Artificial Intelligence in Neural Network

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Abstract:- Since the invention of computers or machines, their capability to perform various tasks went on growing exponentially. Humans have developed the power of computer systems in terms of their diverse working domains, their increasing speed, and reducing size with respect to time. A branch of Computer Science named Artificial Intelligence pursues creating the computers or machines as intelligent as human beings. Software technologies that make a computer or robot perform equal to or better than normal human computational ability in accuracy, capacity, and speed. Two very different approaches rule-based systems and neural networks have produced increasingly powerful applications that make complex decisions, evaluate investment opportunities, and help in developing new products. Neural networks are a popular target representation for learning. These networks are inspired by the neurons in the brain but do not actually simulate neurons. Artificial neural networks typically contain many fewer than the approximately 10^{11} neurons that are in the human brain, and the artificial neurons, called units, are much simpler than their biological counterparts. A neural network topology represents the way in which neurons are connected to form a network. In other words, the neural network topology can be seen as the relationship between the neurons by means of their connections. The topology of a neural network plays a fundamental role in its functionality and performance, as illustrated throughout the handbook.

Keywords:- Artificial Intelligence, Neural network in Artificial intelligence,Topologies.

1. INTRODUCTION

An artificial neural network(ANN), often just called a "neural network" (NN), is a mathematical model or computational model based on biological neural networks, in other words, is an emulation of biological neural system. It consists of anointer connected group of artificial neurons and processes information using a connection is approach to computation. Inmost cases an ANN is an adaptive system that changes its structure based on external or internal information that flows through the network during the learning phase. As part of neuroscience, to understand real neural systems, researchers are simulating the neural systems of simple animals such as worms, which promises to lead to an understanding about which aspects of neural systems are necessary to explain the behavior of these animals.

Some researchers seek to automate not only the functionality of intelligence (which is what the field of artificial intelligence is about) but also the mechanism of the brain, suitably abstracted. One hypothesis is that the only way to build the functionality of the brain is by using the mechanism of the brain. This hypothesis can be tested by attempting to build intelligence using the mechanism of the brain, as well as without using the mechanism of the brain. Experience with building other machines - such as flying machines, which use the same principles, but not the same mechanism, that birds use to fly - would indicate that this hypothesis may not be true. However, it is interesting to test the hypothesis.

The brain inspires a new way to think about computation that contrasts with currently available computers. Unlike current computers, which have a few processors and a large but essentially inert memory, the brain consists of a huge number of asynchronous distributed processes, all running concurrently with no master controller. One should not think that the current computers are the only architecture available for computation.

As far as learning is concerned, neural networks provide a different measure of simplicity as a learning bias than, for example, decision trees. Multilayer neural networks, like decision trees, can represent any function of a set of discrete features. However, the functions that correspond to simple neural networks do not necessarily correspond to simple decision trees. Neural network learning imposes a different bias than decision tree learning. Which is better, in practice, is an empirical question that can be tested on different domains.

2. NEURAL NETWORK TOPOLOGIES:

Feed forward neural network: The feed forward neural network was the first and arguably simplest type of artificial neural network devised. In this network, the information moves in only one direction, forward, from the input nodes, through the hidden nodes (if any) and to the output nodes. There are no cycles or loops in the network. The data processing can extend over multiple (layers of)units, but no feedback connections are present, that is, connections extending from outputs of units to inputs of units in the same layer or previous layers.

Recurrent network: Recurrent neural networks that do contain feedback connections. Contrary to feed forward networks, recurrent neural networks(RNs) are models with bi-directional data flow. While a feed forward network propagates data linearly from input to output, RNs also propagate data from later processing stages to earlier stages.

3. BACKGROUND

The examination of the central nervous system of human brain was the inspiration of neural networks. In an Artificial Neural Network, simple artificial nodes, known

as "neurons", "processing elements" or units", are connected together to form a network which is called a biological neural network.
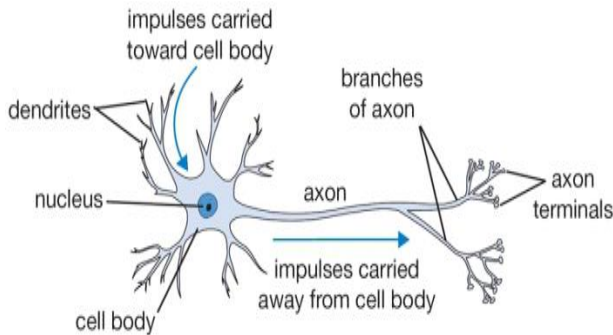

Fig.2 *Genetic Neuron Structure.*

There is no single formal definition of an artificial neural network. However, a class of statistical or mathematical or computational models may commonly be called "Neural Networks" if they possess the following characteristics:

1. Consist of sets of adaptive weights, i.e. numerical parameters that are tuned by a learning algorithms, and

2. Capable of approximating non-linear functions of their inputs.

The adaptive weights are conceptually connection strengths between neurons, which are activated during training and prediction.

