Available online at www.elixirpublishers.com (Elixir International Journal)

Computer Science and Engineering

Elixir Comp. Sci. & Engg. 38 (2011) 4423-4425

ISSN: 2229-712X

Artificial neural networks bidirectional associative memory

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ARTICLE INFO

Article history:

Received: 22 August 2011;

Received in revised form:

26 August 2011;

Accepted: 31 August 2011;

Keywords

Associative Neural Memories,
Bidirectional Associative Memory,
Hop Field Network,
Noise tolerance.

ABSTRACT

This paper focuses on the bidirectional associative memory its features and the future aspects and the current context of application. BAM is a type of neural network. Artificial neural network (Ann's) resembled the human nervous system, with algorithms consisting of weighted interconnecting processing units (like neural map of the human brain). To address a particular problem using Ann's, the interrelated connections are tuned and the value of weights between units is needed. Neural network is a new unexplored topic of interest for the computer scientists. Bam comes under recurrent types of network called Hopfield network. BAM is a resonance model, in the sense that information is passed back and forth between two layers of units until a stable sate is reached. The Hopfield network is said to be auto associative, because it uses a partial and noisy pattern to recall the best match of itself.

BAM includes: ASSOCIATIVE NEURAL MEMORIES:

Associative neural memories are a class of artificial neural networks (connectionist nets) which have gained substantial attention relative to other neural net paradigms. Associative memories have been the subject of research.

NOISE TOLERANCY:

This paper analyzes the sensitivity to noise in BAM (Bidirectional Associative Memory), and then proves the noise immunity of BAM relates not only to the minimum absolute value of net inputs (MAV) but also to the variance of weights associated with synapse connections.

Introduction

Case studies about the NEURAL COMPUTATION: - Many scientists and engineers now use neural networks to tackle problems that are either intractable or unrealistically time consuming to solve, through traditional computational strategies. Fault Tolerant Systems: Recent advances in computer technology have made the design of large and very flexible associative processors possible.

The future aspects of BAM such as Database Management System and Natural Language Learning through abstract memory and LIFE robotics are also featured.

Artificial neural networks are intended for modeling the organizational principles of central nervous system.

So that ANN will allow cognitive and sensory tasks to be performed much faster than is possible using conventional serial processors.

ANN is an information processing paradigm that is inspired by the way biological nervous systems, such as the brain, process information.

The key element of this paradigm is the novel structure of the information processing system.

It is composed of a large number of highly interconnected processing elements (neurons) working in unison to solve specific problems.

There are six types of neural networks one among them is BAM-Bidirectional associative memory. Which comes under recurrent type of network called as Hopfield network? The bidirectional associative memory can be viewed as a generalization of the Hopfield model, to allow for a heteroassociative memory to be implemented. In this case, the association is between names and corresponding phone numbers.

The bidirectional associative memory is related to the e Hopfield network and also has some similarity to the ART architecture. It consists of two layers.

Uses the forward and backward information flow between the layers to perform a search for a stored stimulus-response association. The network evolves to a local minimum of the "energy" Surface, which is a two pattern resonance state, which is a two pattern resonance state, with each pattern at the output of one layer.

Bidirectional associative memory:

Features of BAM:

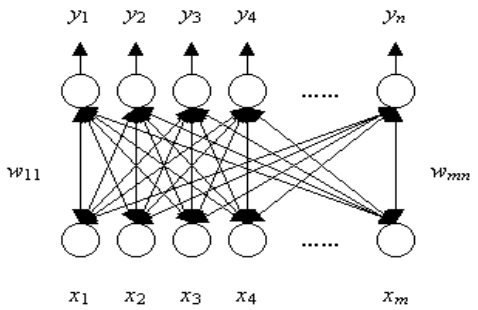
Kosko (1988) extended the Hopfield model by incorporating an additional layer to perform recurrent auto associations as well as heteroassociations on the stored memories.

The network structure of the Bidirectional Associative Memory model is similar to that of the linear associator but the connections are bidirectional, i.e., wij = wji, for i = 1, 2, ..., m and j = 1, 2, ..., n.

Also, the units in both layers serve as both input and output units depending on the direction of propagation. Propagating signals from the X layer to the Y layer makes the units in the X layer act as input units while the units in the Y layer act as output units.

The same is true for the other direction, i.e., propagating from the Y layer to the X layer makes the units in the Y layer act as input units while the units in the X layer act as output units. Below is an illustration of the BAM architecture.

Tele:
E-mail addresses:



BAM model

Expression:

Just like the linear associator and Hopfield model, encoding in BAM can be carried out by using:

$W_k = X_k^T Y_k$

to store a single associated pattern pair and

$$W = \alpha \sum_{k=1}^{p} W_k$$

to simultaneously store several associated pattern pairs in the Bidirectional Associative Memory.

Updating Schemes:

Several modes can also be used to update the states of the units in both layers namely synchronous, asynchronous, and a combination of the two. In synchronous updating scheme, the states of the units in a layer are updated as a group prior to propagating the output to the other layer. In asynchronous updating, units in both layers are updated in some order and output is propagated to the other layer after each unit update. Lastly, in synchronous-asynchronous updating, there can be subgroups of units in each layer that are updated synchronously while units in each subgroup are updated asynchronously.

