

A **neural network** is a neural circuit of biological neurons, sometimes also called a biological neural network, or a network of artificial neurons or nodes in the case of an artificial neural network.

Artificial neural networks are used for solving artificial intelligence (AI) problems; they model connections of biological neurons as weights between nodes. A positive weight reflects an excitatory connection, while negative values mean inhibitory connections. All inputs are modified by a weight and summed. This activity is referred to as a linear combination. Finally, an activation function controls the amplitude of the output. For example, an acceptable range of output is usually between 0 and 1, or it could be -1 and 1.

These artificial networks may be used for predictive modeling, adaptive control and applications where they can be trained via a dataset. Self-learning resulting from experience can occur within networks, which can derive conclusions from a complex and seemingly unrelated set of information.

A biological neural network is composed of a group of chemically connected or functionally associated neurons. A single neuron may be connected to many other neurons and the total number of neurons and connections in a network may be extensive. Connections, called synapses, are usually formed from axons to dendrites, though dendrodendritic synapses^[3] and other connections are possible. Apart from electrical signalling, there are other forms of signalling that arise from neurotransmitter diffusion.

Artificial intelligence, cognitive modelling, and neural networks are information processing paradigms inspired by how biological neural systems process data. Artificial intelligence and cognitive modelling try to simulate some properties of biological neural networks. In the artificial intelligence field, artificial neural networks have been applied successfully to speech recognition, image analysis and adaptive control, in order to construct software agents (in computer and video games) or autonomous robots.

Historically, digital computers evolved from the von Neumann model, and operate via the execution of explicit instructions via access to memory by a number of processors. On the other hand, the origins of neural networks are based on efforts to model information processing in biological systems. Unlike the von Neumann model, neural network computing does not separate memory and processing.

Neural network theory has served to identify better how the neurons in the brain function and provide the basis for efforts to create artificial intelligence.

Neural networks can be used in different fields. The tasks to which artificial neural networks are applied tend to fall within the following broad categories:

- Function approximation, or regression analysis, including time series prediction and modeling.
- Classification, including pattern and sequence recognition, novelty detection and sequential decision making.
- Data processing, including filtering, clustering, blind signal separation and compression.

Application areas of ANNs include nonlinear system identification^[37] and control (vehicle control, process control), game-playing and decision making (backgammon, chess, racing), pattern recognition (radar systems, face identification, object recognition), sequence recognition (gesture, speech, handwritten text recognition), medical diagnosis, financial applications, data mining (or knowledge discovery in databases, "KDD"), visualization and e-mail spam filtering. For example, it is possible to create a semantic profile of user's interests emerging from pictures trained for object recognition

Types of models

Many models are used; defined at different levels of abstraction, and modeling different aspects of neural systems. They range from models of the short-term behaviour of individual neurons, through models of the dynamics of neural circuitry arising from interactions between individual neurons, to models of behaviour arising from abstract neural modules that represent complete subsystems. These include models of the long-term and short-term plasticity of neural systems and their relation to learning and memory, from the individual neuron to the system level.

AI

A neural network (NN), in the case of artificial neurons called artificial neural network (ANN) or simulated neural network (SNN), is an interconnected group of natural or artificial neurons that uses a mathematical or computational model for information processing based on a connectionistic approach to computation. In most cases, an ANN is an adaptive system that changes its structure based on external or internal information that flows through the network.

In more practical terms, neural networks are non-linear statistical data modeling or decision making tools. They can be used to model complex relationships between inputs and outputs or to find patterns in data.

An artificial neural network involves a network of processing elements (artificial neurons) which can exhibit complex global behavior, determined by the connections between the processing elements and element parameters. Artificial neurons were first proposed in 1943 by Warren McCulloch, a neurophysiologist, and Walter Pitts, a logician, who first collaborated at the University of Chicago