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STUDY OF ARTIFICIAL NEURAL NETWORK

Miss. Bangar Amruta

(MSc(CS), Department of Computer Science, Savitribai Phule Pune University, Maharashtra)

Prof. Sonali Doifode

(Research Scholar, Department of Computer Science, JJTU, Rajasthan)

Bangar Amruta Ramesh

Sarhad College of Arts, Commerce and Science, Katraj, Pune

Abstract:

A subfield of machine learning is Artificial Neural Networks (ANN). This algorithm is based on the neural network of the human brain. An Artificial Neural Network is made up of a number of connected nodes that act as information carriers. Recently, artificial neural networks with artificial neurons that behave and perform like actual neurons were introduced. They are employed for a variety of tasks that a human brain may perform, including speech, hearing, reorganization, pattern-spotting, and storing knowledge. This is not the case for any artificial networking because these neural networks were combined and dynamically self-assembled. To tackle the issue, these neurons cooperate in clusters and divide it into smaller components. Engineering skill is required to make them, which are arranged in layers, solve issues in the actual world. The connections between the neurons are crucial because they serve as the system's glue during the excitation-inhibition process, in which one neuron is excited while the other is inhibited as in subtraction-addition operations. During training, this network controls the connections. The issues are identified and resolved by this ANN. This paper provides an overview of an Artificial Neural Network. Additionally, applications and types are explained in this research article.

Key Word *: Artificial Neural Network, Neurons.*

Introduction:

New methods and computational methodologies for machine learning, knowledge demonstration, and ultimately the application of acquired information to maximize the output responses of complex systems are called artificial neural networks (ANNs), sometimes known as neural networks. The idea of biological neural networks in the human brain gave rise to artificial neural networks (ANN), which are algorithms based on brain activity. An effort to simulate how the human brain functions resulting in the creation of ANN. Although they don't operate exactly same, biological neural networks and ANNs have many similarities. The ANN algorithm would only accept input from structured, numeric data. Many industry professionals believe that artificial neural networks offer the best and probably the only chance to create an intelligent machine. The ANNs are used to identify patterns and

find trends that are challenging for people and conventional computer techniques since they have the outstanding capacity to extract meaning from complex or ambiguous data. This is because, in contrast to typical computers, neural networks take a unique approach to problem-solving. Traditional computing employs an algorithmic and cognitive approach, which implies that in order for the computer to solve a problem, it must follow a specific set of instructions, in contrast to neural networks.

The neural network is made up of tightly coupled processing components that cooperate in parallel to get an answer. Conventional computing and neural networks are complementary rather than rival technologies. Adaptive learning, self-organization, and real-time processing are the main characteristics of ANN.

- Adaptive learning :- The capacity to learn how to perform activities using training or firsthand experience as the basis for instruction.
- Self-organization :- An ANN can organize or represent the data it receives during learning period however it sees fit.
- Real-time processing:- Parallel ANN computations are possible, and specialized hardware is being developed and produced to take use of this potential.

Objectives:
- To create a system that can carry out numerous computations more quickly than current systems. These activities include of data clustering, approximation, optimization, and pattern recognition and classification.
- The Artificial neural networks are designed by using sound mathematical principles, not by the magic.
- Recognize the meaning of the term "artificial neural networks" (ANN).

- Learn how biological & artificial neural networks differ and overlap.
- Learn about the many artificial neural network kinds.

What is Artificial Neural Network?

A system based on the functioning of biological neural networks, or an imitation of a biological brain system, is called an artificial neural network. In simple terms, experience is how the brain learns. It is an example of how small, energy-efficient packages can effectively solve some issues that are beyond the capabilities of modern processors. Additionally, this brain modeling provides a less technical approach to creating mechanical solutions. In comparison to its more conventional counterparts, this novel method of computing also offers a more gradual deterioration amid system overload. The next significant development in the computing field is anticipated to be these biologically inspired computer techniques. Simple animal brains can perform tasks that are currently beyond the capabilities of computers.