Applications of BAM

Associative Neural Memories:

Associative neural memories are a class of artificial neural networks (connectionist nets) which have gained substantial attention relative to other neural net paradigms.

Associative memories have been the subject of research since the early seventies. Recent interest in these memories has been spurred by the seminal work of Hopfield in the early eighties, who has shown how a simple discrete nonlinear dynamical system can exhibit associative recall of stored binary patterns through collective computing.

Since then, a number of important contributions have appeared in conference proceedings and technical journals addressing various issues of associative neural memories, including multiple-layer architectures, recording/storage algorithms, capacity, retrieval dynamics, fault-tolerance, and hardware implementation.

Noise tolerance:

This application analyzes the sensitivity to noise in BAM (Bidirectional Associative Memory), and then proves the noise immunity of BAM relates not only to the minimum absolute value of net inputs (MAV) but also to the variance of weights associated with synapse connections. In fact, it is a positive monotonically increasing function of the quotient of MAV divided by the variance of weights. Besides, the performance of pseudo-relaxation method depends on learning parameters (lambda and xi), but the relation of them is not linear. So it is hard to find a best combination of lambda and xi which leads to the best BAM performance. And it is obvious that pseudo-relaxation is a kind of local optimization method, so it cannot guarantee to get the global optimal solution.

Study of Neural Networks

Neural Computation:

Many scientists and engineers now use neural networks to tackle problems that are either intractable or unrealistically time consuming to solve, through traditional computational strategies. To address the need for speedy dissemination of new ideas in this field to a broad spectrum of neural network user's designers and implementers, Oxford University Press and the Institute of Physics have joined forces to create a major reference publication devoted to neural network fundamentals, models, algorithms applications and implementations. This work is intended to become the standard reference resource for the neural network community. The Handbook of Neural Computation will be produced in parallel in two updatable formats, loose-leaf paper and CD-ROM and will be kept up to date by means of supplements published on a regular basis. Details of new architectures, algorithms and applications may be submitted to the Handbook editors for peer review and possible inclusion in a future supplement to the Handbook. In this way we will create a moving compendium of the state of the art of neural computation. Key features of the Handbook of Neural Computation: A hands-on guide to the design and implementation of neural networks. A comprehensive source of reference for all neural network users, designers and implementers Provides an information pathway between scientists and engineers in different disciplines who apply neural networks to generically similar problems Provides timely information in a rapidly changing field

Fault Tolerant:

Recent advances in computer technology have made the design of large and very flexible associative processors possible. Such systems are extremely complex and must be adequately protected against failures if they are to be used in critical application areas such as air traffic control or for performing control func-tions in fault-tolerant computers. This paper summa- rizes the results of a study which has indicated the techniques that are applicable in the design of fault- tolerant associative processors. Associative processors are divided into four classes of fully parallel, bit-serial, word-serlal, and block-orlented systems. A technique for modularlzlng the design of an associative processor is given. The detection of errors within modules is discussed for the four classes mentioned above. Several schemes for reconfiguration are discussed which allow us to establish an appropriate inter-Communication pattern after replacing the faulty module By a spare. The design of a fault-tolerant associative processor, which uses some of the techniques discussed previously, is presented.

Future Aspects of Bam

Database Management:

Its broad coverage of expert systems, decision support, artificial neural networks, fuzzy systems and evolutionary computation will show how intelligent systems work together and be utilized in health care and the public health practice. Some applications include networks that perform: -Pattern matching, storage, and recall, -Data extraction from images, -New neural networks that combine pattern matching with fuzzy logic.

Life and Robotics:

This covers a broad mu Artificial Life and Robotics is an international journal publishing original technical papers and

authoritative state-of-the-art reviews on the development of new technologies concerning artificial life and robotics, especially computer-based simulation and hardware for the twenty-first centuryltidisciplinary field, including areas such as artificial brain research, artificial intelligence, artificial life, artificial living, artificial mind research, chaos, cognitive science, complexity, evolutionary computations, fuzzy control, genetic algorithms, innovative computations, micro machines, mobile vehicles, neural networks, neurocomputers, neurocomputing technologies and applications, robotics, and virtual reality. Hardware-oriented submissions are particularly welcome.

Natural Language by Abstract Memory:

A model is proposed for the functioning of natural language in a mind.

The underlying model is that of a highly orthogonal grid, with input and output flowing vertically, in parallel but opposite directions, while associative interconnections flow back and forth horizontally. In the superstructure model for natural language, an "abstract" memory channel is superimposed to flow in parallel with the input/output channels, in such a way that a spiral of habituation comes to dominate the associative crossflows in a conscious, linguistically generative process of "transabstractivity."

Conclusion

Neural networks is an Expectations of faster and better solutions provide us with the challenges to build machines using the same computations and organizational principles, simplified and abstracted from neurobiological studies of the brain. BAM is a resonance model, in the sense that information is passed back and forth between two layers of units until a stable sate is reached. Thus BAM can be used to analyse and understand the complex problem domains the connection of current problem can be solved using previous experiences of the memory of the system. Thus can be of great interest to computer scientist to develop software to imitate the human brains capacity to recollect information from past experiences.

Acknowledgement

I would like to acknowledge the contributions of Joseph.J and Solomon to make this project successful.

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