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INTRODUCTION
REVIEW OF LITERATURE
NEED/IMPORTANCE OF THE STUDY
STATEMENT OF THE PROBLEM
OBJECTIVES
HYPOTHESIS (ES)
RESEARCH METHODOLOGY
RESULTS & DISCUSSION
FINDINGS
RECOMMENDATIONS/SUGGESTIONS
CONCLUSIONS
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SCOPE FOR FURTHER RESEARCH
REFERENCES
APPENDIX/ANNEXURE

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CONTRIBUTIONS TO BOOKS

- Sharma T., Kwatra, G. (2008) Effectiveness of Social Advertising: A Study of Selected Campaigns, Corporate Social Responsibility, Edited by David Crowther & Nicholas Capaldi, Ashgate Research Companion to Corporate Social Responsibility, Chapter 15, pp 287-303.

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- Schemenner, R.W., Huber, J.C. and Cook, R.L. (1987), "Geographic Differences and the Location of New Manufacturing Facilities," Journal of Urban Economics, Vol. 21, No. 1, pp. 83-104.

CONFERENCE PAPERS

- Garg, Sambhav (2011): "Business Ethics" Paper presented at the Annual International Conference for the All India Management Association, New Delhi, India, 19–23

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- Garg, Bhavet (2011): Towards a New Gas Policy, Political Weekly, Viewed on January 01, 2012 http://epw.in/user/viewabstract.jsp

ARCHITECTURAL REVIEW OF NEURAL NETWORK

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ABSTRACT

An Artificial Neural Network (ANN) is an information processing technology that is inspired by biological nervous systems(that is based on human body), such as the brain, process information. The key element of this technology is the novel structure of the information processing system. It is composed of a large number of highly interconnected neuron working in unison to solve specific problems. ANNs, like people, learn by example. An ANN is configured for a specific application, such as pattern recognition or data classification, through a learning process. Learning in biological systems involves adjustments to the synaptic connections that exist between the neurons. This is true of ANNs as well. This paper gives overview of Artificial Neural Network, architecture of ANN. It also explain some basic learning rule in ANN.

KEYWORDS

ANN, Neurons Multilayer, SRN.

INTRODUCTION

An ANN is basically approach of biological neuron. It have device with many input and one output. An ANN is composed of processing elements called or perceptronsor neuron organized in different ways to form the network's structure. An ANN consists of perceptrons. Each of the perceptrons receives inputs, processes inputs and delivers a single. Similar to biological neuron ANN have neuron which are artificial and receive input also from other element and after Input are weighted and added, result is transformed by transfer function in to output [1].

Some term based on neural model:-

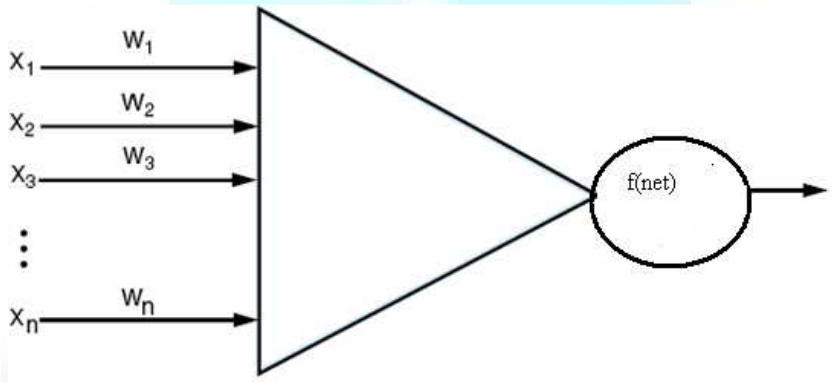
Input:-the neuron responds to input, in this case coming from x1, x2, …, xn.

Output: -the neuron computes its output value, denoted here as f(net).

Weight: -the computation for f(net) takes the values of the inputs and multiplies each input by its corresponding weight

x1*w1 + x2*w2 + … + xn*wn

FIGURE 1: NEURAL MODEL



Weight may be positive (excitatory) or negative (inhibitory).

Threshold: - different types of neurons will use different activation functions with the simplest being if x1*w1 + x2*w2 + … + xn*wn>= t then f(net) = 1 else f(net) = -1

Checks each input symbol to see if it is above or below the threshold value (signals below threshold values are ignored).

