Role of Artificial Neural Network in an Intelligent Educational System

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Abstract— Artificial Neural Network (ANN) is an important part of the artificial brain. This study presents the promise of artificial neural network in development of artificial brain and controls intelligent educational systems. Some important factors that may influence the performance of artificial neural network are outlined in this research paper. Moreover, applications of a variety of neural network architectures in intelligent educational systems are surveyed. Further an attempt has been made to explore the relations between the fields of natural science and neural networks in a unified presentation.

Keywords—Artificial Neural Network, Intelligent Educational System, Intelligent Technology

I. INTRODUCTION

Education plays an important part in our life and usage of advanced technologies update the educational system. Technologies are widely used in today's education system. Unfortunately, it is not practiced utilizing latest technological devices as replacement of old educational methodologies. Today's educational system including faculties and students for teaching and learning, use methods just opposite to ancient methods of teaching because of all graphical presentations. AI learning systems have many intelligent tools for providing the best environment for students for better learning and faculties can also use them for improving course contents and dealing with complex topics. Therefore, by exploring the capabilities of these technologies, different components of learning can be implemented [1].

In present scenario, our education system uses many latest technicalities like artificial intelligence and computer graphics. It is important that the instructors provide students a kind of environment where the students get a chance to understand the importance of technologies and utilize effectively for educational activities and personal growth. In this modern era, education system uses high technologies like some expert systems, knowledge base systems, neural networking for making artificial brain and genetic algorithms for solving complex problems etc. Mainly artificial intelligence is the need of modern education system [3]. The development of a wide range of educational tools is looking forward to the concept of artificial intelligence. Intelligent tools can be operated by the human or in a self-operating mode without external instructions.

II. ARTIFICIAL NEURAL NETWORK

Artificial Neural Network is an interconnected network of artificial neurons, which is known as Perceptron. This is a knowledge-processing unit of intelligent systems that works in an intelligent machine like human brain working in a human body. Artificial neural network is a basic knowledge or information-processing unit in an intelligent system. AI neurons are connected to each other and also work in the same manner as biological neurons. Computational scientists, United Nations agency work with such systems, typically assume that they are oversimplified versions of the neural systems inside our brains [2].

The intelligent technology neural network is a human brain based computational technology with certain human-like abilities. In this intelligent technology mathematical functions are modelled as a set of artificial neurons in a computerized network of the brain. All nodes are connected to each other and every connection is defined with a weight. When a node gets any input then that input is multiplied by a defined weight of connection. The given mathematical function is performed now by internal nodes upon the sum that getting from inputs and then providing an output, which received by other nodes as inputs. In a neural network structure, the level of internal nodes can be one or more than one and these levels are connected to each other whereas the final level of internal nodes is connected from nodes of output level. In the term of weight, the flexibility is given by artificial neural network because of it performs a function to fit as a set of data. Within the brain, neurons work as nodes. The add of neuron's inputs is understood as hearth primarily based upon and knowledge is kept by ever-changing the

strength of connections between all neurons out there in a network, that is the brain's analogy of adjusting the weights of connections in the neural network. Neural network algorithms could also be at work while not our acutely aware information within the brain.

In practical applications, neural networks have been found very useful. After we check a number of these applications, it's clear that the hardware within the brain is over enough for playing those operations that we would commonly classify as "computations". The question raise about performing complex mathematical problems using neural network's processing power. The intelligent neural network system has some important functions to classify events as signal and background. The provided function is to taking inputs in the form of variables for handling some energy deposits event of processing and output is estimated from probability distributions to providing an output level of nodes. To judge this process, the network undergoes from a specific coaching amount, during this amount one feeds during a sample of background events and a sample of signal events. The neural network adjusts the weights of its various connections using the training samples and making an attempt to search out the weights that correspond to the most effective work between the process and knowledge. All these nodes like input nodes, internal nodes, and output nodes process knowledge for solving educational problems using mathematical calculations of input signals and weight of connections. So the neural network has an important space in intelligent systems.

III. REVIEW OF RELATED WORK

Artificial neural networking is frequently used with intelligent technologies. Some of intelligent technologies are broadly used to handle educational activities. The modern work concentrates on the event and establishment of each method within the framework. Primarily the try out area unit supported the models of neural network and conjointly the rightness of the model of prediction, is defined with increase. Therefore it's potential that the recommendation system can offer a useful facility for the management system of university, counsellors of courses, students and academic employees. It can become a part of management to control every situation. The projected system also will support Student Relationship Management methods among the non-public universities [4,5].

