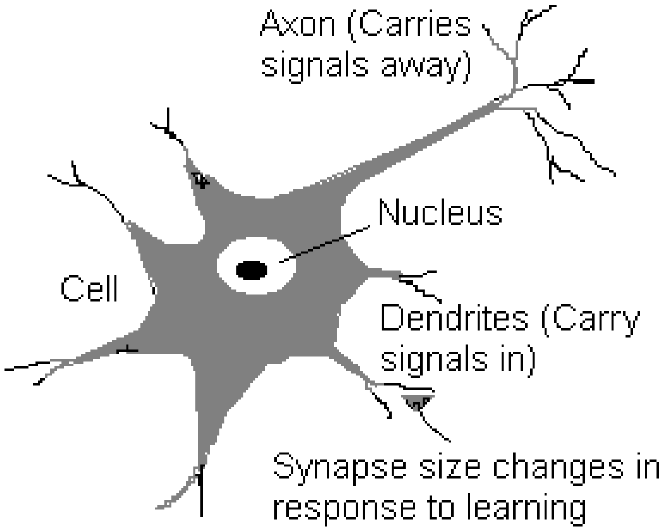

Fig 1: Basic component of a neuron

In a similar manner, ANN's are usually formed from many hundreds or thousands of simple processing units, connected in parallel and feeding forward in several layers. In a biological neural network, the memory is believed to be stored in the strength of interconnections between the layers of neurons. Using neural network terminology, the strength or influence of an interconnection is known as its weight. ANN borrows from this theory and utilizes variable inter-connections weights between layers of simulated neurons.

ANN's were proposed early in 1960's, but they received little attention until mid 80's. Prior to that time, it was not generally possible to train networks having more than two layers. These early two layers networks were usually limited to expressing linear relationships between binary input and output characters. Unfortunately, the real world is analog and doesn't lend itself to a simple binary model. The real break through in ANN research came with the discovery of the back propagation method

II. LEARNING IN ARTIFICIAL NEURAL NETWORKS

Learning is the process by which the neural network adapts itself to a stimulus, and eventually, it produces a desired response. Learning is also a continuous classification process of input stimuli when a stimulus appears at the network; the network either recognizes it or develops a new classification. In actuality, during the process of learning, the network adjusts its parameters the synaptic weights, in response to an input stimulus so that its actual output response is the same as the desired one, the network has completed the learning phase in other words, it has 'acquired knowledge'. Mathematical expressions, learning equations describe the learning process for the paradigm, which in actuality is the process for self- adjusting its synaptic weights.

A. Supervised Learning

During the training session of a neural network, an input stimulus is applied that results in an output response. The response is compared with a prior desired output signal, the target response, if the actual response differs from the target response; the neural network generates an error signal, which is then used to calculate the adjustment that should be made to the network's synaptic weights so that the actual output matches the target output. In other words, the error is minimized, possibly to zero. The error minimization process requires a special circuit known as supervisor; hence, the name, 'supervised learning'. With ANN the amount of calculation required to minimize the error depends on the algorithm used; Some parameters to watch, are the time required per iteration, the number of iterations per input pattern for the error to reach minimum during the training session, whether the neural network has reached a global minimum or a local one, and, if a local one, whether the network can escape from it or it remains trapped.

B. Unsupervised Learning

Unsupervised learning does not require a teacher, that is, there is no target output. During the training session, the neural net receives at its input many different excitations, or input patterns and it arbitrarily organizes the patterns in categories. When a stimulus is later applied, the neural net provides an output response indicating the class to which the stimulus belongs. If a class cannot be found for the input stimulus, a new class is generated. Example, show a person a set of different objects. Then ask him/her to separate object out into groups or classifications such that objects in a group have one or more common features that distinguishes them form another group.

When this is done, show the same person another object and ask him/her to place the object is one of the groups. Grouping may be based on shape, color, or material consistency or on some other property of the object. If no guidelines have been given as to what type of features should be used for grouping the objects, the grouping may or may not be successful.

C. Reinforced Learning

Here, we requires one or more neurons at the output layer and a teacher that, unlike supervised learning, does not indicate how close the actual output is to the desired output but whether the actual output is the same with the target output response is obtained. The teacher does not present the target output to the network, but presents only a pass/fail indication. Thus, the error signal generated during the training session is binary: pass or fail.If the teacher's indication is 'bad' the network readjusts its parameters and tries again and again until it get output response right. Process of correcting synaptic weight follows a different strategy than the supervised learning process [8]. Some parameters to watch are the following: the time per iteration and the number of iteration per pattern to reach the desired output during the training session, whether the neural network reaches a global minimum or a local minimum. Certain boundaries should be established so that the trainee should not keep trying to get the correct response at infinitum.

D. Competitive Learning

Competitive learning is another form of supervised learning that is distinctive because of its characteristic operation and architecture and several neurons are at the output layer. When an input stimulus is applied, each output neuron competes with the others to produce the closest output signal to the target. This output then becomes the dominant one, and the other outputs cease producing an output signal for that stimulus. For another stimulus, another output neuron becomes the dominant one, and so on. When an ANN with competitive learning is part of greater ANN system then, because of connectivity issues, these random specializations may not always be desirable. Competitive learning is frequently encountered in groups of people where each member of the group was selected and trained to perform specific tasks based on the principle of the right person at the right time at the right place.

III. TRANSFER FUNCTION IN NEURAL NETWORKS

The behaviour of an ANN (Artificial Neural Network) depends on both the weights and the input-output function (transfer function) that is specified for the units. This function typically falls into one of three categories:

linear (or ramp) threshold sigmoid For linear units, the output activity is proportional to the total weighted output. For threshold units, the output is set at one of two levels, depending on whether the total input is greater than or less than some threshold value. For sigmoid units, the output varies continuously but not linearly as the input changes. Sigmoid units bear a greater resemblance to real neurones than do linear or threshold units, but all three must be considered rough approximations.

