Artificial neural networks

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Abstract- **A neural network is to simulate lots of interconnected brain cells inside a computer so that, people can get it to learn things, recognize patterns, and make decisions in their own way. The amazing thing about a neural network it is "just like a brain! "Neural Networks made by programming very ordinary computers, working in a very traditional fashion with their ordinary components. Computer outputs are just collections of algebraic variables and mathematical equations linking them together. You might also see neural networks referred to by names like parallel distributed processors (PDP), thinking machines, but in this article we're going to use the term "neural network" which also mean artificial Neural Network."**

Index Terms- Neural Networks, PDP, Feed forward, Feedback, Adaptive learning, Hopfield Law.

INTRODUCTION

The term 'Neural' is derived from the human nervous system's basic functional unit 'neuron' or nerve cells which are present in the brain and other parts of the human body.

Artificial Neural Networks is a biologically inspired network of artificial neurons configured to perform specific tasks.

It is composed of a large number of highly interconnected processing elements (neurones) working in unison to solve specific problems. ANNs, like people, learn by example. An artificial neural network is configured for a specific application, such as pattern recognition through some learning process.

Brain Vs. Computer

BRAIN	COMPUTER
Biological neurons or nerve cells	Silicon Transistors
200 billion neurons, 32 trillion interconnections	1 billion bytes RAM, trillion bytes on disk
Neuron size: 10-6m	Single transistor: 10 gm
Energy consumption: 6-10 joules	Energy consumption: 10-16 joules

Learning capability	Programming capability

Architecture of Artificial Neural Networks
In artificial neural network, there are different types of layers are the following :
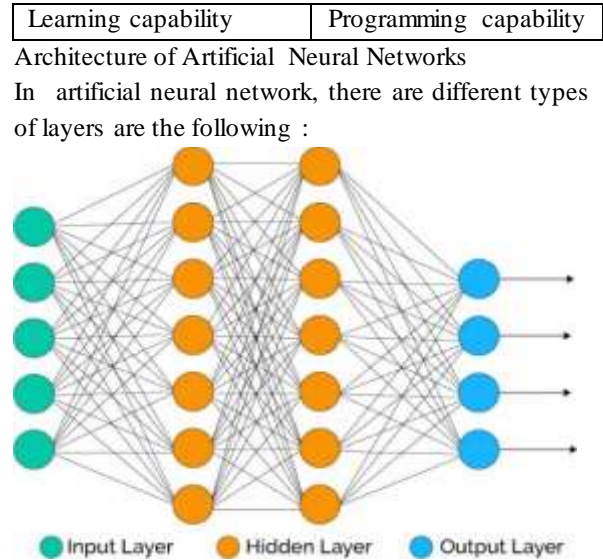

Figure 1. Architecture of ANN

Input layer—It contains those of neurons which receive input from the outside world on which network will learn, recognize about .

Output layer—It contains units that respond to the information about how it is learned from the inputs.

Hidden layer—In this layer units are in between input and output layers. The job of hidden layer is to transform the input into something that output can use in different ways.

II. TYPES OF ARTIFICIAL NEURAL NETWORKS

There are two Artificial Neural Network topologies
Feed Forward ANN
The information flow is unidirectional. In this unit sends information to other unit from which it does not receive any information. There are no feedback loops. They are used in pattern generation/recognition/classification. They have fixed inputs and outputs.
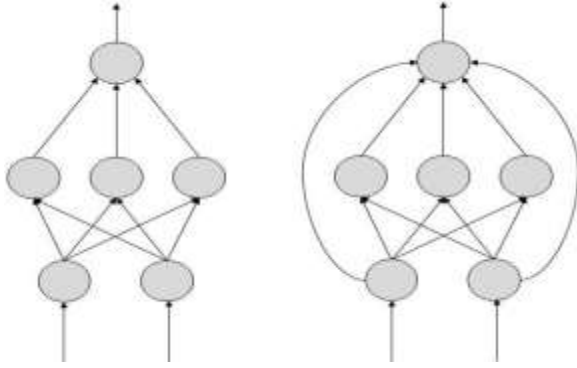
Figure 2. Feed Forward ANN

