Role of Artificial Neural Network in real life applications

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Abstract : Artificial Neural Network contains a huge no. of neurons that work in harmony to solve particular problems. An Artificial Neural Network is an information processing system that works as our biological nervous systems, such as the brain process all the raw data and give information [1].The unique arrangement of the information processing system is a significant part of this system. Artificial Neural Network is designed for particular applications, such as data classification or recognition of pattern, through learning. In the biological systems learning comprises of adjusting the synaptic connections existing b/w the neurons. It is also true for Artificial Neural Networks. This paper provides an insight into Artificial Neural Network, working & its application and advantages.

Index Terms : Artificial, Neural, applications, input, hidden

I.   INTRODUCTION

The learning from the structure of human brain can be traced back for up to thousands of years. As modern electronics became prevalent, harnessing this thinking process became a desire. In 1943, a neurophysiologist, named Warren McCulloch & a young mathematician, named Walter Pitts had written a paper on the working of the neurons. A simple neural network having electrical circuits was modelled. Neural networks have an extraordinary capability of deriving sense out of imprecise/complicated data & can be utilised to detect and extract trends which go un-noticed, owing to their complexity, by any humans/other computer techniques. A neural network which is trained could be considered as an "expert" to analyse the given information category.

Neural networks go for a different approach to solving a problem than the conventional computers that practice an algorithmic approach which is a set of commands followed by a computer to resolve a problem. The problem cannot be solved unless the computer knows the specific steps it needs to take. In this way, the capability of conventional computers of solving the problem is restricted to the problems we are previously aware of & know how it can be solved. Nonetheless, the computers would have been much more worthwhile if they did things which we do not know just how to be done. The neural networks & the human brain process info in a comparable manner. The network comprises of a huge no. of neurons working to solve a specific problem in parallel. Examples enhance the learning of the neural networks. Their programming is not task specific. If the examples are not carefully chosen, valuable time is wasted as there are chances that the network may have been functioning inaccurately. The disadvantage being that as the network discovers the solution of a problematic situation by itself, its process becomes incalculable. In contrast, the conventional computers practice their cognition to solve the problem. The methods to the solution of the problem need to be known & specified in small clear-cut guidelines. These unambiguous guidelines are further transformed to a program which is in high level language followed by a conversion into a machine code which is understandable by the computer. These machines can be totally predicted; operations go wrong due to either s/w or h/w fault. Conventional algorithmic computers and neural networks are complementary and not in competition. There are tasks that are more suitable to algorithmic approaches such as tasks & arithmetic processes which better suit the neural networks. Further, systems which utilise a mixture of the two methods (usually a neural network is supervised by a conventional computer) in order to achieve maximum efficacy are required to perform a large number of tasks.

II.   Overview of Artificial Neural Network

Dr. Robert Hecht-Nielsen, defined the neural network as follows −

"A computing system made up of a number of simple, highly interconnected processing elements, which process information by their dynamic state response to external inputs."[5]

The Artificial Neural Networks are comparatively unpolished electronic models which are based on the neural structure that of the brain which works cognitively. This brain model even promises a lesser technical method for the development of machine solutions. This modern method of computing offers for a more elegant degradation in the course of system over-load than its conventional counterparts. These naturally inherited techniques are the subsequent major development in technical industry. Currently, even the ordinary animal brain can execute functions which the computers are incapable of. Computers can memorise

stuffs - like performing complex math or keeping ledgers – well, however have trouble associating with simple designs as well as they generalize the patterns of the past and project them as future actions. Currently, advancements in natural researches have promised an early understanding in the usual thinking mechanism. This study demonstrates that the brain stores info in the arrangement of patterns. Certain patterns are very complex & thus give us the capability of individual face recognition by various viewpoints. This procedure of storage of the info as patterns, to utilize them & then to solve the problems incorporates a novel area in computing which doesn't utilize old-style program writing but includes the formation of enormously similar networks & their teaching to resolve particular problems. This area too exploits various arguments from old-style computing like react, perform, learn, forget, self-organize and simplify. The Artificial Neural Network has its structural design moulded after the brain. Basically, it comprises of basic processing components – hundreds of them - wired together in a typical communiqué network. Every node or unit is a basic prototype of a neuron that transmits a new signal on receiving an adequately strong input sign from the different linked nodes.
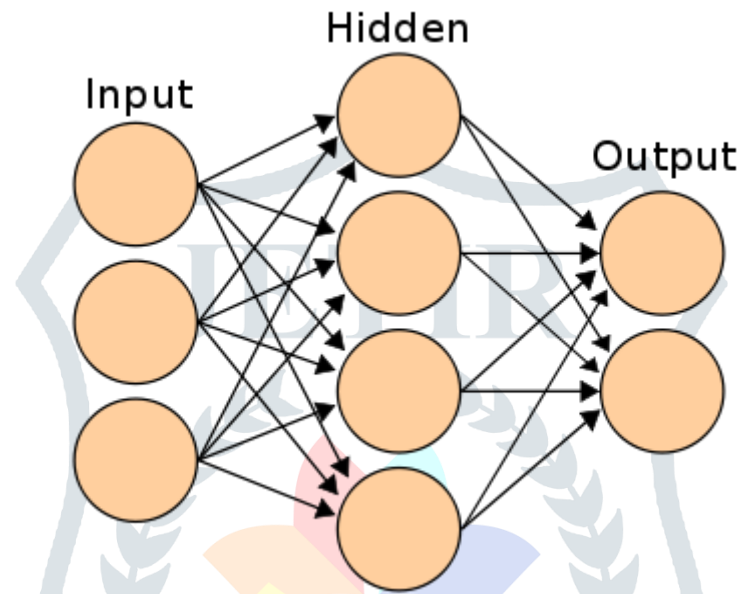