Neural networks are similar to biological neural networks in performing functions collectively and in parallel by the units, rather than there being a clear delineation of subtasks to which various units are assigned. The term "neural network" usually refers to models employed in statistics, cognitive psychology and artificial intelligence. Neural network models which emulate the central nervous system are part of theoretical neuroscience and computational neuroscience.

4.WORKING OF NEURAL NETWORKS

The working of neural networks revolves around the myriad of ways these individual neurons can be clustered together. This clustering occurs in the human mind in such a way that information can be processed in a dynamic, interactive, and self-organizing way. Biologically, neural networks are constructed in a three-dimensional world from microscopic components. These neurons seem capable of nearly unrestricted interconnections. That is not true of in the case of any proposed, or existing, man-made network. Integrated circuits, using current technology, are two-dimensional devices with a limited number of layers for interconnection. This physical reality restrains the types, and scope, of artificial neural networks that can be implemented in silicon. Currently, neural networks are the simple clustering of the primitive

artificial neurons. This clustering occurs by creating layers which are then connected to one another. How these layers connect is the other part of the "art" of engineering networks to resolve real world problems.

5. ANN MODELS

A common use of the ANN model really means the definition of a class of such functions (where members of the class are obtained by varying parameters, connection weights, or specifics of the architecture such as the number of neurons.
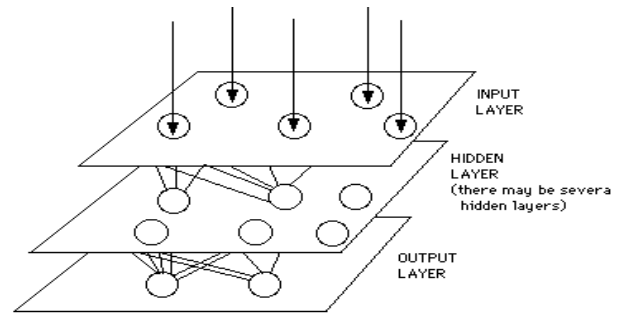

Fig.2 A Simple Neural Network Diagram.

Basically, all artificial neural networks have a similar structure or topology asshown in Figure1. In that structure some of the neurons interfaces to the real world to receive its inputs. Other neurons provide the real world with the network's outputs. This output might be the particular character that the network thinks that it has scanned or the particular image it thinks is being viewed. All the rest of the neurons are hidden from view.

But a neural network is more than a bunch of neurons. Some early researchers tried to simply connect neurons in a random manner, without much success. Now, it is known that even the brains of snails are structured devices. One of the easiest ways to design a structure is to create layers of elements. It is the grouping of these neurons into layers, the connections between these layers, and the summation and transfer functions that comprises a functioning neural network. The general terms used to describe these characteristics are common to all networks.

Although there are useful networks which contain only one layer, or even one element, most applications require networks that contain at least the three normal types of layers - input, hidden, and output. The layer of input neurons receive the data either from input files or directly from electronic sensors in real-time applications. The output layer sends information directly to the outside world, to a secondary computer process, or to other devices such as a mechanical control system. Between these two layers can be many hidden layers. These internal layers contain many of the neurons in various interconnected structures. The inputs and outputs of each of these hidden neurons simply go to other neurons.

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In most networks each neuron in a hidden layer receives the signals from all of the neurons in a layer above it, typically an input layer. After a neuron performs its function it passes its output to all of the neurons in the layer below it, providing a feedforward path to the output. (Note: in section 5 the drawings are reversed, inputs come into the bottom and outputs come out the top.)

These lines of communication from one neuron to another are important aspects of neural networks. They are the glue to the system. They are the connections which provide a variable strength to an input. There are two types of these connections. One causes the summing mechanism of the next neuron to add while the other causes it to subtract. In more human terms one excites while the other inhibits.

