www.ijifr.com | Volume 5 | Issue 9 | May 2018

International Journal of Informative & Futuristic Research | ISSN: 2347-1697

Neural Network : Architecture and Applications

Paper ID	IJIFR/V5/ E9/ 002	Page No.	9241-9250	Subject Area	Computer Application
Key Words	Adapative linear Neuron(ADALINE), Basis Spline(B- Spline), Brain Gate, Aritificial Neural Network(ANN).,				
General Terms	Neural network, Backpropagation, NETtalk, Emulator				

1	Rashmi Dutta	Assistant Professor Deptt. of Computer Applications M.L.N.College,Yamuna Nagar(Haryana)-India
2	Jyoti Oberoi	Assistant Professor Deptt. of Computer Applications M.L.N.College,Yamuna Nagar(Haryana)-India

Abstract

Neural Network (NN) has made significant contribution to the progression of various fields of endeavor. The purpose of this work is to examine neural networks and their evolving applications in the field of engineering, pattern recognition, signal processing, speech recognition, speech production, medicine, data analysis, control and clustering. In this paper, we have examined different architectures of NN and the learning process also. Artificial Neural Networks have ample features including high processing speeds and the ability to learn the solution to a problem from a set of examples.

1. INTRODUCTION

A scheme of software or hardware patterned produced after the processing of neurons in the human brain is called as Neural Network. Artificial Neural Networks are a variety of deep learning technologies. Various applications of these technologies usually focus on solving pattern recognition problems or signal processing.

A neural network frequently involves a large number of processors working simultaneously and set in tiers. The first level receives the unprocessed input information -- analogous to optic nerves in human visual processing. Each layer receives the result from the earlier level, rather than from the unprocessed input. In the same way neurons moved from the optic nerve receive signals from those nearer to it. The last tier delivers the output of the system.

This work is published under Attribution-NonCommercial-ShareAlike 4.0 International License

ISSN: 2347-1697
International Journal of Informative & Futuristic Research (IJIFR)
Continuous 57th Edition, Volume - 5, Issue -9, May 2018
Page No. : 9241-9250

Neural networks are incredible for being adaptive, which means that they changes themselves as they learn from primary training and subsequent runs which provide more awareness about the world.

The key element of neural network is the tale structure of the information processing system. It is made up of a number of highly interrelated processing elements working in union to solve specific problems. ANNs, also learn by example. An ANN is produced for a precise application like pattern recognition or data classification, via a learning process. Learning in biological systems involves alterations to the connections that occur between the neurones.

2. Why ANN?

An expert neural network can be thought of as an "expert" in the category of information it has been given to examine. This expert can then be used to deliver projections given new situations of interest and answer "what if" questions. Other advantages include: Adaptive learning, Self-Organization, Real Time Operation and Fault Tolerancevia Redundant Information Coding Neural networks process information in a similar way the human brain does. The network is composed of a huge number of highly interconnected neurones working in parallel to solve a specific problem. Neural networks learn by example. They cannot be programmed to perform a particular job. The cases must be nominated carefully otherwise useful time is lost or even worse the network might be functioning falsely. The drawback is that because the network finds out how to solve the problem by itself, its operation can be unpredictable.

Neural networks and conventional algorithmic computers are not in race but they counterpart each other.

3. Types Of ANN

Neural networks have the exceptional ability to derive meaning from compound and inexact data. Neural networks can effortlessly dig out trends and patterns that are way too dense for humans or other computer techniques to extract. Neural networks that are thoroughly trained can be thought of as ‘experts’ in the areas of information that have been given to them for analysis.