Activation function:-Used to combine the neurons inputs and generate an output signal. Transfers function f may be a linear or nonlinear function of net input n.

Bias: - the bias b is much like a weight w,that has a constant input of 1.it can be omitted if not necessary .bias and weight are adjustable scalar parameter of neuron. They are adjustable by some learning rule so that the neuron input and output meets some special goal [2,4].

ADVANTAGES

1. Adaptive learning: An ability to learn how to do tasks based on the data given for training or initial experience.
2. Self-Organization: An ANN can create its own organization or representation of the information it receives during learning time.
3. Real Time Operation: ANN computations may be carried out in parallel, and special hardware devices are being designed and manufactured which take advantage of this capability.
4. Pattern recognition is a powerful technique for harnessing the information in the data and generalizing about it. Neural nets learn to recognize the patterns which exist in the data set.
5. The system is developed through learning rather than programming.. Neural nets teach themselves the patterns in the data freeing the analyst for more interesting work.
6. Neural networks are flexible in a changing environment. Although neural networks may take some time to learn a sudden drastic change they are excellent at adapting to constantly changing information.

7. Neural networks can build informative models whenever conventional approaches fail. Because neural networks can handle very complex interactions they can easily model data which is too difficult to model with traditional approaches such as inferential statistics or programming logic.
8. Performance of neural networks is at least as good as classical statistical modeling, and better on most problems. The neural networks build models that are more reflective of the structure of the data in significantly less time.

ARCHITECTURE OF NEURAL NETWORK

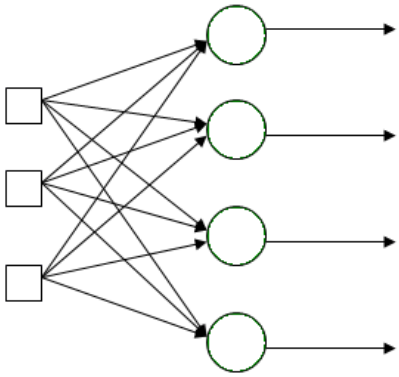
Architecture of ANN is based on requirement of problem or application:-
1. Single layer architecture
2. Multilayered architecture
3. Recurrent architecture

Architecture of neural network are by the three basic entities:
Model of processing element (neuron),
Model of interconnection and structures (network topology)
Model of learning rules(ways information is stored in network. [6]

1. SINGLE LAYER ARCHITECTURE

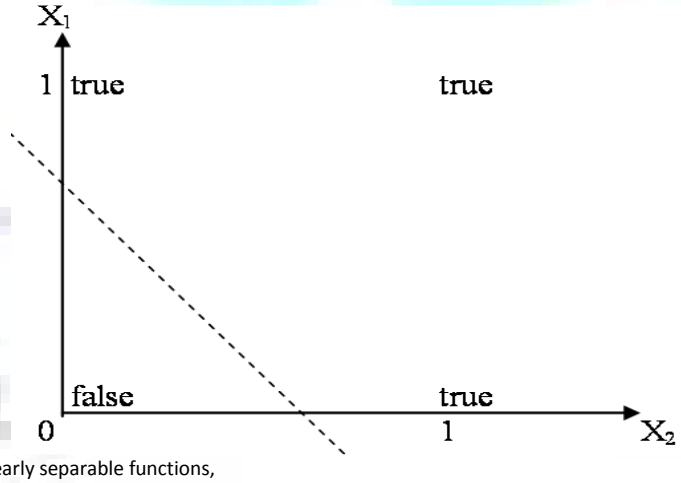
In single layer Architecture**,** figure the layer receives inputs is called input layer and output generated by output layer.

FIGURE 2: SINGLE LAYER MODEL



The perceptron was first proposed by Rosenblatt (1958) is a simple neuron that is used to classify its input into one of two categories. A perceptron uses a step function that returns +1 if weighted sum of its input ≥ 0 and -1 otherwise .Theperceptron is used for binary classification.
First train a perceptron for a classification task.
Find suitable weights in such a way that the training examples are correctly classified.
Geometrically try to find a hyper-plane that separates the examples of the two classes.The perceptron can only model linearly separable classes. When the two classes are not linearly separable, it may be desirable to obtain a linear separator that minimizes the mean squared error[3].
Given training examples of classes C_1, C_2 train the perceptron in such a way that:
If the output of the perceptron is +1 then the input is assigned to class C_1
If the output is -1 then the input is assigned to C_2