6.FUNCTION OF NEURAL NETWORK:

The word network in the term 'artificial neural network' refers to the interconnections between the neurons in the different layers of each system. An example system has three layers. The first layer has input neurons which send data via synapses to the second layer of neurons, and then via more synapses to the third layer of output neurons. More complex systems will have more layers of neurons with some having increased layers of input neurons and output neurons. The synapses store parameters called "weights" that manipulate the data in the calculations. An ANN is typically defined by three types of parameters:

1. The interconnection pattern between the different layers of neurons
2. The learning process for updating the weights of the interconnections
3. The activation function that converts a neuron's weighted input to its output activation.
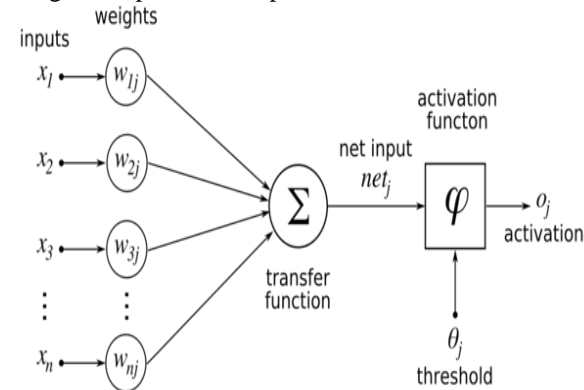
7.CHARACTERISTICS OF NEURAL NETWORK

Basically Computers are good in calculations that takes inputs process then and gives the result as per the calculations which is done by using the particular Algorithm which are programmed in the software's but ANN uses its own rules, the more decisions they make, the better decisions may become. all artificial neural networks have a similar structure or topology as shown in Figure1. In that structure some of the neurons interfaces to the real world to receive its inputs. Other neurons provide the real world with the network's outputs. This output might be the particular character that the network thinks that it has scanned or the particular image it thinks is being viewed. All the rest of the neurons are hidden from view.
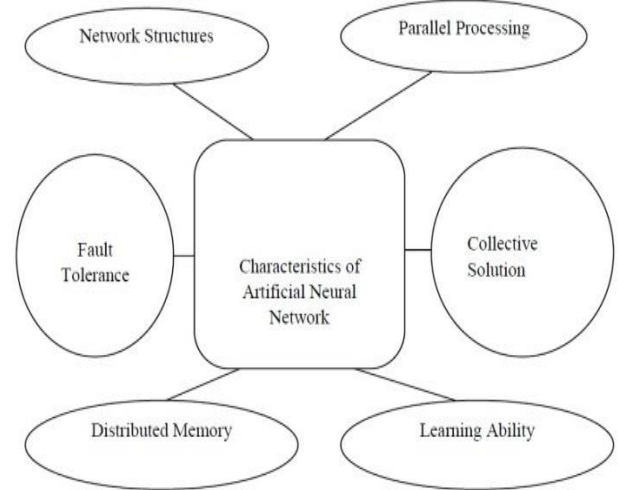
The Characteristics are basically those which should be present in intelligent System like robots and other Artificial Intelligence Applications. There are six characteristics of Artificial Neural Network which are basic and important for thistechnology.

8.LIMITATION OF NUERAL NETWORK:
Every single thing in this world has some merits and demerits, so the ANN also has some merits and demerits. The limitations of neural network system

1. Nature of ANN is like a Black box.
2. There is no structured methodology available.
3. There is no single standardized paradigm for Neural Networks development.
4. The Output Quality of an ANN can be unpredictable.
5. ANN or Neural Networks is not a daily life problem solver.

9. APPLICATION

The various real time application of Artificial Neural Network are as follows:

1. Function approximation, orregression analysis, includingtime series predictionand modelling.
2. Call control- answer an incoming call (speaker-ON) with a wave of the hand while driving.
3. Classification, includingpatternand sequence recognition, novelty detection and sequential decision making.
4. Skip tracks or control volume on your media player using simple hand motions- lean back, and with no need to shift to the device- control what you watch/ listen to.

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5. Data processing, including filtering, clustering,blind signal separationand compression.
6. Adaptive learning: An ability to learn how to do tasks based on the data given for training or initial experience.
7. Self-Organisation: An ANN can create its own organisation or representation of the information it receives during learning time.
8. Performance of neural networks is very good and better on most of the problems. The neural networks can build models that are more complex in the structure of the data in significantly less time
9. 6Neural networks are very flexible in a changing environment. Although neural

10. networks may take some time to learn a sudden drastic change but they are excellent in adapting the constantly change in information.

10.CONCLUSION:

In this paper we discussed about the artificial neural network, working of neural networks, characteristics of ANN, its advantages, limitations and applications of ANN. There are various advantages of ANN over conventional approaches. Depending on the nature of the application and strength of the internal data patterns you can generally expect a network to train quite well.

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.

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