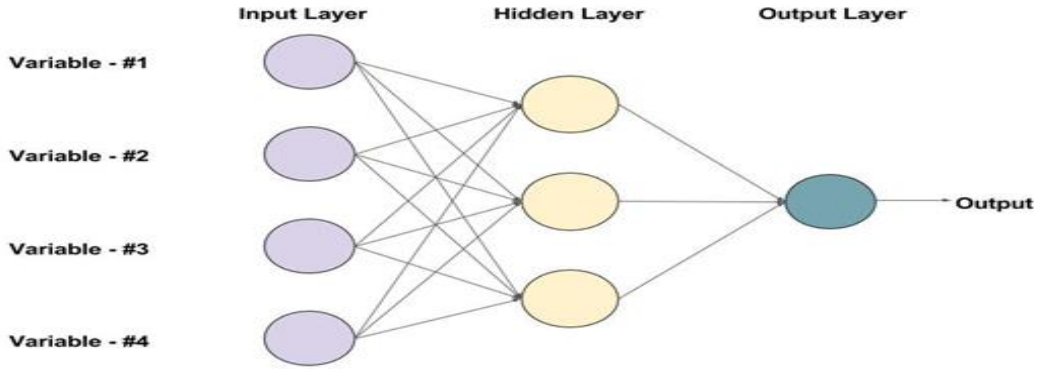

Diagram 1 : Neural Network

ISSN: 2347-1697
International Journal of Informative & Futuristic Research (IJIFR)
Continuous 57th Edition, Volume - 5, Issue -9, May 2018
Page No. : 9241-9250

There are basically six types of neural Networks Available. They are as follows:-

A. Feedforward Neural Network

The simplest of all neural networks, the feedforward neural network, moves information in one direction only. Data moves from the input nodes to the output nodes, passing through hidden nodes (if any). The feedforward neural network has no cycles or loops in its network.

B. Multilayer Perceptrons

The most common form of Neural Network Architecture is Multilayer perceptron (MLP). A multilayer perceptron:

- has any quantity of inputs.
- has many hidden layers with any number of units.
- uses linear combination functions in the input layer.
- uses normally sigmoid activation functions in the hidden layers.
- has any amount of outputs with any activation functions.
- has link between the input layer and the first hidden layer, between the hidden layers and the last hidden layer and the output layer.

Given ample data, plentiful hidden units and sufficient training time, an MLP with just one hidden layer can learn to estimate virtually any function with any degree of precision.

C. Radial Basis Function Neural Network

The Radial Basis Function neural network is the former choice when interpolating in a multidimensional space. The RBF neural network is a extremely intuitive neural network. Each neuron in the RBF neural network stores an example from the training set as a "prototype". Linearity involved in the functioning of this neural network offers RBF the advantage of not suffering from local minima.

D. Kohonen Self-Organizing Neural Network

Teuvo Kohonen invented the Kohonen self-organizing neural network. The self-organizing neural network is ideal for the visualization of low-dimensional views of high-dimensional data. This network is different from other neural networks and applies competitive learning to a set of input data, as opposed to error-correction learning applied by other neural networks. The Kohonen self-organizing neural network is well-known for performing functions on unlabeled data to describe hidden structures in it.

E. Modular Neural Networks

This interesting neural network comprises of a series of independent neural networks that are moderated by an intermediary. Each of these self-sufficient neural networks works with separate inputs, accomplishing subtasks that make up the job the network as whole hope to perform. The intermediary accepts the inputs of each of these individual neural networks, processes them, and creates the final output for the modular neural network. The independent neural networks do not interact with each other.

ISSN: 2347-1697
International Journal of Informative & Futuristic Research (IJIFR)
Continuous 57th Edition, Volume - 5, Issue -9, May 2018
Page No. : 9241-9250

F. Recurrent Neural Network

A neural network that allows for a bi-directional flow of data is known as recurrent neural network. The network between the connected units forms a directed cycle. Such a network allows for dynamic temporal behavior to be exhibited. The recurrent neural network is capable of using its internal memory to process arbitrary sequence of inputs. This neural network is a popular choice for tasks such as handwriting and speech recognition.

4. Architecture

Typical neural networks consist of a large number of artificial neurons called units organized in a series of layers. In typical artificial neural network, involves different layers.

