ISSN 2319 – 7757 EISSN 2319 –7765

Indian Journal of Engineering

Artificial neural network: New horizons

Shweta garg, Shrishti Vashist, Shruti Aggarwal

CSE department, Dronacharya College of Engineering, Gurgaon, India

Received 01 August; accepted 12 September; published online 01 October; printed 16 October 2013

ABSTRACT

Artificial neural networks have been applied to problems ranging from speech recognition to prophecy of protein secondary structure, classification of cancers and gene prediction. Make some generalizations concerning the capabilities of neural networks and make out the areas where they do well and where they don't. Review a assortment of applications where neural networks have been used. Define general criteria for identifying good neural network applications and recommend a longer term sketch.

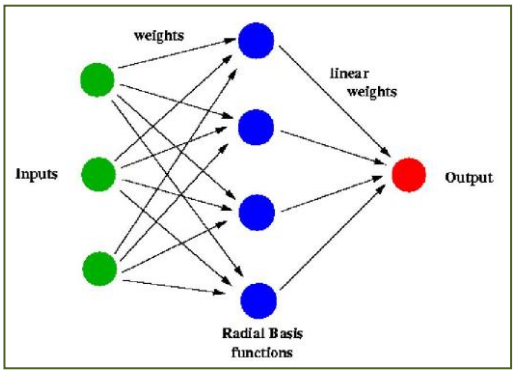
Keywords: neuron:- a conducting cell that is the functional unit of the nervous system, neural:- pertaining to a nerve, delineation:- a chart or diagram, statistics:- the science that deals with collection, cognitive psychology:- the branch of psychology studying the mental processes.

Abbreviation: ANN- Artificial neural network

To Cite This Article
Shweta garg, Shrishti Vashist, Shruti Aggarwal. Artificial neural network: New horizons. *Indian Journal of Engineering*, 2013, 5(12), 7-9

1. INTRODUCTION

Numerous advances have been made in developing intelligent systems, some stimulated by biological neural networks. Researchers from many scientific disciplines are designing artificial neural networks to solve a variety of problems in pattern recognition prediction, optimization, associative memory, and control. Conventional approaches have been proposed for solving these problems. Although successful applications can be found in certain well-constrained environments, none is flexible enough to perform well outside its domain. ANNs provide exciting alternatives, and many applications could benefit from using them.' An artificial neural network is an interconnected group of nodes, similar to the vast network of neurons in a brain (Bhadeshia, 1999; Bishop, 1995; Gurney, 1997; Lawrence, 1994; Ripley, 1996). Here, each circular node represents an artificial neuron and an arrow represents a connection from the output of one neuron to the input of another. In computer science and related fields, artificial neural networks are models inspired by animal central nervous system that are capable of machine learning and pattern recognition. They are usually presented as systems of interconnected "neurons" that can compute values from inputs by feeding information through the network. For example, in a neural network for handwriting recognition, a set of input neurons may be activated by the pixels of an input image representing a letter or digit. The activations of these neurons are then passed on, weighted and transformed by some function determined by the network's designer, to other neurons, etc., until finally an output neuron is activated that determines which character was read. Like other machine learning methods, neural networks have been used to solve a wide variety of tasks that are hard to solve using ordinary rule-based programming, including computer vision and speech recognition.



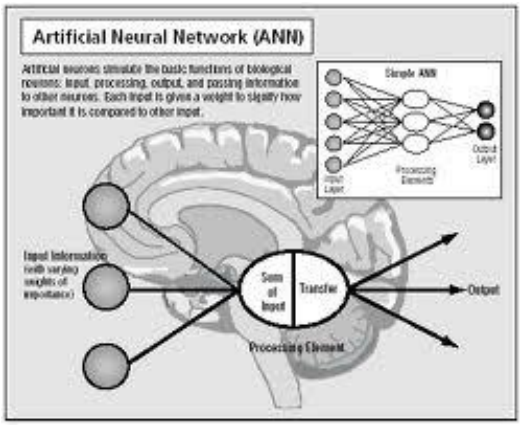
A Simple neural network

2. BACKGROUND

The inspiration for neural networks came from examination of central nervous system. In an artificial neural network, simple artificial nodes, called "neurons", "neurodes", "processing elements" or "units", are connected together to form a network which mimics a biological neural network. There is no single formal definition of what an artificial neural network is, Generally, it involves a network of simple processing elements exhibiting complex global behavior determined by the connections between the processing elements and element parameters. Commonly, though, a class of statistical models will be called "neural" if they

1. consist of sets of adaptive weights, i.e. numerical parameters that are tuned by a learning algorithm, and
2. are capable of approximating non-linear functions of their inputs.

Shweta Garg et al.
Artificial neural network: New horizons,
Indian journal of engineering, 2013, 5(12), 7-9,



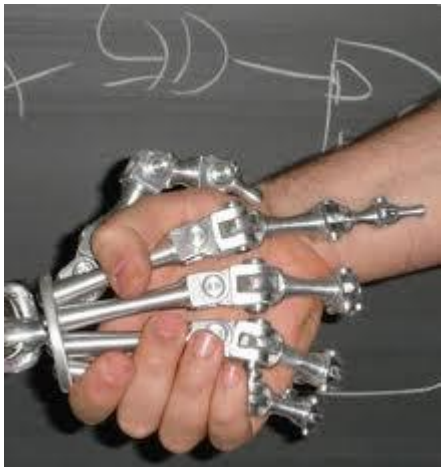
The adaptive weights are conceptually connection strengths between neurons, which are activated during training and prediction.