Figure 1: A simple neural network [2]

The linkages between nodes are the most crucial finding in an Artificial Neural Network.Conventionally, neural networks were referred as network of biological neurons but its modern usage frequently referred to Artificial Neural Network which is a computational or mathematical model is an example of information processing & is inspired by the biotic nervous system. Artificial Neural Network consists of interlocking artificial neurons that are encoded to imitate the properties of living neurons that work in harmony to resolve particular problems. Artificial Neural Network is constructed to solve AI issues without creation of any prototype of biological system. Artificial Neural Network is utilised for analysing image, recognising speech, adapting control etc. Learning processes, like learning in human anatomy, which requires the adjustment b/w neurons via synaptic connection are used to execute these applications. Similar may happen in the case of Artificial Neural Network.

III.　　How Artificial Neural Network works:

The art of making use of the neural networks revolves around the numerous ways in which the clustering of the neurons can be individually done. Information is dealt with in a self-organizing, dynamic and interactive way accompanied by the clustering that occurs in the human mind. Biologically, neural networks are built from microscopic elements in a three-dimensional sphere. The neurons are capable of nearly unobstructed interlinking. Incorporated circuits, that use the present technology, are two-dimensional devices with restricted nos. of interlocking layers. This physical reality restricts scope & kind of Artificial Neural Network s that could be applied in silicon. Presently, neural networks are basically the clusters of the primitive non-natural neurons. These cluster occurring by the creation of the layers which are connected to one another then. The connecting way of these layers is a fragment to solve the problems of the engineering networks.
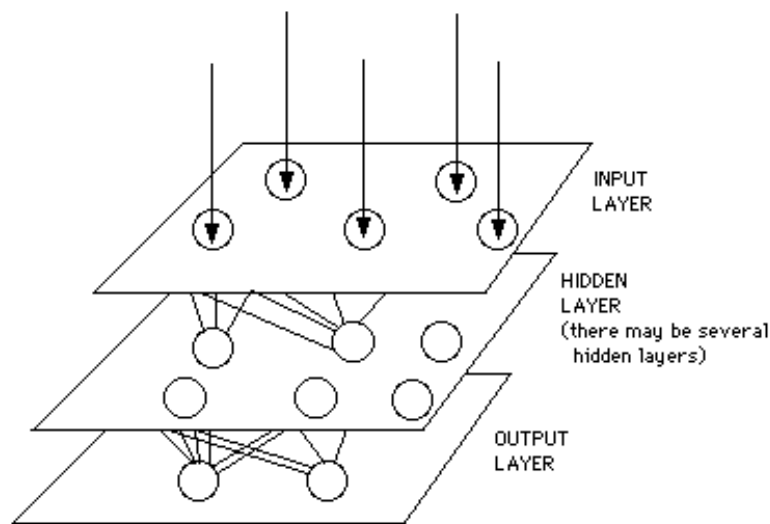
Figure 2: A Basic Diagram of Neural Network[3].

The above figure shows that Artificial Neural Networks have an identical topology. In this structure, various neurons associate to receive inputs of the actual world. The output may be in specific character which the network believes that it has skimmed or the specific spitting image it considers is been seen. Rest of the neurons are concealed from outlook. Currently, the brains of the snails are even known to be designed devices. Creation of layers of elements is one of the simplest methods to project an arrangement. A functional neural network comprises of the combination of such neurons in layers, the synopsis & the links b/w such layers & its functions of transfer. Though useful networks remain present which consist of only a single layer, or maybe even a single element, maximum applications need networks having as a minimum three normal categories of layers that are- the input layer, the hidden layer & the output layer. Electronic devices in the real-time apps send data to the layers present in the input neurons. The outer world, the secondary computer procedure or additional devices for instance the mechanical control systems directly receive information from the output layer. Many hidden layers exist between these two layers. The internal layers consist of many neurons in numerous interlinking arrangements. The hidden neurons have input & output that basically go to the further neurons. In most of the networks, every neuron which is present in the hidden layer that accepts the indications from all the neurons from the layer which is above it. Afterwards a neuron exhibits its functionalities; it transmits the o/p to every neuron present in the layer below the current level, provided that for a Feedforward pathway to the o/p.