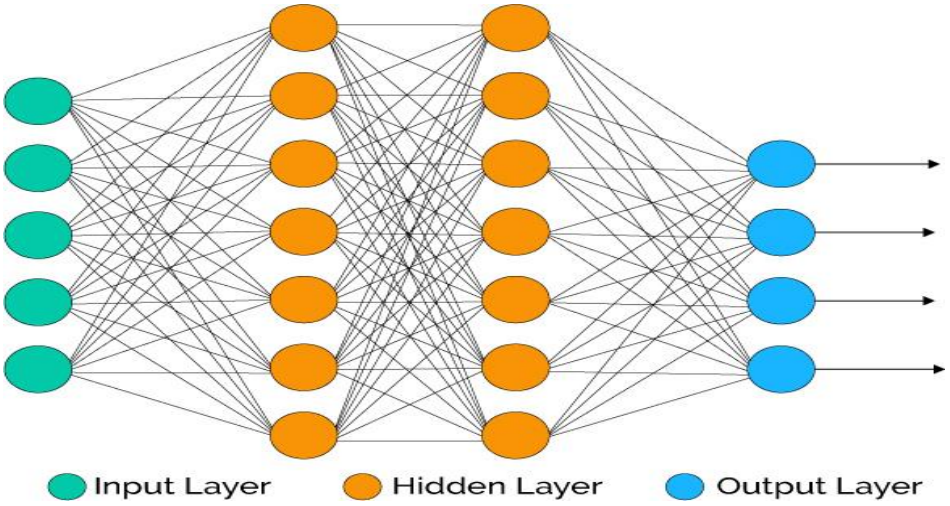

Diagram 2: Architecture

- *Input layer*—It comprises of those units (artificial neurons) which accept input from the outside world on which network will learn, identify about or otherwise process.
- *Output layer*—It comprises of units that respond to the information about how it's learned any job.
- *Hidden layer*—These units are in between input and output layers. The work of this layer is to convert the input into something that output unit can use in some way.

Generally neural networks are totally associated that means each hidden neuron is fully connected to the every neuron in its previous layer (input) and to the next layer (output) layer.

The architecture of a specific network is specified in terms of the number of neurons per layer, the number of layers and the general connectivity pattern between the different PE's in the different layers. The number of input and output depends on those of the equivalent system that is being executed. When the input/output relation is not pretty simple or clear so as to re-modify the inputs in the hidden layers to give the desired output values, in that case hidden layers are required. Sometimes rising the number of hidden layers will have no real enhancement on the output values, but increasing the number of PE's in the

ISSN: 2347-1697
International Journal of Informative & Futuristic Research (IJIFR)
Continuous 57th Edition, Volume - 5, Issue -9, May 2018
Page No. : 9241-9250

existing hidden layers is what will do the trick. The connectivity pattern is normally specified by the network model in use. Some models have very few connections while others are densely connected.

5. Applications

Artificial Neural Network is extended form of Biological neural network (BNN). Like BNN it contains neurons which take input process it and provide output. It consists of three layers:

- Input layer- It takes raw facts as input.
- Hidden layer- There can be one or more hidden layers present in this structure.
- Output Layer- It delivers result as output.

There is virtually any area in which ANN is not used. Many of the recent expansion have been made in the field of Robotics, Artificial Intelligence, including Image Recognition, Voice Recognition using Artificial Neural Networks.

A. Signal Processing

Neural networks also works in the general area of signal processing. One of the first commercial applications was to hold back noise on a telephone line. The neural network used for this purpose is a form of ADALINE. The need for adaptive echo cancelers has become more pressing with the development of transcontinental satellite links for long-distance telephone circuit. The two way round trip time delay for the radio transmission is on the order of half a second. Even in the case of wire- based telephone transmission, the repeater amplifiers introduce echoes in the signal.

The adaptive noise cancellation idea is quite simple. At the end of a long distance line, the incoming signal is applied to both telephone system component called hybrid and the adaptive filter (the ADALINE type of neural net). The difference between the output of the hybrid and output of ADALINE is the error, which is used to adjust the weights on the ADALINE. The ADALINE is trained to remove the noise (echo) from the hybrid's output signal.

