Study of Artificial Neural Network

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Abstract: In this paper we also show that "what are neural networks" and "Why they are so important in today's Artificial intelligence?" Because numerous advances have been made in developing Intelligent system, some inspired by biological neural networks. ANN provides a very exciting alternatives and other application which can play important role in today's computer science field. There are some Limitations also which are mentioned. An Artificial Neural Network (ANN) is an information processing paradigm that is inspired by the way biological nervous systems, such as the brain, process information. This paper gives overview of Artificial Neural Network, working & training of ANN. It also explain the application and advantages of ANN.

Keywords:- Artificial Neural Network, ANN, Feedback Network, Feed Forward Network

I. INTRODUCTION

The concept of ANN is basically introduced from the subject of biology where neural network plays a important and key role in human body. In human body work is done with the help of neural network. Neural Network is just a web of inter connected neurons which are millions and millions in number. With the help of this interconnected neurons all the parallel processing is done in human body and the human body is the best example of Parallel Processing. A neuron is a special biological cell that process information from one neuron to another neuron with the help of some electrical and chemical change. It is composed of a cell body or soma and two types of out reaching tree like branches: the axon and the dendrites. The cell body has a nucleus that contains information about hereditary traits and plasma that holds the molecular equipments or producing material needed by the neurons . The whole process of receiving and sending signals is done in particular manner like a neuron receives signals from other neuron through dendrites. The Neuron send signals at spikes of electrical activity through a long thin stand known as an axon and an axon splits this signals through synapse and send it to the other neurons.
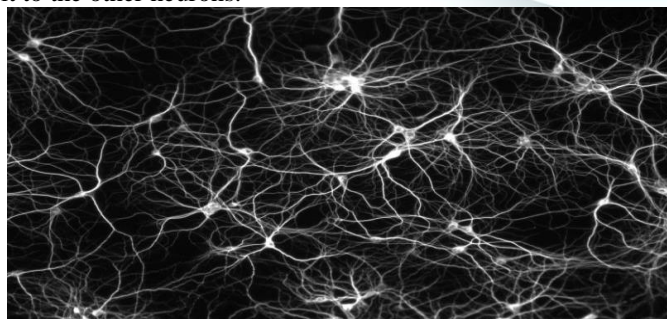

Fig 1 Neural Network in Human Body

II. WHAT IS ARTIFICIAL NEURAL NETWORK

Artificial Neural Networks are relatively crude electronic models based on the neural structure of the brain. The brain basically learns from experience. It is natural proof that some problems that are beyond the scope of current computers are indeed solvable by small energy efficient packages. This brain modeling also promises a less technical way to develop machine solutions. This new approach to computing also provides a more graceful degradation during system overload than its more traditional counterparts. These biologically inspired methods of computing are thought to be the next major advancement in the computing industry. Even simple animal brains are capable of functions that are currently impossible for computers. Computers do rote things well, like keeping ledgers or performing complex math. But computers have trouble recognizing even simple patterns much less generalizing those patterns of the past into actions of the future. Now, advances in biological research promise an initial understanding of the natural thinking mechanism. This research shows that brains store information as patterns. Some of these patterns are very complicated and allow us the ability to recognize individual faces from many different angles. This process of storing information as patterns, utilizing those patterns, and then solving problems encompasses a new field in computing. This field, as mentioned before, does not utilize traditional programming but involves the creation of massively parallel networks and the training of those networks to solve specific problems. This field also utilizes words very different from traditional computing, words like behave, react, self-organize, learn, generalize, and forget. Whenever we talk about a neural network, we should more popularly say ─Artificial Neural Network (ANN), ANN are computers whose architecture is modeled after the brain. They typically consist of hundreds of simple processing units which are wired together in a complex communication network. An

Artificial Neuron is basically an engineering approach of biological neuron. It have device with many inputs and one output. ANN is consist of large number of simple processing elements that are interconnected with each other and layered also.
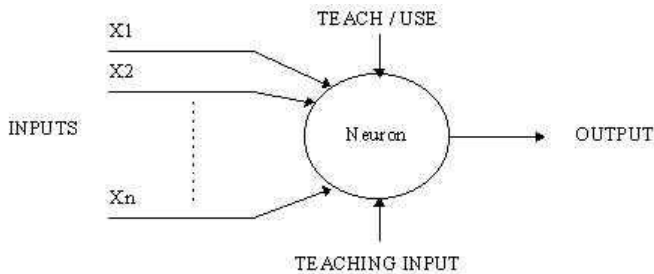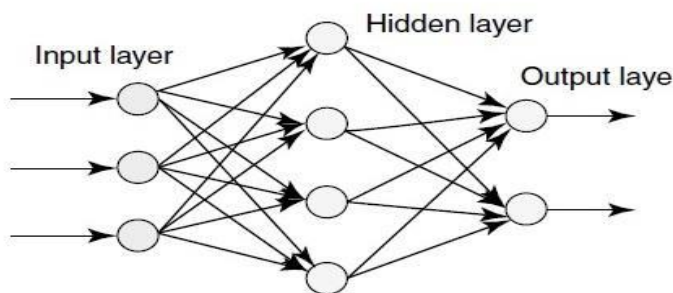

Fig 2 Artificial Neuron

(b)   Multilayered artificial neural network

Similar to biological Neuron Artificial Neural Network also have neurons which are artificial and they also receive inputs from the other elements or other artificial neurons and then after the inputs are weighted and added, the result is then transformed by a transfer function into the output. The transfer function may be anything like Sigmoid, hyperbolic tangent functions or a step.