FIGURE 3: LINEAR SEPARABLE

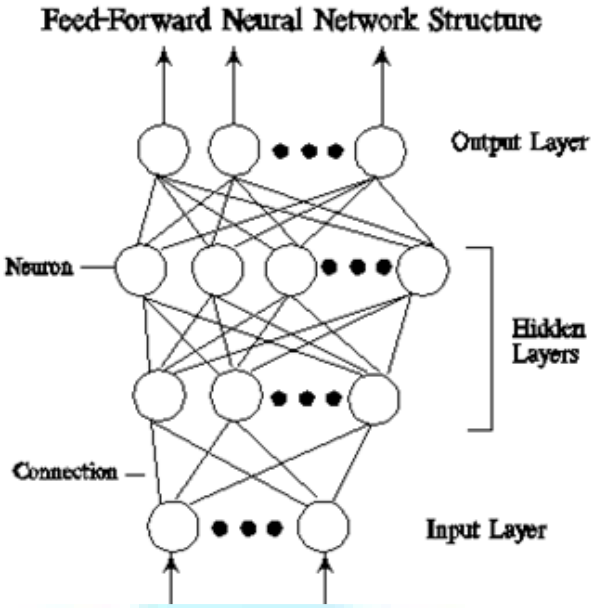


- The perceptron can only model linearly separable functions,
  - Those functions which can be drawn in 2-dim graph and single straight line separates values in two part.
- Boolean functions given below are linearly separable:
  - AND
  - OR
  - COMPLEMENT
- It cannot model XOR function as it is non linearly separable.
  - When the two classes are not linearly separable, it may be desirable to obtain a linearseparator that minimizes the mean squared error.

2. MULTILAYER ARCHITECTURE

The second class of feed forward neural network it differs from layer network network. It is more general network architecture where arehidden layer between and output layer.

FIGURE 4: MULTILAYER ARCHITECTURE



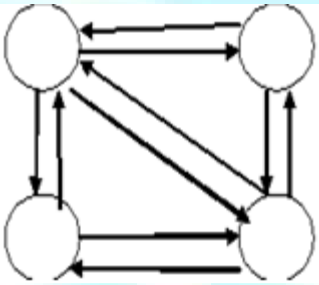
This architecture consistsof:-
• Source node (input)
• Hidden layer (one or more)
• Output layer

Concept of hidden layer: whose computation node is corresponding called hidden layer. Hidden layer node do not directly receive input. They send output to external environment. They also handle non separable problem[4].

Working of multilayer feed forward network: the source in input layer of network supply respective element of activation patterns. Inputsignal applied to neuron in second hidden layer. Output of second layer is input to third and so on. They are two types:-
•Fully connected
•Partially connected

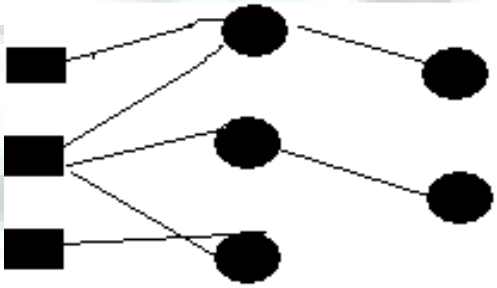
Fully connected: -The neural network is said to be fully connected in the sense that every node in each layer of the network is connected to every other node in the adjacent forward layer. Shown in following figure:-

FIGURE 5: FULLY CONNECTEDMULTILAYER ARCHITECTURE



Partially connected:- some of the communication links missing from the network ,refer partially connected.