B. Pattern Recognition

Many interesting troubles fall into the field of pattern recognition. One precise area in which many neural network applications have been developed is the automatic recognition of handwritten characters. The large variation of sizes, position & styles of writing make this a difficult problem for traditional techniques. It is a good example, however, of the type of information processing that humans can perform relatively easily.

The backpropagation net is the technique that has been used for recognizing handwritten zip codes. Even when an application is based on a standard training algorithm, it is quite common to customize the architecture to improve the performance of the application. This backpropagation net has several hidden layers, but the pattern of connections from one layer to the next is quite localized.

An alternative approach to the problem of recognizing handwritten characters is the "neocognition". This net has several layers, each with a highly structured pattern of

ISSN: 2347-1697
International Journal of Informative & Futuristic Research (IJIFR)
Continuous 57th Edition, Volume - 5, Issue -9, May 2018
Page No. : 9241-9250

connections from the previous layers and to the subsequent layer. However, its training is a layer-by-layer process, specialized for just such an application.

C. Medicine

One example of the application of neural network to medicine was developed by Anderson in the mid 1980's. It was called the "Instant Physician". Instant Physician trains an auto associative memory neural network (the "Brain-State-in-a-Box") to stock up a large number of medical records, each of which comprises information on symptoms, diagnosis, and treatment for a particular case. After training, the net can be presented with input consisting of a set of symptoms; it will then find the full stored pattern that represents the "best" diagnosis and treatment.

The net performs unexpectedly well, given its simple structure. When a particular set of symptom occurs repeatedly in the training set, mutually with a unique diagnosis and treatment, the net will usually give the same diagnosis and treatment. In cases where there are ambiguities in the training information, the net will give the most familiar diagnosis and treatment. In novel situations, the net will recommend a treatment corresponding to the symptoms it has seen before, regardless of the other symptoms that are present.

D. Speech Production

Learning to interpret English text audibly is not easy task, because the accurate phonetic pronunciation of a letter depends on the context in which the letter appears. A traditional approach to the trouble would involve constructing a set of policies for the standard pronunciation of various groups of letters, together with a look-up table for the exceptions. A multilayer neural net i.e a net with hidden units is called as NETtalk. Unlike the need to construct set of laws and look-up tables for the exceptions, NETtalk's only requires a set of example of the written input, together with the correct pronunciation for it. The written input includes two things i-e the letter that is currently being spoken and three letters before and after it. To indicate the end of a word or punctuation additional symbols are used. The net is skilled by 1,000 most frequent English words. After training, the net can read new words with very few errors; the errors that it does make are slight mispronunciations and the intelligibility of the speech is quite good.

There are numerous fairly dissimilar stages to the respond of the net as training progresses. The net learns quite speedily to differentiate vowels from consonants. However it uses the same vowel for all vowels and the same consonant for all consonants at this first stage. The outcome is a babbling sound. The second stage of learning corresponds to the net recognizing the boundaries between words; this produces a pseudo word type of response. After as few as 10 passes through the training data, the text is intelligible. Thus the response of the net as training progresses is similar to the development of speech in small children.

E. Speech Recognition

In the difficult area of speaker-independent recognition of speech a huge progress have been made. Amount of useful systems now has a restricted vocabulary or grammar or

ISSN: 2347-1697
International Journal of Informative & Futuristic Research (IJIFR)
Continuous 57th Edition, Volume - 5, Issue -9, May 2018
Page No. : 9241-9250

needs retraining for dissimilar speakers. Many types of neural networks have been used for speech recognition.

Kohonen developed a net known as "phonetic type writer" which is of particular interest, both because of its level of development toward a practical system and its design. The output units for a self-organizing map are arranged in a two dimensional array. The input to the net is based on short segments of the speech waveform. As the net combines similar inputs, the cluster that are formed are located so that different examples of the same approach occur on output units that are close collectively in the output array.

After the speech input signals are combined to the phoneme regions (which has been done without telling the net what a phoneme is), the output units can be coupled to the suitable typewriter key to build the phonetic type-writer. Because the correspondence between phonemes and written letters is very regular in Finnish, the spelling is often correct.

