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Neural Networks in Data Mining

Rashmika K. Vaghela
Lecturer,R.C.Technical Institute,
Sola,Ahmedabad-60
vaghela_rashmi@yaoo.com

***Abstract*—**Data Mining means extraction of hidden predictive information from huge amount of databases. It is beneficial in every field like business, engineering, web data etc. In data mining classification of data is very difficult task that can be solving by using different algorithms. The more common model functions in data mining include classification, clustering, rule generation and knowledge discovery. There are many technologies available to data mining, including Artificial Neural Networks, Regression, and Decision Trees. In this paper the data mining based on neural networks is studied in detail, and the key technology and ways to achieve the data mining based on neural networks are also studied.

Keywords:- Data Mining, *neural networks, artificial neural network (ANN), data mining process,* Neuralnetwork training.

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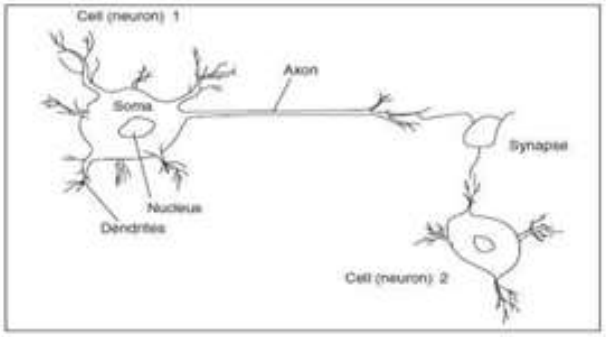
I. INTRODUCTION

Data mining is also known as Knowledge Discovery Data (KDD). Data mining is the term used to describe the process of extracting value from a database. A data-warehouse is a location where information is stored. The type of data stored depends largely on the type of industry and the company. Many companies store every piece of data they have collected, while others are more ruthless in what they deem to be "important". Data mining interprets its data into real time analysis that can be used to increase sales, promote new product, or delete product that is not value-added to the company. Data mining has relationship with other areas like neural network, database, and business intelligence.

There are different type of learning mechanisms in the data mining supervised and unsupervised learning. Supervised learning means classification of data and unsupervised learning means clustering. Different methods are used to classify the data in data mining like decision trees, nearest neighbor, neural network. Neural network play significant role in data mining. Neural network consist of different node with weighted inputs, it is constructive in classification of complex data. Advantage of data mining is that it can construct and learn boundaries for large number of attributes.

Neural Network

Neural networksrepresent a brain metaphor for information processing. A neural network is an artificial representation of human brain that tries to simulate its learning process. These models are biologically inspired ratherthan an exact replica of how the brain actually functions. Neural networks have been shown to be very promising systems in many forecasting applications and business classification applications due to their ability to "learn" from the data, their nonparametric nature (i.e., no rigid assumptions), and their ability to generalize.



(Two interconnected biological cells)

Neural computing refers to a pattern recognition methodology for machine learning. The resulting model from neuralcomputing is often called an artificial neural network (ANN) or a *neural network*. Neural networks have been used in many business applications for pattern recognition, forecasting, prediction, and classification. Neural network computing is a key component of any data mining tool kit.

ADVANTAGES OF NEURAL NETWORKS

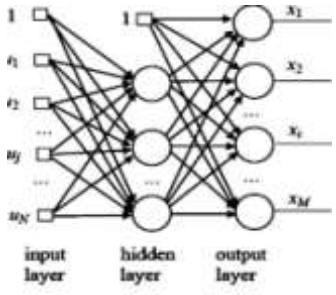
- Adaptive learning: An ability to learn how to do tasks based on the data given for training or initial experience.
- Self-Organization: An ANN can create
- its own organization or representation of the information it receives during learning time.
- Real Time Operation: ANN computations may be carried out in parallel, and special hardware devices are being designed and manufactured which take advantage of this capability.
- Fault Tolerance via Redundant Information Coding: Partial destruction of a network leads to the corresponding degradation of performance.

II. NETWORK ARCHITECTURES

Neural computing is an alternative to programmed computing which is a mathematical model inspired by biological models. This computing system is made up of a number of artificial neurons and a huge number of interconnections between them. According to the structure of the connections the architectures are as follows:-

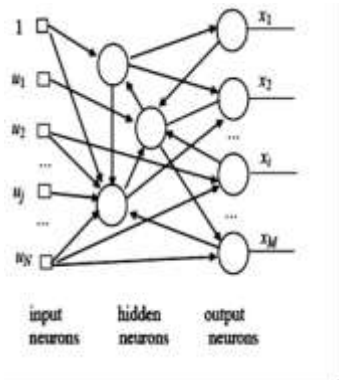
FEED FORWARD NEURAL NETWORK

In feed forward neural networks, the neurons are organized in the form of layers. The neurons in a layer get input from the previous layer and feed their output to the next layer. In this kind of networks connections to the neurons in the same or previous layers are not permitted. The last layer of neurons is called the output layer and the layers between the input and output layers are called the hidden layers. The input layer is made up of special input neurons, transmitting only the applied external input to their outputs .In a network if there is only the layer of input nodes and a single layer of neurons constituting the output layer thenthey are called single layer network. If there are one or more hidden layers, such networks are called multilayer networks.