The lines of communication provide varied strength to an i/p. These connections are of two kinds: One that reasons the summing feature of the following neuron to enhance and the extra that reasons it to deduct. In other words, the former stimulates while the latter constrains. In certain networks, some neurons inhibit the others in the similar layer. Thus, it is known as lateral inhibition. It is used in the output layer most frequently. For e.g.: while recognising text, if .85 is the likelihood of a character to be a "P" and that to be "F" is .65, the network will tend to select the highest possibility while inhibiting others. Lateral inhibition helps to do that. Feedback is a different kind of association. Here, the o/p of any layer is routed back to the preceding layer. The figure below demonstrates this process.
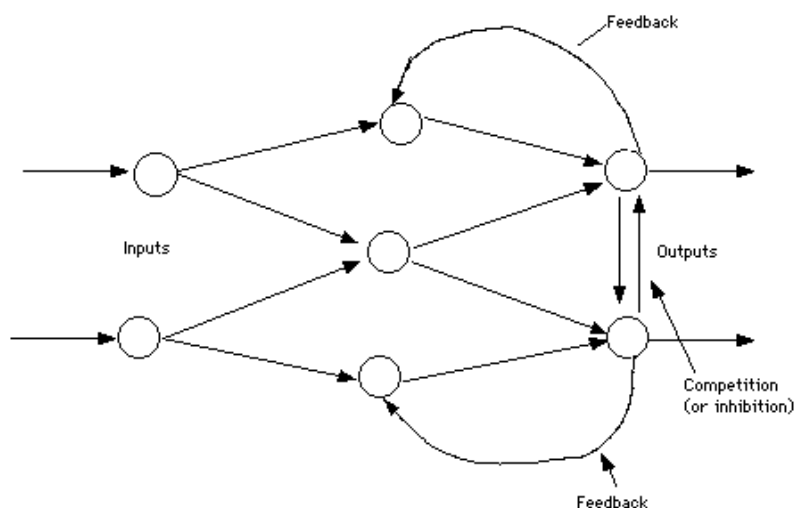
Figure 3: A Simplified Network with Feedback &Competition[1].

The way of interlinking of the neurons with one another has a great significance over the operation of the network. On a wider level, the users are permitted to control, add & delete these associates by more professional software at their will.

IV.   Various Applications of Artificial Neural Network:

Numerous real time applications of Artificial Neural Networks are listed below:

1.These days handwriting recognition has become very popular. Neural network can be used to recognize handwritten symbols and characters. Neural Network plays an important role in image compression.
2.Waving the hand to answer an incoming call while driving. Simple hand motions - lean back, not needing to shift the device - would enable us to control the volume or skip songs on our media player.
3.Modelling & time series prediction together with regression analysis or function approximation.
4.Arrangement, including sequence & pattern recognition, sequential decision making & novelty detection.
5. Data processing, including compression, blind signal separation, clustering & filtering.

As we described, artificial neural networks have many applications such as character recognition ,language generation, speech recognition and machine translation etc.

V.   Advantages of artificial Neural Network:

This section describes various advantages of Artificial Neural network :

1. Real Time Operation refers to the computations of the ANN that are carried out correspondingly & those special h/w devices are been made & manufactured to gain benefit of this ability.
2. Self-Organisation is the characteristic feature of an ANN which creates its own demonstration or organisation of the learning time info received.
3. Learning has played a key role in the development of this system and not programming. The analyst is freed as the teaching of various patterns in the provided data is done by the artificial neural network themselves
4. An influential method for attaching the info in the data & generalizing it is termed as pattern recognition. Neural nets study to recognize the patterns that are present in the data set.
5. Even in a changing environment, neural networks are flexible. Though the neural networks might take a certain time in learning drastic unexpected changes, they excellently adapt to the ever changing information.
6. When a conventional approach fails, neural networks build informative models as they single-handedly process even complex interactions & simply prototype data that is too tough with old-style methodologies such as programming logic or inferential data.
7Adaptive learning is the ability that enables us to acquire how to perform tasks which are based on the given information for the initial experience or training.
8. Neural networks' performance is as good as model of classical statistics to the minimum, & better on most problems. Models which are more thoughtful of the data's construction are built in considerably less time by the neural networks.

Thus we can conclude that artificial neural network is very useful model and the Artificial neural network could be applied in machine –learning and problem-solving[4].

VI.   Conclusion

This paper have discussed about the Artificial Neural Network, applications and its various advantages over conventional approaches. Currently, neural networks are a topic of discussions everywhere. Analytical alternatives to conventional techniques are provided by ANNs which mostly are limited by variable independence, linearity, strict assumptions of normality, etc.

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