FIGURE 6: PARTIALLY CONNECTED MULTILAYER ARCHITECTURE



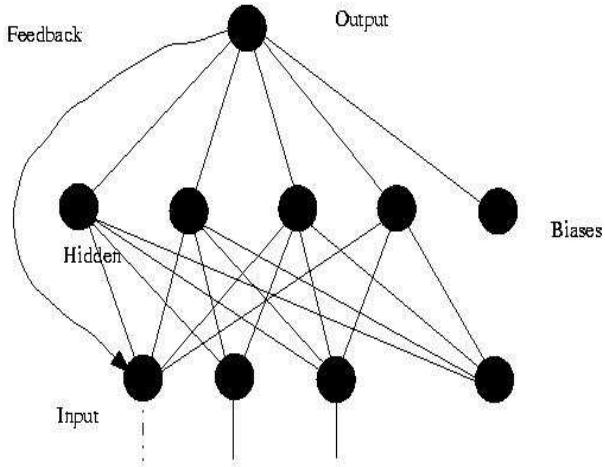
APPLICATIONS OF FEED-FORWARD NETS
• Pattern recognition
- Character recognition
- Face Recognition
• Sonar mine/rock recognition (Gorman &Sejnowksi)
- Navigation of a car (Pomerleau, 1989)
- Stock-market prediction
- Pronunciation (NETtalk)

3. RECURRENTARCHITECTURE

Some connections are present from a layer to the previous layers. Recurrent are those which are one or more feedbackloop. Feedback loop are two types:-
• Local
• Global

Recurrent architecture use concept of global.

FIGURE 7: RECURRENT ARCHITECTURE

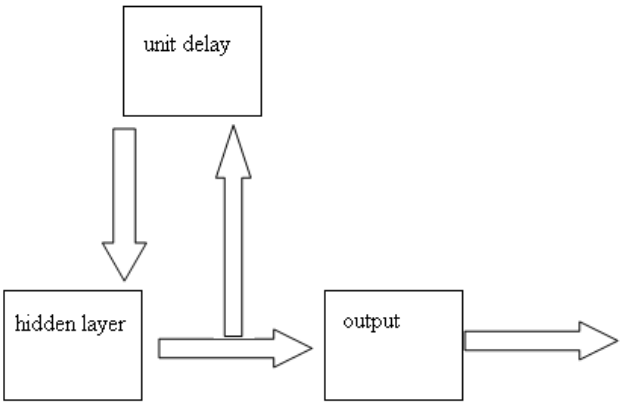


Basically two area of this network:-

- Associate memories
- Input output mapping network

Input output mapping network:-Input space of mapping network is mapped onto an output space. Thisnetwork responds temporary to an externally appliedinput signal.

FIGURE 8: SIMPLE RECURRENT NETWORK (SRN)



Hidden layer define stateOutput of hidden is feedback to input layer via unit delay .Input layer consist of catcatentation of feedback node and source.Network concected to external environment via source node

ASSOCIATIVE NETWORKS

There is no hierarchical arrangement.The connections can be bidirectional. An associate memory is a brain like distributed memory that learns by association. Memory associtionn takes one of two forms:-

Auto association

Hetro association

LEARNING

The ability of the neural network (NN) to learn from its environment and to improve its performance through learning.

- The NN is stimulated by an environment
- The NN undergoes changes in its free parameteres
- The NN responds in a new way to the environment

Learning is a process by which the free parameters of a neural network are adapted through a process of stimulation by the environment in which the network is embedded. The type of the learning is determined by the manner in which the parameter changes take place. (Mendel & McMcLaren 1970).

FIVE BASIC LEARNING RULES

- Error-correction learning <- optimum filtering
- Memory-based learning <- memorizing the training data explicitly
- Hebbian learning <- neurobiological
- Competitive learning <- neurobiological
- Boltzmann learning <- statistical mechanics

ERROR-CORRECTION LEARNING

Error-Correction Learning is based onerror signal = desired response – output signal

$e_k(n) = d_k(n) - y_k(n)$

where $e_k(n)$ actuates a control mechanism to make the output signal $y_k(n)$ come closer to the desired response $d_k(n)$ in step by step manner.

A cost function $\varepsilon(n) = \frac{1}{2}e^2_k(n)$ is the instantaneousvalue of the error energy.delta rule or Widrow-Hoff rule

$\mathbf{\Delta w_{kj}(n) = \eta\, e_k(n)\, x_j(n),}$

η is the learning rate parameter.The adjustment made to a synaptic weight of a neuron is proportional to the product of the error signal and the input signal of the synapse in question.

$\mathbf{w_{kj}(n+1) = w_{kj}(n) + \Delta w_{kj}(n)}$

Memory-Based Learning:all of the past experiences are explicitly stored in a large memory of correctly classified input-output examples

$\mathbf{\{(x_i, d_i)\}^N_{i=1}}$

Hebbian Learning: It is based on neurobiological

If two neurons on either side of synapse (connection) are activated simultaneously, then the strength of that synapse is selectively increased.