An intelligent system with neural networking is able to perform "intelligent" tasks almost like those implemented by the human brain. This study discusses a brand new criterion of machine-driven paper assessment exploitation neural network method. Within the projected system, a learner has to try the queries in a prescribed format exclusively then exploitation computers' papers will be evaluated outright by

exploitation information Server and this data server is then connected to real servers that contains information concerning all the themes organized in a very specific way. So the information is organized in a specific way in the server. Finally the decided questions are asked by intelligent system from each student according to their specialization by conducting an exam. It can be used in examination systems for conduction of exams accurately, without wasting paper [8,9].

IV. RELATION TO EACH OTHER OF ARTIFICIAL NEURAL NETWORKS & THE NATURAL BRAIN

The term neural network is conceptually structured on the basis of human brain metaphor that consists of a lot of neurons and they are interconnected with each other broadly. The main part of the brain is the neuron for wisdom and handling of the nervous system. Signals are treated as electrochemical pulses; they pass from one neuron to another. An artificial neural net is developed with an artificial representation of the natural intelligence of a human brain that tries to simulate its learning process. There is no comparison between human brain and artificial brain on the issues of memory. Neural networks are much better and faster than humans.

The Human Brain
We know that every brain works using neurons because the nervous system is fully controlled by these small entities. A natural brain has 10 to 500 billion (around) neurons and each neuron is linked with other neurons in a large amount (about 1000 on average). According to biological theory, a neuron consists of dendrites, axons, soma and myelin sheath.
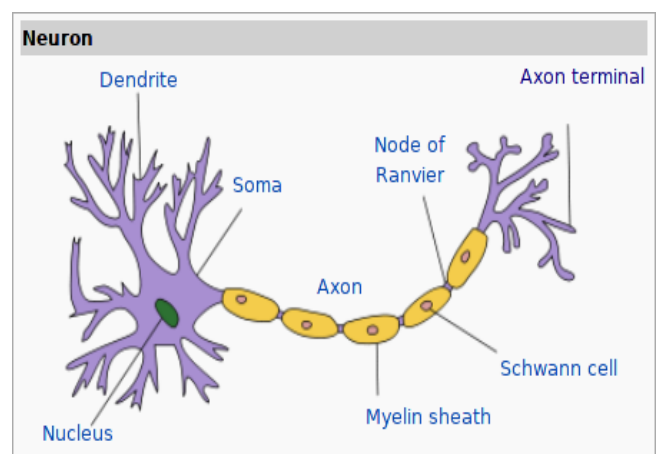

Figure 1– Components of a neuron

All parts of a neuron play a vital role in processing data, such as an output part of a neuron known, as axons will connect to an input part of other neurons known as dendrites.

By using strength of the synapse, signal's strength can be modified easily which is called the process of brain learning. All neurons follow an arrangement to connect each other and perform processing. This arrangement is a layered structure and in this structure starting layers are used for getting input using different sense organs and the terminating layers which provide outputs.
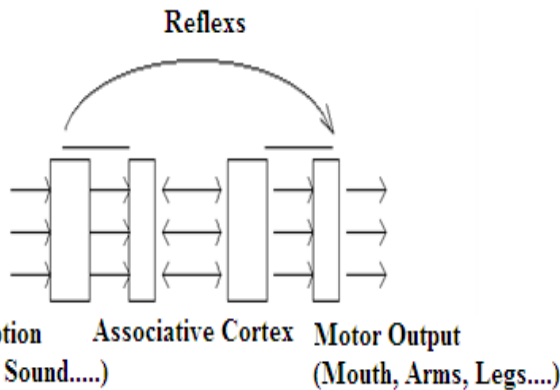

Figure 2 – Levels of neural network system

The middle layers are also known as hidden layers that play a vital role in understanding and knowledge processing. All these layers build neural network for process information and knowledge [7].

By the Human Neurons to Artificial Neurons
Firstly an attempt has been made to understand the necessary features of a natural neuron and their procedure of interconnections for conducting a network of artificial neurons. A computer must be programmed to simulate these features properly because there is limited knowledge of neurons and computing power. The models are designed on the basis of idealizations of real networks of neurons to develop an artificial brain.
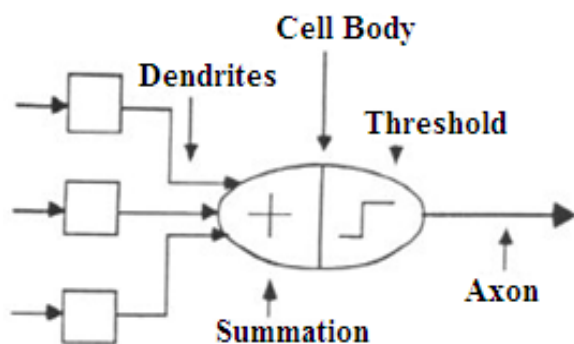

Figure 3– The neuron model

This model of an artificial neuron is designed using the concept of the biological neuron to process information intelligently. These kinds of neurons perform some specific tasks of transmitting signals to the brain from sensory or motor organs in a neural network. Multiple neurons of a neural network transmit data for a specific purpose.