F. Business

Neural networks are being applied in a number of business settings. One such examples is the mortgage assessment work by Nestor, Inc.

Although it may be taken into consideration the rules which form the basis for mortgage underwriting are well understood, it is difficult to specify completely the process by which experts make decisions in marginal cases. In addition, there is a large financial reward for even a small reduction in the number of mortgages that become delinquent. The basic idea behind the mortgage risk assessment is to utilize past understanding to train the net to offer more regular and reliable evaluation of mortgage applications.

The purpose in each of these is to determine whether the applicant should be given a loan. The decision in the second kind of underwriting are more tricky, because only those applicants assessed as higher risks are processed for mortgage insurance. The training input includes information on the applicants's years of employment, number of dependents, current income etc. as well as features related to the mortgage itself, such as the loan-to-value ratio and characteristics of the property, such as its appraised value. The target output from the net is an "accept" or "reject" response.

In both kinds of underwriting, the neural networks achieve a high level of contract with the human experts. Using a free measure of the quality of the mortgages certified, the neural network consistently made improved judgements than the experts. In fact, the net learn to form a consensus from the knowledge of all of the experts whose proceedings had formed the basis for its training.

G. Speech Reading (Lip Reading)

Lip-Reading is a technique used for training deaf and dumb so that they can speak and join effectively with the other people. Another name for lip-reading or speech reading is Speech Vision refers to understanding speech by visually predicting the movement of face, lips and tongue using the information provided by the context, language, and any residual hearing. Than the video of the subject speaking unusual words is translated into images and then images are further chosen manually for processing.

ISSN: 2347-1697
International Journal of Informative & Futuristic Research (IJIFR)
Continuous 57th Edition, Volume - 5, Issue -9, May 2018
Page No. : 9241-9250

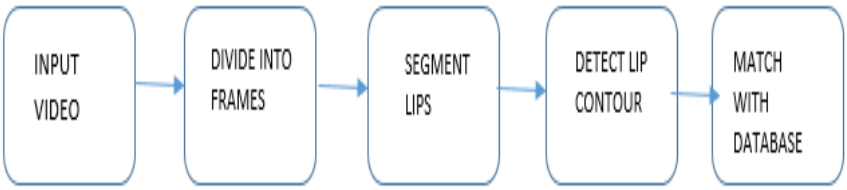

Diagram 3: Lip Reading Structure

The input to a lip-reading system contains of a video which is divided into frames. Lips are then fragmented on the first frame and then lip outline is determined. An object tracking system is then used to track the activity of lips on following frames. The position of lip curve on each frame is stored in a database. A separate database of characters is also maintained. The position of lip contour is matched with the characters to determine what the speaker has spoken.

Diagram 4 : Example of Lip Reading State

H. Brain Computer Interface Based On Neural Networks

Brain Computer Interface (BCI) is one of optimistic interface technologies connecting human and machine. Brain computer interface is also called by mind machine interface (MMI).

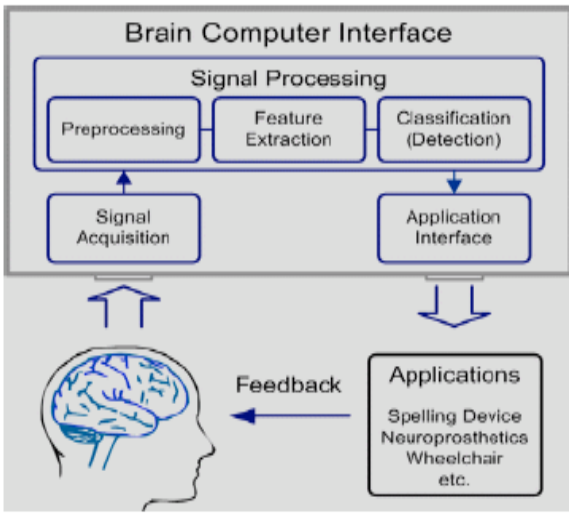

Diagram 5: Schematic Diagram of BCI

ISSN: 2347-1697
International Journal of Informative & Futuristic Research (IJIFR)
Continuous 57th Edition, Volume - 5, Issue -9, May 2018
Page No. : 9241-9250

Brain Computer Interface (BCI) is an interface that connects brain to a computer or any electronic machine that enables signals from the brain to undeviating interact with external motion, such as control of a cursor. The interface enables a straight contact passageway between the brain and the object to be controlled. Brain Computer Interface enable a person misery from paralysis to write a book or control a motorized wheelchair.