Neural networks are also similar to biological neural networks in performing functions collectively and in parallel by the units, rather than there being a clear delineation of subtasks to which various units are assigned. The term "neural network" usually refers to models employed in statistics, cognitive psychology and artificial intelligence. Neural network models which emulate the central nervous system are part of theoretical neuroscience and computational neuroscience.

In modern software implementation of artificial neural networks, the approach inspired by biology has been largely abandoned for a more practical approach based on statistics and signal processing. In some of these systems, neural networks or parts of neural networks form components in larger systems that combine both adaptive and non-adaptive elements. While the more general approach of such systems is more suitable for real-world problem solving, it has far less to do with the traditional artificial intelligence connectionist models. What they do have in common, however, is the principle of non-linear, distributed, parallel and local processing and adaptation. Historically, the use of neural networks models marked a paradigm shift in the late eighties from high-level artificial intelligence, characterized by expert system with knowledge embodied in *if-then* rules, to low-level machine learning, characterized by knowledge embodied in the parameters of a dynamical system.

3. NETWORK FUNCTION

The word network in the term 'artificial neural network' refers to the inter–connections between the neurons in the different layers of each system. An example system has three layers. The first layer has input neurons, which send data via synapses to the second layer of neurons, and then via more synapses to the third layer of output neurons. More complex systems will have more layers of neurons with some having increased layers of input neurons and output neurons. The synapses store parameters called "weights" that manipulate the data in the calculations.



An ANN is typically defined by three types of parameters:

1. The interconnection pattern between different layers of neurons
2. The learning process for updating the weights of the interconnections
3. The activation function that converts a neuron's weighted input to its output activation.

4. APPLICATIONS

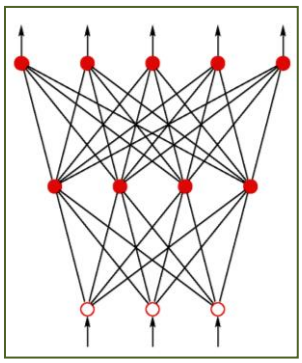
The utility of artificial neural network models lies in the fact that they can be used to infer a function from observations. This is particularly useful in applications where the complexity of the data or task makes the design of such a function by hand impractical.

4.1. Real-life applications

The tasks artificial neural networks are applied to tend to fall within the following broad categories:

- Function approximation, or regression analysis, including time series prediction, fitness approximation and modeling.
- Classification, including pattern and sequence recognition, novelty detection and sequential decision making.
- Data processing, including filtering, clustering, blind source separation and compression.
- Robotics, including directing manipulators,prosthesis.
- Control , including computer numerical control.

Application areas include system identification and control (vehicle control, process control, natural resources management), quantum chemistry, game-playing and decision making (backgammon, chess, poker), pattern recognition (radar systems, face identification, object recognition and more), sequence recognition (gesture, speech, handwritten text recognition), medical diagnosis, financial applications (automated trading systems), data mining (or knowledge discovery in databases, "KDD"), visualization and e-mail spam filtering. Artificial neural networks have also been used to diagnose several cancers. An ANN based hybrid lung cancer detection system named HLND improves the accuracy of diagnosis and the speed of lung cancer radiology. These networks have also been used to diagnose prostate cancer. The diagnoses can be used to make specific models taken from a large group of patients compared to information of one given patient. The models do not depend on assumptions about correlations of different variables. Colorectal cancer has also been predicted using the neural networks. Neural networks could predict the outcome for a patient with colorectal cancer with a lot more accuracy than the current clinical methods. After training, the networks could predict multiple patient outcomes from unrelated institutions.



A two-layer feed forward artificial neural network

4.2. Neural networks and neuroscience

Theoretical and computational neuroscience is the field concerned with the theoretical analysis and computational modeling of biological neural systems. Since neural systems are intimately related to cognitive processes and behavior, the field is closely related to cognitive and behavioral modeling. The aim of the field is to create models of biological neural systems in order to understand how biological systems work. To gain this understanding, neuroscientists strive to make a link between observed biological processes (data), biologically plausible mechanisms for neural processing and learning and theory (statistical learning theory and information theory).

Shweta Garg et al.
Artificial neural network: New horizons,
Indian journal of engineering, 2013, 5(12), 7-9,

REFERENCES

1. Bhadeshia HKDH. Neural network in material science,1999
2. Bishop CM. *Neural Networks for Pattern Recognition*,1995 Oxford: Oxford University Press
3. Gurney K. *An Introduction to Neural Networks* London,1997
4. Lawrence Jeanette. *Introduction to Neural Networks*, 1994 California Scientific Software Press
5. Ripley Brian D. *Pattern Recognition and Neural Networks*, Cambridge,1996

Shweta Garg et al.
Artificial neural network: New horizons,
Indian journal of engineering, 2013, 5(12), 7-9,