An Artificial Brain
A collection of many simple and highly connected Perceptron (Artificial Neurons) is called an artificial neural network. All neurons are linked with each other by links assigned a particular weight to pass signals from one neuron to another neuron. The first model of an artificial neuron presented in 1942 by McCulloch and Pitts that is still the base of many networks today [7].

The model is consisted of:
- Group of inputs connections known as dendrites
- Group of variable resistances known as synapses
- Processing element is known as neuron
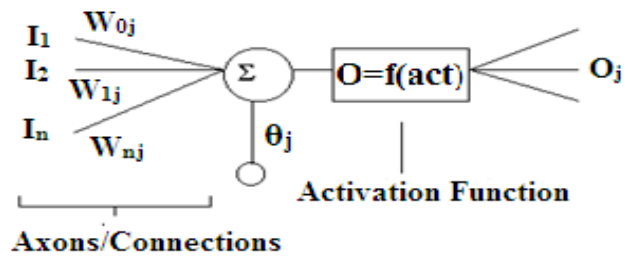- An output connection is known as axon

Figure 4– Model of an artificial brain

- Input set- (I_1, I_2, I_n)
- Variable resistances - (W_0, W_1, W_n)
- Main element of processing - (summation and activation)
- Output unit - (O_j)

The main cell body of neuron consists of:
- A summation component works to find the addition of all input signals of the neuron.
- The results of the summation can be modified by the transfer function (activation function) before sending it to the single output.

The transfer functions or activation functions are properly utilized in elements, processed in large numbers and a few of these are found of practical use. A transfer function can be treated as a logic gate of electronics [6].
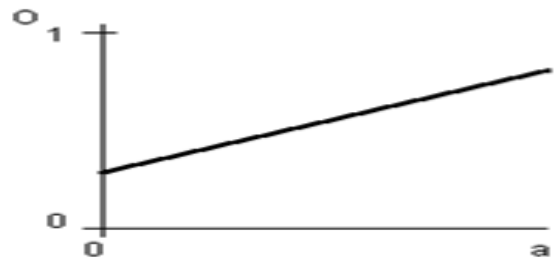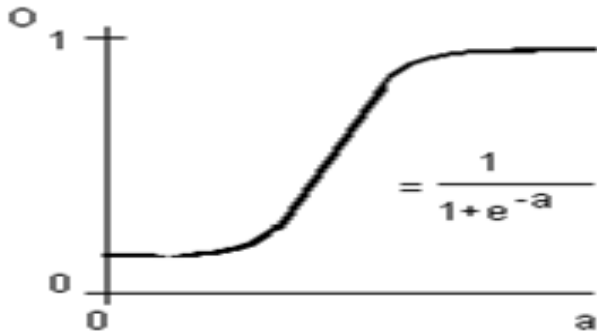

Figure 5 – Linear function
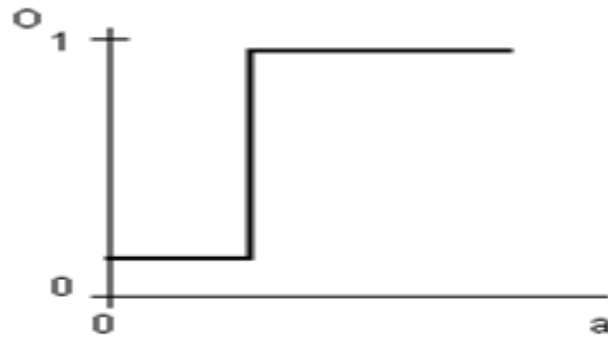
Figure 6 – Semi-linear function

$$= \frac{1}{1+e^{-a}}$$

Figure 7 – Nonlinear function

Figure 8– Computation Function

$$A_j = f\left\{ \sum_{i=j}^{N} W_{ij}A_i + \theta_j \right\}$$

Every connection of neuron assigns a weight and an input-output function that play a vital role in the processing of an artificial neural network. This function has three usual categories, such as linear, threshold and sigmoid [6].

First, for the linear units, the activity of neurons in form of output and the total weighted output is proportional to each other.

In the threshold entities, initially, the output is divided into two separate levels, they depend on comprising the amount of total input which is less than or greater than some threshold value.

In the case of sigmoid units, the output occurs continuously but not in linear form due to the changes of input.

To make a network of artificial neurons which ought to perform some specific tasks, we have a tendency to select however the units square measure connected to at least one another as a result of it's abundant vital for style of a network, and that we should set the weights on the connections fittingly for hard outputs. The connections verify whether it's doable or not for one unit to influence another. The weights specifically rely on the strength of the influence.