I. Facial Animation

One of the trickiest job in computer graphics is modeling and animation of human face today, even more so when life is to be breathed into digitized versions of real, well-known character. Neural networks could be applied for learning of each dissimilarity in the face expressions for animated sequences. Some clustering and device learning approach are joined together to study the correspondence between the speech acoustic and face animation parameters. The main learning machine used for speech facial animations are HMM, SVM and Neural Networks.

Diagram 6: Facial Animation

Above figure shows diverse facial expression from many peoples in unlike situations. Thus neural networks and some others machine learning tools are used for recognition of expression.

6. Advantages

- Relatively simple learning algorithm
- Can significantly out-perform other models when the conditions are right
- Fault Tolerance
- When an element of the neural network fails, it can continue without any problem by their parallel nature.
- Nonlinear Data Processing
- It can be implemented in any application.
- It can be implemented without any problem.
- A neural system learns and does not need to be reprogrammed.
- A neural network can perform tasks that a linear program cannot.

7. Disadvantages

- Lack of Computing power

ISSN: 2347-1697
International Journal of Informative & Futuristic Research (IJIFR)
Continuous 57th Edition, Volume - 5, Issue -9, May 2018
Page No. : 9241-9250

- Self-Learning needed in Early stage
- Cannot Reflect Human Emotion
- Costly to Develop System
- The neural network needs training to operate.
- The architecture of a neural network is unusual from the architecture of microprocessors thus desires to be emulated.
- Require high processing time for huge neural networks.

8. Conclusion

The computing world has a lot to achieve from neural networks. Their capability to study by example makes them very flexible and powerful. Furthermore there is no need to develop an algorithm in order to perform a precise task; i.e. there is no need to understand the internal mechanisms of that task. They are also very fine appropriate for real time systems because of their speedy reply and computational times which are due to their equivalent architecture. Neural networks also contribute to other area of study such as neurology and psychology. They are frequently used to model parts of living organisms and to investigate the internal mechanisms of the brain.Perhaps the most exciting aspect of neural networks is the possibility that some day aware networks might be produced. There is a number of scientists arguing that realization is a 'mechanical' property and that 'conscious' neural networks are a practical possibility.

9. References

[1] C. Yildiz and M. Turkmen, “A CAD approach based on artificial neural networks for shielded multilayered coplanar waveguides,” Int. J. Electron. Commun., pp. 1-9, 2004.
[2] C. Yildiz and M. Turkmen, “Very accurate and simple CAD models based on neural networks for coplanar waveguides synthesis,” Int. J. RF and Microwave, CAE 15, pp. 218-224, 2005.
[3] Ajith Abraham, “Artificial Neural Networks”, Stillwater,OK, USA, 2005.
[4] Anil K Jain, Jianchang Mao and K.M Mohiuddin, “Artificial Neural Networks: A tutorial”, Michigan State university, 1996
[5] Christos Stergiou and Dimitrios Siganos, “Neural Networks”
[6] Girish Kumar Jha, “Artificial Neural Network and its Applications”,IARI New delhi.
[7] Vincent Cheung and Kevin Cannons, “An Introduction of Neural Networks”, Manitoba, Canada, May 27, 2002.
[8] Adya, M., & Collopy, F. (1998), How Effective Are Neural Networks at Forecasting and Prediction?A Review and Evaluation, J. Forecasting, 17, 481-495.
[9] Towell, G. G., & Shavlik, J. W. (1994), Knowledge-Based Artificial Neural Networks, Artificial Intelligence, 70(1), 119-165.
[10] HaykinS., “Neural Networks A Comprehensive Foundation”, 2nd edition, Pearson Education, 1999.