III. WHY ANN ?

The long evolution has given many best and excellent characteristics to brain of human being which are not present in modern computers which are :-
1) Massive Parallelism
2) Distributed representation and computation
3) Adaptability
4) Learning Ability
5) Generalization Ability
6) Inherent Contextual Information Processing
7) Fault Tolerance
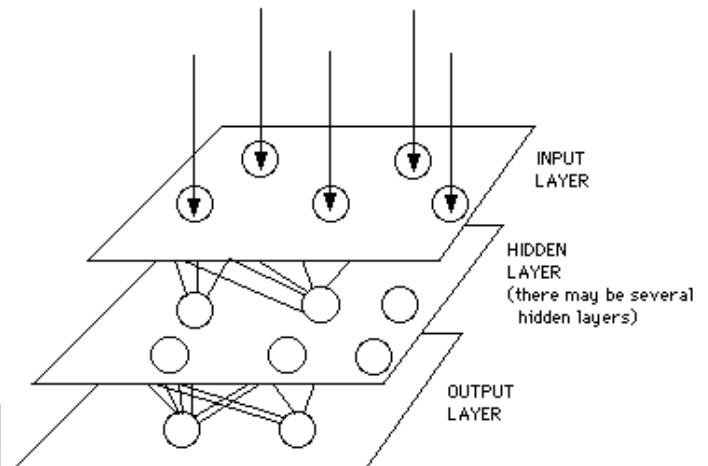8) Love Energy Consumption

Figure 4:- A Simple Neural Network Diagram

IV. ANN CHARACTERISTICS

Basically Computers are good in calculations that basically takes inputs process then and after that gives the result on the basis of calculations which are done at particular Algorithm which are programmed in the software's but ANN improve their own rules, the more decisions they make, the better decisions may become. The Characteristics are basically those which should be present in intelligent System like robots and other Artificial Intelligence Based Applications. There are six characteristics of Artificial Neural Network which are basic and important for this technology.

1. The Network Structure:-
The Network Structure of ANN should be simple and easy. There are basically two types of structures recurrent and non recurrent structure. The Recurrent Structure is also known as Auto associative or Feedback Network and the Non Recurrent Structure is also known as Associative or Feed forward Network. [6,7,20,21] In Feed forward Network, the signal travel in one way only but in Feedback Network, the signal travel in both the directions by introducing loops in the network. The Figures are given below which shows the direction of signals in both the network structures Feed forward and feedback.
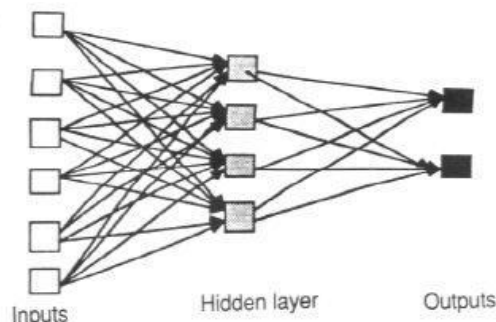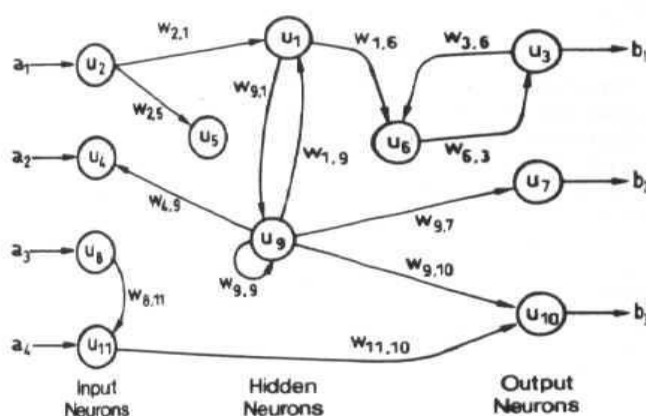
Fig 5:-Feed Forward Network

Fig 6 :- Feed Back Network

2. Parallel Processing Ability:-

ANN is only introduce to enlarge the concept of parallel processing in the computer field. Parallel Processing is done by the human body in human neurons are very complex but by applying basic and simple parallel processing techniques we implement it in ANN like Matrix and some matrix calculations. [7]

3. Distributed Memory:-

ANN is very huge system so single place memory or centralized memory cannot fulfill the need of ANN system so in this condition we need to store information in weight matrix which is form of long term memory because information is stored as patterns throughout the network structure.

4. Fault Tolerance Ability:-

ANN is a very complex system so it is necessary that it should be a fault tolerant. Because if any part becomes fail it will not affect the system as much but if the all parts fails at the same time the system will fails completely.

5. Collective Solution:-

ANN is a interconnected system the output of a system is a collective output of various input so the result is summation of all the outputs which comes after processing various inputs. The Partial answer is worthless for any user in the ANN System.

6. Learning Ability:-

In ANN most of the learning rules are used to develop models of processes, while adopting the network to the changing environment and discovering useful knowledge. These Learning methods are Supervised, Unsupervised and Reinforcement Learning.

V. LIMITATIONS OF ARTIFICIAL NEURAL NETWORK

In this technological era every has Merits and some Demerits in others words there is a Limitation with every system which makes this ANN technology weak in some points. The various Limitations of ANN are:-

1) ANN is not a daily life general purpose problem solver.

2) There is no structured methodology available in ANN.

3) There is no single standardized paradigm for ANN development.

4) The Output Quality of an ANN may be unpredictable.

5) Many ANN Systems does not describe how they solve problems.

6) Black box Nature

7) Greater computational burden.

8) Proneness to over fitting.

9) Empirical nature of model development.

VI. CONCLUSION

Artificial Intelligence has become an essential part of the technology industry, providing the heavy lifting for many of the most challenging problems in computer science.

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