RECURRENT NETWORK

The structures, in which connections to the neurons of the same layer or to the previous layers are allowed, are called recurrent networks. For a feed-forward network always exists an assignment of indices to neurons resulting in a triangular weight matrix. Furthermore if the diagonal entries are zero this indicates that there is no self-feedback on the neurons. However in recurrent networks, due to feedback, it is not possible to obtain a triangular weight matrix with any assignment of the indices.



LEARNING METHODS OF ARTIFICIAL NEURAL NETWORK

A **neural network** has to be configured such that the application of a set of inputs produces (either 'direct' or via a relaxation process) the desired set of outputs. Various methods to set the strengths of the connections exist. One way is to set the weights explicitly, using a priori knowledge. Another way is to **'train' the neural network** by feeding it teaching patterns and letting it change its weights according to some learning rule. Various methods of learning are as follows:

Supervised learning or Associative learning in which thenetwork is trained by providing it with input and matching output patterns.

Unsupervised learning or Self-organization in which an(output) unit is trained to respond to clusters of pattern within the input. In this paradigm the system is supposed to discover statistically salient features of the input population. Unlike the supervised learning paradigm, there is no a priori set of categories into which the patterns are to be classified; rather the system must develop its own representation of the input stimuli.

Reinforcement Learning This type of learning may beconsidered as an intermediate form of the above two types of learning. Here the learning machine does some action on the environment and gets a feedback response from the environment. The learning system grades its action good (rewarding) or bad (punishable) based on the environmental response and accordingly adjusts its parameters. Generally, parameter adjustment is continued until an equilibrium state occurs, following which there will be no more changes in its parameters. The self-organizing neural learning may be categorized under this type of learning.

III. DIFFERENT TYPES OF NEURAL NETWORK

i. MULTI LAYER PERCEPTION MODEL

A multilayer perceptron is used for learning the feature vectors. From experience, 30 neurons in the hidden layer give the best in the hidden layer neurons. The output layer comprises of ten neurons, one neuron for each class. For aparticular class of signal, the neuron corresponding to that class should ideally exhibit an output of one while the other neurons exhibit an output of zero. The log-sigmoid transfer function was picked because of its output range (0 to 1) is perfect for learning to output Boolean values. However, in practical cases this is not achievable. To circumvent this problem a post-processing unit is added to select the neuron with the highest excitation as the class of the signal. The

network is trained with a back propagation algorithm in which, the error measure E is given as α is the momentum constant, η is the learning rate.

$$E = \sum_{j=1}^{Q} (d_j - x_i)^2$$

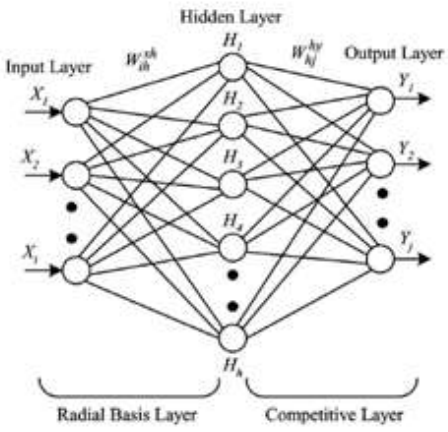
$$\Delta w(k+1) = -h\nabla_w E + a\,\Delta w(k)$$

The gradient decent algorithm was implemented in batch mode. The performance of a gradient decent algorithm is very dependent on the learning rate. If the learning rate is too large, the training would oscillate back and forth and on the other hand if the learning rate is too small, it would take a long time to reach convergence. To overcome this problem an adaptive learning rate that attempts to keep the step size as large as possible without causing oscillation is used. The learning rate is made responsive to the complexity of the local error surface.

ii. PROBABILISTIC NEURAL NETWORK (PNN)

The PNN model is one among the supervised learning networks and has the following features.

- It is implemented using the probabilistic model, such as Bayesian classifiers.
- A PNN is guaranteed to converge to a Bayesian classifier provided that it is given enough training data.
- No learning processes are required.
- No need to set the initial weights of the network.
- No relationship between learning processes and recalling processes.
- The difference between the inference vector and the target vector are not used to modify the weights of the network.



(Probabilistic neural network)

The learning speed of the PNN model is very fast making it suitable in real time for fault diagnosis and signal classification problems. The figure given below shows the architecture of a PNN model that is composed of the radial basis layer and the competitive layer.