Artificial neurons, are frequently referred as a units, they are found in artificial neural networks. These units, which are arranged in various levels, make up the full Artificial Neural Network in a system. Whether a layer includes a dozen units or millions of units depends on how the complex neural networks will be utilized to understand the hidden patterns in the dataset. In addition to input and output layers, artificial neural networks usually incorporate hidden layers as well. The input layer receives data from the external environment that the neural network needs to interpret or learn. This data is then changed into relevant information for the output layer after traveling through one or more hidden layers. The output layer, which produces an output in the form of an artificial neural network's reaction to input data, is the last but not least.

In the majority of neural networks, units are connected to one another from one layer to another. The weights

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in each of these linkages regulate how much one unit influences another. The neural network learns more and more about the data as it moves from one unit to another, eventually generating an output from the output layer.

Artificial neural networks are built with neuron nodes connected in a web-like pattern, just like the human brain. The brain is made up of neuron cells, which number in the billions. The cell body that makes up

each neuron processes information by sending it to and from the brain. Such networks' central concept is (to some extent) modeled after how the biological nervous system functions, which involves processing data and information to facilitate learning and knowledge creation. The creation of new structures for the information processing system is the main component of this concept.

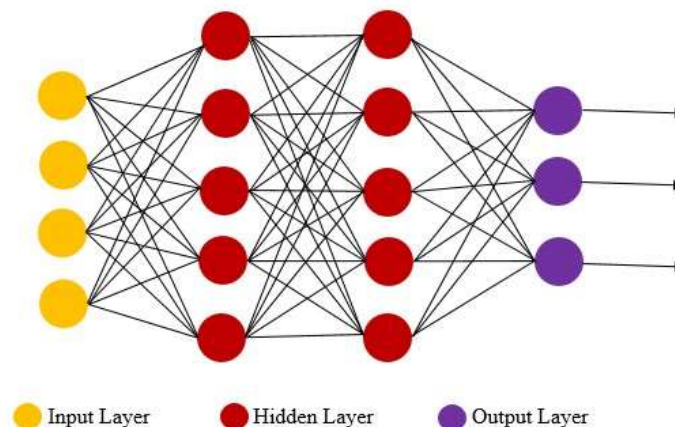**Figure 1 illustrates the construction of an artificial neural network.**

Figure 1 : Artificial Neural Network Architecture

Types of Artificial Neural Network:

Feedforword Neural Network: -This feedforward neural network is one of the most simple artificial neural networks. This ANN takes data or input that only flows in one direction. It enters the ANN with the input layer and leaves through the output layer, though layers that are hidden may or may not exist. This feedforward neural network frequently has just frontal propagation and absence of back propagation as a result.

Convolutional Neural Network: - The feed-forward neural network, in which the connections between units contain weights that indicate the influence of one unit on a different unit, and the convolutional neural network share several characteristics. However, an CNN system has one or more convolutional layers that perform a convolution process on the input before passing the final output to the following layer.

Applications for voice and visual processing using CNN are particularly useful for computer vision.

Modular neural Network :- This modular neural network consists of numerous discrete neural networks, each of which functions independently to provide the desired outcome without interfering with one another. Each of the multiple neural networks conducts a particular sub-task by obtaining unique inputs from other networks. By dividing a large and complex computational operation into smaller components, the modular neural network can minimize complexity while still generating the necessary result.

Radial basis function Neural Network :- Radial basis operations account for the difference between the point and its center. RBF functions have two levels. After converting the input through each radial basis function at the first layer of the hidden

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layer, the output layer computes the result. In order to model the data which represents any basic trend or function, radial basis function networks are typically used.

Applications of Artificial Neural Network

Facial Recognition :- ANN is helpful in developing surveillance systems that use facial recognition. These algorithms compare digital photos to the human face then match it. Systems using artificial neural networks may validate a human face and compare it to a database's ID list. A neural network is trained using a large number of photos, and the model optimizes the data for precise recognition.

Social Media :- Social media networks can utilize ANN to monitor user behaviour and analyse the information exchanged during virtual discussions, which has a variety of uses. The user's favourite page, interactions, and bookmarked choices are a few examples of inputs that assist in training the artificial neural network (ANN) model. Social media networks can analyse user data and forecast preferences with the use of these models.

