

International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)

International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal

Volume 3, Issue 4, June 2023

# **Research Study on Artificial Neural Network**

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**Abstract:** The artificial neural network, which has been widely used in a wide range of applications over the past few decades, may very well be the end-all solution. An artificial neural network (ANN) is a paradigm for processing information that draws inspiration from how biological nerve systems, like the brain, carry out information processing. The unique structure of the information processing system is the fundamental component of this paradigm. It is made up of several, intricately linked processing units called neurons that cooperate to address particular issues. This paper presents a framework for developing new neural network models using artificial neural networks that is ideal for issue formulation.

Keywords: Artificial Neural Network, Neurons, Artificial Intelligence.

# I. INTRODUCTION

Artificial neural networks are rather straightforward reproductions of the neural architecture of the human brain. A significant advancement in the optimisation computing technology is the use of biological computing methods. When neurophysiologist Warren McCulloch and a young mathematician named Walter Pitts published a paper on the potential functions of neurons in 1943, it was the first step towards the development of artificial neural networks. They used electrical circuits to model a straightforward neural network. Neural networks can be used to extract patterns and detect trends from data that is too complex for people or other computer techniques to notice. Neural networks (ANN) is a subfield of Artificial Intelligence (AI), a branch of computer science concerned with improving the intelligence of computers. Artificial neural networks (ANN) process data, show some intelligence, and behave within predetermined limits.

Through an activation, it receives a collection of weighted inputs and generates output function. The output of the neural network is represented by the output layer. What is the process of neural network technology? Neural network technology relies on a sequence of many different processors operating together and in parallel as opposed to the conventional approach of computation using a central processing unit. They are made up of several groups of nodes (also known as "neurons"), each of which is programmed to recognise patterns, decipher data, and respond to stimuli— or, in some cases, even start activity autonomously. These "neurons" are frequently arranged in increasing knowledge layers, with one layer feeding into another to carry out more challenging tasks. A "feed forward" system is one in which one level of "neurons" feeds the following.

Fuzzy logic, Bayesian approaches, and gradient-based training are just a few of the cutting-edge technological ideas that are used in the neural networking process.

# **II. APPLICATION OF ANN**

- Artificial neural network applications are helpful in system modelling, such as in the implementation of complex mapping and system identification.
- They have been utilised in the field of solar energy for modelling and design of a solar steamgenerating plant.
- ANN are used to calculate the local concentration ratio, intercept factor for parabolic trough collectors, and heating loads of buildings.
- ANN are employed in a variety of fields, including signal processing, control, robotics, pattern recognition, forecasting, manufacturing, medical, power systems, and social and psychological sciences.
- They have also been used to forecast energy consumption of solar buildings as well as air flows in a naturally ventilated test room.

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DOI: 10.48175/IJARSCT-11549



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# III. ADVANTAGES OF ANN

- A linear programme cannot execute tasks that a neural network can.
- Due to the neural network's parallel structure, it can function even when one of its components fails.
- Because a neural network self-learns, it does not require programming.
- Neural networks are strong and great at addressing complicated problems because they are adaptive, intelligent systems, and they can be easily deployed without any issues.

Scientists concur that employing ANNs has more benefits than disadvantages because they are effective at programming.

# IV. TYPES OF ANN

Perceptron –Perceptron model, proposed by Minsky-Papert is one of the simplest and oldest models of Neuron. It is the smallest unit of neural network that does certain computations to detect features orbusiness intelligence in the input data.



Fig.1. Perceptron neural network

# Feed Forward Neural Network-

The simplest form of neural networks where input data travels in one direction only, passing through artificial neural nodes and exiting through output nodes. Where hidden layers may or may not be present input and output layers are present there.



Fig.2 Feed Forward Neural Network

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### Multilayer Perceptron -

A point of entry into more intricate neural networks where incoming data is routed through many artificial neuronal layers. Every node is interconnected. It is a completely linked neural network since all neurons in the next layer are connected to it. There are input and output layers with various hidden layers.



Fig.3 Multilayer Perceptron neural network

# Convolutional Neural Network -

The layout of neurons in a convolution neural network is in three dimensions rather than the typical array of two dimensions. Convolutional layer refers to the top layer. Only a small portion of the visual field is processed by each neuron in the convolutional layer. Like a filter, input features are taken in batches.



Fig.4 Convolutional neural network

# V. ALGORITHM

**There are many algorithms in ANN some of them are listed below:** Training Algorithm for Single Output Training Algorithm for Multiple Output

- Adaptive Linear Neuron
  Multiple Adaptive Linear Neurons
  Back Propagation Neural Networks
- Generalized Delta Learning Rule Dragonfly neural network Pulsed neural networks

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In the phrase "artificial neural network," the word "network" refers to the connections that exist between the neurons in the many layers of each system. A model system consists of three layers. Input neurons in the first layer communicate with second-layer neurons via synapses before communicating with output neurons in the third layer via additional synapses. More layers of neurons will be present in more complicated systems, with some having more layers of input and output neurons. The "weights" that are stored in the synapses are variables that control how the calculations treat the data.

Typically, three different sorts of parameters characterize an ANN:

- 1. The way that the various neuronal layers are connected.
- 2. The process of adjusting the connectivity weights through learning.
- 3. The activation process that transforms a neuron's weighted input into its activation at the output.

# VI. CONCLUSION

The ANN is a highly helpful model that may be used in machine learning and problem-solving. The Neural Network has a lot to offer the world of computers. Because they can learn by doing, they are incredibly adaptable and powerful. Therefore, it is crucial to comprehend the Neural Network's potential as well as its limitations in order to utilise it for various challenges in the best way possible. Please feel free to contact us if you have any questions about artificial neural network applications. We'll be happy to address them.

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