In the signal-classification application, the training examples are classified according to their distribution values of probabilistic density function (pdf), which is the basic principle of the PNN. A simple pdf is as follows:

Modifying and applying to the input vector H of the hidden layer in the PNN is

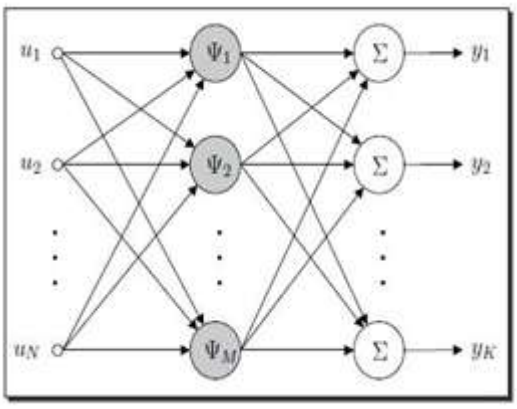
$$H_{k=\exp(}\frac{-\sum_i (X_i - W_{ih}^{xh}}{2s^2})2$$

iii. MODULAR NEURAL NETWORK

A Modular Neural Network (MNN) is a Neural Network (NN) that consists of several modules, each module carrying out one sub-task of the NN's global task, and all modules functionally integrated. A module can be a sub-structure or a learning sub procedure of the whole network. The network's global task can be any neural network application, e.g., mapping, function approximation, clustering or associative memory application.

iv. WAVELET NEURAL NETWORK

Wavelet neural networks are the networks that combine the theory of wavelets and neural networks into one. A wavelet neural network generally consists of a feed-forward neural network, with one hidden layer, whose activation functions are drawn from an ortho-normal wavelet family. One application of wavelet neural networks is that of function estimation. If a series of observed values of a function is given, a wavelet network can be trained to learn the composition of that function, and hence calculate an expected value for a given input.



(A wavelet neural network)

ONE DIMENSSIONAL WAVELET NEURAL NETWORK

The simplest form of wavelet neural network is one with a single input and a single output. The hidden layer of neurons consists of wavelons, whose input parameters (possibly fixed) include the wavelet dilation and translation coefficients. These wavelons produce a non-zero output when the input lies within a small area of the input domain. The output of a wavelet neural network is a linear weighted combination of the wavelet activation functions.

MULTIDIMENSIONAL WAVELET NEURAL NETWORK

The input in this case is a multidimensional vector and the wavelons consist of multidimensional wavelet activation functions. They will produce a non-zero output when the input vector lies within a small area of the multidimensional input space. The output of the wavelet neural network is one or more linear combinations of these multidimensional wavelets.

IV. NEURAL NETWORK APPLICATION IN DATA MINING

Neural networks can be used to model complex relationships between inputs and outputs or to find patterns in data. Using neural networks as a tool, data warehousing firms are extracting information from datasets in the process known as data mining. Prediction,Clustering, Association Rules. Classification and prediction is a predictive model, but clustering and association rules are descriptive models. The most common action in data mining is classification. It recognizes patterns that describe the group to which an item belongs. It does this by examining existing items that already have been classified and inferring a set of rules. Similar to classification is clustering. The major difference being that no groups have been predefined. Prediction is the construction and use of a model to assess the class of an unlabeled object or to assess the value or value ranges of a given object is likely to have. The next application is forecasting. This is different from predictions because it estimates the future value of continuous variables based on patterns within the data. Neural networks, depending on the architecture, provide associations, classifications, clusters, prediction and forecasting to the data mining industry. Financial forecasting is of considerable practical interest. Due to neural networks can mine valuable information from a mass of history information and be efficiently used in financial areas, so the applications of neural networks to financial forecasting have been very popular over the last few years. Some researches show that neural networks performed better than conventional statistical approaches in financial forecasting and information on associations, classifications, clusters, and forecasting.

V. CONCLUSION

Neural network is considered as a promising tool for data mining.Neural network is very suitable for solving the problems of data mining because its characteristics of good robustness, self-organizing adaptive, parallel processing, distributed storage and high degree of fault tolerance. Compared to statistical methods, NN are useful especially when there is no a priori knowledge about the analysed data. They offer a powerful and distributed computing architecture, with significant learning abilities and they are able to represent highly nonlinear and multivariable relationships. Hence, the use of neural networks in data mining is a promising field of research especially given the ready availability of large mass of data sets and the reported ability of neural networks to detect and integrate relationships between a large numbers of variables.

REFERENCES

[1] Neural Networks based Data Mining and Knowledge Discovery in Inventory Applications: KantiBansal, Sanjeev, Vadhavkar, Amar Gupta
[2] Guan Li, Liang Hongjun. Data warehouse and data mining. Microcomputer Applications. 1999
[3] Adriaans P, Zantinge D. Data mining [M]. Addision_Wesley Longman,1996.
[4] Agrawal, R., Imielinski, T., Swami, A., "Database Mining: A Performance Perspective",*IEEE Transactions on Knowledge and Data Engineering*, pp. 914- 925, December 1993.
[5] Berry, J. A., Lindoff, G., Data Mining Techniques, Wiley Computer Publishing, 1997 (ISBN 0-471-17980-9)
[6] Berson, "Data Warehousing, Data-Mining & OLAP", TMH.
[7] Haykin, S., *Neural Networks*, Prentice Hall International Inc., 1999.
[8] Khajanchi, Amit, Artificial Neural Networks: The next intelligence.
[9] Zurada J.M., "An introduction to artificial neural networks systems", St. Paul: West Publishing (1992).
[10]Y.Bengio J.M. Buhmann, M. Embrechts, and J.M. Zurada. Introduction to the special issue on neural networks for data mining and knowledge discovery. *IEEE Trans. Neural Networks*.