Stock Market Prediction :- It can be quite difficult to foresee future developments in the stock exchange because it can be so volatile. Using multilayer perception, or MLP, which consists of numerous layers of completely connected nodes, the appearance of bullish and negative phases has become somewhat more predictable. When creating ANN models to increase forecast accuracy, organizations incorporate the stock's historical performance or annual returns.

Literature Review

Dr. Vinay (May 2023) :- The ANN model has been trained and validated. A dependable and precise model for determining whether groundwater is suitable for irrigation was created using the L-M 3-layer propagation backward approach. The study suggested using the created ANN models for early water quality pollution detection by local authorities; however, it failed to discuss the practical ramifications of establishing such a system, such as the requisite infrastructure and resources.

Mayuri Thorat (Dec. 2022) :- An ANN is trained for a particular application, such as pattern recognition or data classification, using a learning process. ANNs also fit within this category. An overview of artificial neural networks (ANN), its operation, and training is given in this study. In this paper, the authors describe the operation of artificial neural networks (ANNs) as well as the training phases of an ANN. They are commonly used to simulate specific elements of living organizations and investigate the inner workings of the brain.

Roza Dastres (March 2021) :-A computation technique called artificial neural networks creates a number of computing units based on connected connections. It is a component of a system of computers that simulates the data analysis and processing operations of the human brain. The size of the model's adjustments to account for mistakes in each observation depends on the learning rate. While a slow rate of learning requires more time but could result in greater accuracy overall, a rapid rate of learning cuts training time but increases overall accuracy.

Dr. S. Smys (2020) :- The suggested solution employs artificial neural networks for controlling the electricity of the street lighting. The findings of the method's evaluation point to improved power management and lower power consumption in street lights. In the paper, a smart street lighting system based on ANNs is proposed. The program can be used in conjunction with a comprehensive observing and regulating system for street lighting, which is the focus of larger assignments.

S. Walczak (2019) :- It has been highlighted that training data costs ANN systems money. This cost affects the amount of time and effort spent on development in addition to its financial aspect. The "best" performing backwards trained neural network

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models for forecasting are routinely produced with only one or two years of training data. Researchers and practitioners of neural networks are now able to create the highest-quality economic time-series forecasting algorithms in the shortest possible period of time and for the least amount of money thanks to the presented method for determining the smallest training set size required for optimal performance.

Aman Jantan (November2018) :- The study discovered that artificial neural networks with feedforward and feedback transmission are more effective when used to solve human problems. It's interesting to learn how neural network analysis of information increases volume, performance, accuracy, fault tolerance, processing speed, latency, and scalability. In turn, the ANN analytics aid in overcoming obstacles and reducing any potential hazards.

SM Bohte (2017) :- Artificial neural networks (ANN) may utilize spiking neurons-based models, which are more physiologically plausible, or rate-based models, which are utilized in AI. A renaissance of neural networks is changing AI and revealing fresh information about how biological systems use neural computing. The articles in the current issue reveal new developments with neural networks that raise their biological plausibility or effectiveness. In the years to come, it is anticipated that increased collaboration between the communities of AI and neuroscience will provide a number of additional theoretical and practical achievements.

Conclusion:

In this paper, we examined how artificial neural networks (ANNs) function. Also an ANN's applications, architecture. You may typically anticipate the network to train very effectively, depending on the specifics of the program in question and the power of its internal information patterns. This is relevant to issues where the linkages may be complex or non-linear.

ANNs offer an analytical substitute to traditional methods, which are frequently constrained by rigid assumptions on normality, linearity, variable independence, etc. An ANN's ability to capture a variety of associations enables users to quickly and reasonably easily model phenomena that would otherwise be exceedingly challenging or impossible to understand. Neural network debates are prevalent right now. The phenomenon itself is the evidence that this sort of thing works, thus their promise appears to be quite bright. But hardware development holds the key to its future and the technology as a whole. Most neural network research is currently focused on demonstrating the validity of the basic idea.

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Cite This Article:

*** Miss. Bangar A.,**Prof. Doifode S. & ***Bangar A.R. (2023).** Study of Artificial Neural Network*, *Electronic International Interdisciplinary Research Journal*, XII, Issues – IV, July -August, 2023, 16-21.