Feed Back ANN

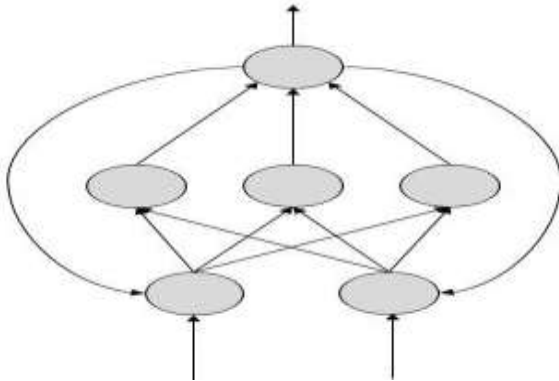Here, feedback loops are allowed. They are used in content addressable memories.

Figure 3. Feedback ANN

Other types of Neural Network

1) Modular Neural Network—It is the combined structure of different types of the neural network like multilayer perceptron, Hopfield network, recurrent neural network etc which are incorporated as a single module into the network to perform independent subtask of whole complete neural networks.

2) Physical Neural Network—In this type of artificial neural network, electrically adjustable resistance material is used to emulate the function of synapse instead of software simulations performed in the neural network.

Advantages of neural networks :

1) Adaptive learning: Adaptive learning is a typr of an ability to learn how to do tasks based on the data given for training or initial experience.

2) Self-Organisation: An artificial neural network can create its own organisation or representation of the information it receives during learning time.

3) Real Time Operation: The artificial neural network computations may be carried out in parallel and special hardware devices which take advantage of the capability.

4) Fault Tolerance via Redundant Information Coding: Partial destruction of a network leads to degradation of performance

Three Different Uses of Neural Networks

1) Classification—A neural network can be used to classify given sequence or data set into predefined class. It uses feed forward networks.

2) Prediction—A neural network can be used to produce outputs that are expected from given input

3) Clustering—The Neural network is able to identify a special feature of the data and classify them into different categories without any prior knowledge of the data.

Applications of Neural Networks

1) Aerospace − Autopilot aircrafts, aircraft fault detection etc .

2) Automotive − Automobile guidance systems.

3) Military − Weapon orientation and steering, target tracking, object 1

4) Electronics − Code sequence prediction, IC chip layout, chip failure analysis, machine vision, voice synthesis.

5) Financial − Real estate appraisal, loan advisor, mortgage screening, corporate bond rating, portfolio trading program,

6) Industrial − Manufacturing process control, product design and analysis, quality inspection systems, welding quality analysis

7) Medical − Cancer cell analysis, EEG and ECG analysis

8) Speech − Speech recognition, speech classification, text to speech conversion.

9) Software − Pattern Recognition in facial recognition, optical character recognition, etc.

III. LEARNING ALGORITHMS USED IN NEURAL NETWORK

Gradient Descent—It is the type of algorithm used in case of supervised training. In this case, the actual

output is different from target output and the error is find out. The gradient descent algorithm changes the weights of the network in such a manner to minimize this error and it is the simplest learning algorithm.

Back propagation—It is also known as extension of gradient based delta learning rule. In this method after, finding an error the difference between desired and target output, the error is propagated backward from output layer to the input layer through hidden layer. It is also used in case of multilayer neural network.

Types of Learning in Neural Network
Supervised Learning—In supervised learning, the training data is input and the desired output is known weights .

Unsupervised Learning— In this method of learning input data is used to train the network whose output is known.

Reinforcement Learning— This type of learning is the value of the output is unknown, but the network provides the feedback whether the output is right or wrong. It is also known as semi-supervised learning.

Offline Learning—In official learning, the adjustment of the weight vector and threshold is done only after all training set is presented to the network It is also called as batch learning.

Online Learning—in Online learning, the adjustment of the weight and threshold is done after presenting each sample to the network.

IV. CONCLUSION

Neural networks are also called as Artificial Neural Network. . They are the commonly applied machine learning algorithm. In this paper I have provided a brief sketch of types of artificial neural network and different types of learning involve in it . We've also discussed about the uses of Neural Networks along with their respective functions. The advantages and disadvantages of ANNs and the issues related to the ANNs have been discussed in the paper.

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