According to these functions, the characteristics of both networks are common that can be artificial neural network or biological neural networks. The most advanced neural network has an ability of computation performed parallel. It supports self-organization process to changing environment and intelligent information processing functions [6].

V. HOW NEURAL NETWORKS LEARN?

Artificial neural networks are combinations of interconnected neurons like biological nervous system. A modifiable weight is associated with each connection of neurons in the network and useful for defining the function of the synapse. The pattern of incoming activities is converted by every neuron and this pattern receives into a single outgoing activity. This output broadcasts to all other neurons. This task of conversion is performed in two stages:

1. In the first stage of this process, the multiplication of each incoming activity and the weight of the connection are performed and then found the addition of all weighted inputs to get the total input.
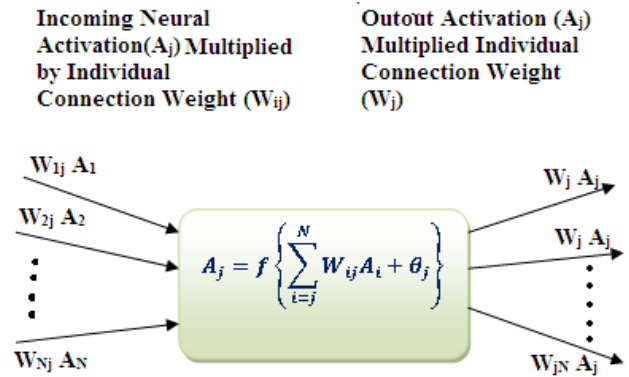2. In the second stage of this process, the total input is transformed into output using an input-output function.

VI. CONCLUSION

According to this study and research, we discovered that the artificial neural network can do work successfully in the same way as the human brain can do in terms of achieving quality education. Artificial neural network and human brain are purely related to each other in terms of knowledge processing. A model of an artificial neuron is presented on the basis of natural neuron, because an artificial neuron works on the strategy of the natural neuron for developing a perfect network of neurons to processing knowledge intelligently. This paper proves that artificial neural network is a perfect knowledge processing technology that has the ability to develop an intelligent educational system and further provides a platform for future scholars to research more in this area.

VII.   FUTURE REFERENCE

Intelligent evaluation systems can be developed for handling examination related activities. At present we have some systems for evaluation of objective type papers using OMR technology. We can think about the development of a new evaluation system for subjective type papers using intelligence technologies for extracting authentic results in examinations. It is a real need of today's education system because there are many boards and universities; which are not able to provide result on time and different examiners apply their own methods of evaluating and marking, therefore accuracy can't be expected. It would be very helpful in result preparation moreover, unbiased and accurate results can be derived using AI based system.

REFEFENCE

[1]   S. Drigas, and R. Ioannidou, *"A Review on Artificial Intelligence in Special Education"*, M.D. Lytras et al. (Eds.): WSKS-2011, CCIS 278, pp. 385–391, 2011.

[2]   A.K. Gupta, S. Gupta, *"Neural Network through Face Recognition"* International Journal of Scientific Research in Computer Science and Engineering, Vol.6, Issue.2, pp.38-40, 2018.

[3]   M. Ziaaddini, and A. Tahmasb *"Artificial Intelligence Handling through Teaching and Learning Processandit's Effecton Science-based Economy",* International Journal on Soft Computing, Artificial Intelligence and Applications (IJSCAI), Vol.3, No. 1, 2014.

[4]   S. Athanasios, R. Ioannidou, *"Artificial Intelligence in Special Education: A Decade Review"*, International Journal of Engineering Education Vol. 28, No. 6, pp. 1366–1372, 2012.

[5]   K. Kumar, M. Thakur, *"Advanced Applications of Neural Networks and Artificial Intelligence: A Review"*, I.J. Information Technology and Computer Science, vol. 6, pp. 57-68, 2012.

[6]   A.Yadav, V.K. Harit, "*Fault Identification in Sub-Station by Using Neuro-Fuzzy Technique"* International Journal of Scientific Research in Computer Science and Engineering, Vol.4, Issue.6, pp.1-7, 2016.

[7]   O. Awodele, O. Jegede*, "Neural Networks and Its Application in Engineering"*, Proceedings of Informing Science & IT Education Conference (InSITE) 2009.

[8]   Chahar, R., Agarwal, A., Malhotra, V., Jain, R. and Chandiok, A. (2013), "Intelligent Online Education Transformation System", IJCSI International Journal of Computer Science Issues, Vol. 10, Issue 2, No 2, pp. 438 - 444, 2013.

[9]   H. Chen, *"Machine Learning for Information Retrieval: Neural Networks, Symbolic Learning, and Genetic Algorithms"*, Journal of the American Society for Information Science, 1995-04, Vol.46, Issue-3, pp. 194-216, 2004.

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