2. If two neurons on either side of a synapse are activated asynchronously, then that synapse is selectively weakened or eliminated.

A Hebbian synapse increases its strength with positively correlated presynaptic and postsynaptic signals, and decreases its strength when signals are either uncorrelated or negatively correlated.Note, that:

1. Synaptic weight w_{kj} is enhanced if the conditions $x_j > \bar{x}$ and $y_k > \bar{y}$ are both satisfied.

2. Synaptic weight w_{kj} is depressed if there is $x_j > \bar{x}$ and $y_k < \bar{y}$ or $y_k > \bar{y}$ and $x_j < \bar{x}$.

COMPETITIVE LEARNING

The output neurons of a neural network compete among themselves to become active.

- a set of neurons that are all the same (excepts for synaptic weights)
- a limit imposed on the strength of each neuron
- a mechanism that permits the neurons to compete -> a winner-takes-all

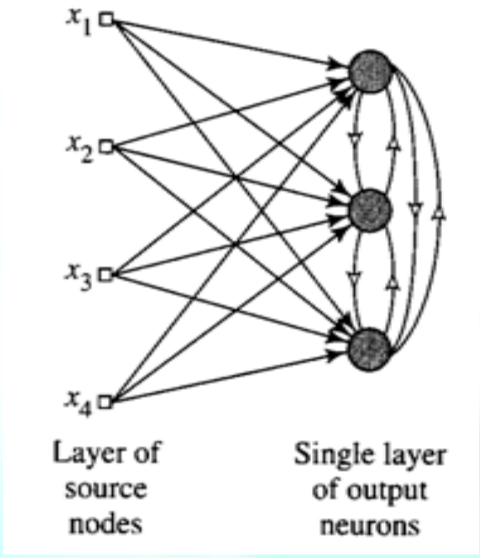
The standard competitive learning rule

$\Delta w_{kj} = \eta(x_j - w_{kj})$ if neuron k wins the competition

ss= 0 if neuron k loses the competition

Note. all the neurons in the network are constrained to have the same length

FIGURE 9: COMPETITIVE LEARNING



1. BOLTZMANN LEARNING

The neurons constitute a recurrent structure and they operate in a binary manner. The machine is characterized by an energy function E.

$E = -\frac{1}{2}\sum_j\sum_k w_{kj}x_kx_j$, $j \neq k$

Machine operates by choosing a neuron at random then flipping the state of neuron k from state x_k to state $-x_k$ at some temperature T with probability

$P(x_k \rightarrow -x_k) = 1/(1+\exp(-\Delta E_k/T))$

It follow two condition:

Clamped condition: the visible neurons are all clamped onto specific states determined by the environment

Free-running condition: all the neurons (=visible and hidden) are allowed to operate freely .

The Boltzmann learning rule:

$\Delta w_{kj} = \eta(\rho^+_{kj} - \rho^-_{kj})$, $j \neq k$,

both ρ^+_{kj} and ρ^-_{kj} range in value from –1 to +1

TYPE OF LEARNING

Learning is the process of modifying the weights in order to produce a network that performs some function

Learning with Teacher->Supervised training

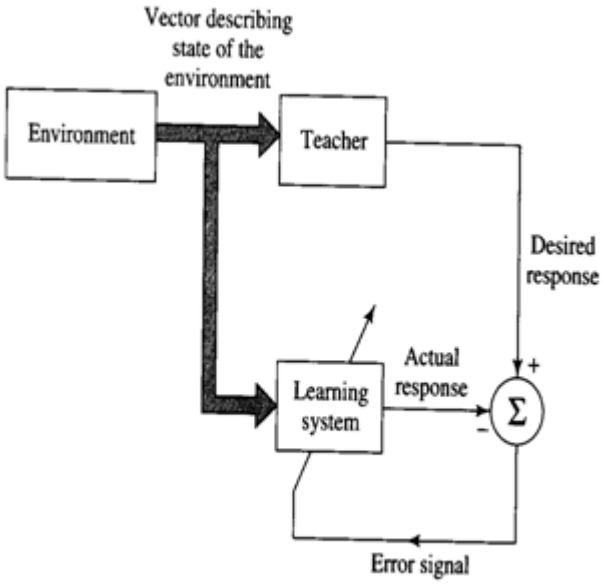
Learning without a Teacher->1. Reinforcement learning

2. UNSUPERVISED LEARNING

SUPERVISED TRAINING

In supervised training, both the inputs and the outputs are provided. The network then processes the inputs and compares its resulting outputs against the desired outputs. Errors are then propagated back through the system, causing the system to adjust the weights which control the network. This process occurs over and over as the weights are continually tweaked. The set of data which enables the training is called the "training set." During the training of a network the same set of data is processed many times as the connection weights are ever refined. The current commercial network development packages provide tools to monitor how well an artificial neural network is converging on the ability to predict the right answer.