IV. TYPES OF NEURAL NETWORK ARCHITECTURES

Neural Network Toolbox supports a variety of supervised and unsupervised network architectures. With the toolbox's modular approach to building networks, you can develop custom architectures for your specific problem. You can view the network architecture including all inputs, layers, outputs, and interconnections

A. Supervised Networks

* Supervised neural networks are trained to produce desired outputs in response to sample inputs, making them particularly well-suited to modeling and controlling dynamic systems, classifying noisy data, and predicting future events.
  Neural Network Toolbox supports four types of supervised networks:
* **Feedforward networks** have one-way connections from input to output layers. They are most commonly used for prediction, pattern recognition, and nonlinear function fitting. Supported feedforward networks include feedforward backpropagation, cascade-forward backpropagation, feedforward input-delay backpropagation, linear, and perceptron networks.
* **Radial basis networks** provide an alternative, fast method for designing nonlinear feedforward networks. Supported variations include generalized regression and probabilistic neural networks.
* **Dynamic networks** use memory and recurrent feedback connections to recognize spatial and temporal patterns in data. They are commonly used for time-series prediction, nonlinear dynamic system modeling, and control systems applications. Prebuilt dynamic networks in the toolbox include focused and distributed time-delay, nonlinear autoregressive (NARX), layer-recurrent, Elman, and Hopfield networks. The toolbox also supports dynamic training of custom networks with arbitrary connections.
* **Learning vector quantization (LVQ)** is a powerful method for classifying patterns that are not linearly separable. LVQ lets you specify class boundaries and the granularity of classification.

B. Unsupervised networks

* Unsupervised neural networks are trained by letting the network continually adjust itself to new inputs. They find relationships within data and can automatically define classification schemes.
  Neural Network Toolbox supports two types of self-organizing, unsupervised networks:
* **Competitive layers** recognize and group similar input vectors, enabling them to automatically sort inputs into categories. Competitive layers are commonly used for classification and pattern recognition.
* **Self-organizing maps** learn to classify input vectors according to similarity. Like competitive layers, they are used for classification and pattern recognition tasks; however, they differ from competitive layers because they are able to preserve the topology of the input vectors, assigning nearby inputs to nearby categories.

V. RELATED WORK

A number of researches are being carried for application of neural networks The table below shows the comparisons between various solutions to artificial neural networks.

S/N	Author Name	Techniques	Findings	Limitations
1.	Frauke Gunther and Stefan Fritsch.	neuralnet	Contains a flexible function that trains multilayer perceptrons to a given data setin Regression analysis.	The training process needed 5254 steps of iterations and takes a long time to execute.
2.	Robert Milewski, Anna J.M,Teresa Wiesak and Allen Morgan	Logistic regression	Due to in efficiency of ART to cure infertility therefore application of MLR and ANN is demonstrated which is more efficient in clinical prediction.	is more appropriate for theoretical (scientific) purposes.
3.	Farhad S.G., Maryam M., Freshte D.M.	Back propagation learning algorithm	Increase the accuracy of performance	it is very complex as is need 6 hidden layers

4.	Dr. M. Durairaj and P. Thamilselvan	Artificial Neural Networks	Aim to find the success rate of IVF treatment using Artificial Neural Network (ANN).	It take a long time to train, cross validation, testing and predict the IVF success rate.
5.	M. Durairaj, and K. Meena	Rough set theory and Artificial neural networks	It is observed from the experiments that the hybridization of RST and ANN significantly improves the overall predictive ability of ANN.	It does not involves incorporating biological information into the model.
6.	Mirza R. S., Fauzia M., and Mehwish R	Neural Network approach	To built a Neural Network model in determining the factors those are affecting fertility.	A lot of parameters region, status of education, wealth index, current age and contraception were used
7.	Ali A.A.Q., Poorya H.N. Alireza S and Shahrokh G.	Using Phenotypic trait by Artificial neural networks	it is a good support system for farmer for decision making .	The accuracy of ANN will be more improved when variables which are more relevant to the output variables are used.
8.	S.J.Kaufmann, J.L.Eastaugh, S.Snowden, S.W.Smye and V.Sharma1	The application of neural networks in predicting the outcome of in-vitro fertilization	The application of neural networks in predicting the outcome of in-vitro fertilization	This study needs to be repeated with a more comprehensive and self-corrected data set.
9.	Siti K.B., Samihah M. and Wan Ishak W.I.	Application of Artificial Neural Network in Predicting Crop Yield	Presents a review on the use of (ANN) in predicting crop yield using various crop performance factors.	ANN impacts towards crop yield production must be conducted to ensure sustainability of future food needs.

VI. CONCLUSION AND FUTURE WORK

This paper presents a brief survey on various techniques for application of artificial neural networks and the different learning in neural networks, such as supervised, unsupervised, reinforced and competitive learning it also analysis the major advantages and their drawbacks. In order to find out the perfect, efficient solutions for artificial neural networks has been widely studied.

ACKNOWLEDGEMENT

Our thanks to the faculties of Department of Computer Science, Sharda University who have contributed towards development of this paper survey. The constant guidance and encouragement received from Zubainatu Uwaisu Muhammad, Mardiyya Aminu Madawaki, Kamaluddeen Ibrahim Yarima, Abdullahi Garba Musa and Prof. Ishan Ranjan, Head of department CSE Sharda University

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