FIGURE 10: SUPERVISED TRAINING



These tools allow the training process to go on for days, stopping only when the system reaches some statistically desired point, or accuracy. However, some networks never learn. This could be because the input data does not contain the specific information from which the desired output is derived.

Learning without a Teacher: no labeled examples available of the function to be learned.

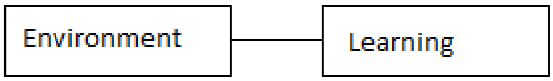
Reinforcement learning

Unsupervised learning

UNSUPERVISED OR ADAPTIVE TRAINING

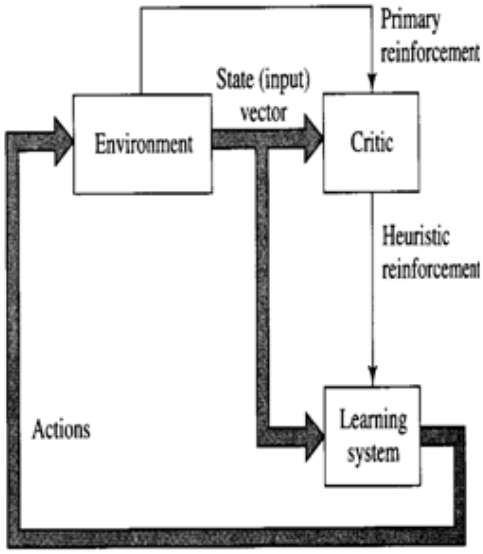
The other type of training is called unsupervised training. In unsupervised training, the network is provided with inputs but not with desired outputs. The system itself must then decide what features it will use to group the input data. This is often referred to as self-organization or adaption.

FIGURE 11: UNSUPERVISED OR ADAPTIVE TRAINING



Reinforcement learning: The learning of input-output mapping is performed through continued interaction with the environment in oder to minimize a scalar index of performance.

FIGURE 12: REINFORCEMENT LEARNING



APPLICATIONS OF NEURAL NETWORKS

Character Recognition - The idea of character recognition has become very important as handheld devices like the Palm Pilot are becoming increasingly popular. Neural networks can be used to recognize handwritten characters.

Image Compression - Neural networks can receive and process vast amounts of information at once, making them useful in image compression. With the Internet explosion and more sites using more images on their sites, using neural networks for image compression is worth a look.

Stock Market Prediction - The day-to-day business of the stock market is extremely complicated. Many factors weigh in whether a given stock will go up or down on any given day. Since neural networks can examine a lot of information quickly and sort it all out, they can be used to predict stock prices.

Traveling Salesman's Problem - Interestingly enough, neural networks can solve the traveling salesman problem, but only to a certain degree of approximation.

Medicine, Electronic Nose, Security, and Loan Applications - These are some applications that are in their proof-of-concept stage, with the acception of a neural network that will decide whether or not to grant a loan, something that has already been used more successfully than many humans.

Miscellaneous Applications - These are some very interesting (albeit at times a little absurd) applications of neural networks.

CONCLUSION AND FUTURE WORK

In this paper, we discussed about the Artificial neural network,architecture and learningof ANN. There are various advantages of ANN over conventional approaches. In this we discuss architecture of ANN, and understand how choose on application.Depending on the nature of the application and the strength of the internal data patterns you can generally expect a network to train quite well. This applies to problems where the relationships may be quite dynamic or non-linear. Today, neural networks discussions are occurring everywhere. Their promise seems very bright as nature itself is the proof that this kind of thing works. Yet, its future, indeed the very key to the whole technology, lies in hardware development. Currently most neural network development is simply proving that the principal works. In future, we work on algorithms of learning

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Thanking you profoundly

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