The Gas Consumption Rate Anticipation by Neurotic Network

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Abstract: the consumption rate anticipation for gas power and telecommunication companies is an essential task. For gas companies managers the prediction of the amount of gas consumption and also the customer behavior determination can be a management tool for planning and the supply and demand levels coordination as well as offering a consumption pattern method in this Organization. An adequate anticipation of the customer consumption rate in next periods can solve the problems which managers and this Organization encountered with. In this paper the anticipation bas been done by the neurotic net algorithms. The suggested system accuracy has been evaluated by SQl server and WEKA software. The data was the information of 400 gas consumers. The outcomes showed that the offered system was desirable. [Rahim Rashidi, Azad Shojaei and Saeid Yousefpour., The Gas Consumption Rate Anticipation by Neurotic Network**.** *J Am Sci* 2012;8(7):223-226]. (ISSN: 1545-1003). http://www.jofamericanscience.org. 35

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1.Introduction

The artificial neurotic network are in fact inspired by the mammal's blended and mass like brain which has millions of connected neurotic cells neuron, solve the problems. These networks are composed of collections of different model proposed by mathematicians and engineers in order to stimulate a part of brain function. The neurotic nets have been known since 1950s, but in 1980, the algorithms and methods related to the artificial neurotic networks were so developed that they could be used in solution of real problems. The neurotic networks are used in different affairs such as: in pattern recognition including matters like line recognition, speech recognition, and image processing, and also in classifying matters like literature and image grouping.

The artificial neurotic networks are used in monitoring and modeling the unknown and very complicated systems increasingly. Briefly, these networks are the most applied cases in the solution of the following 3 groups of issues. The problems which have no algorithmic solution, the problems which have very complicated algorithmic solution, and the problem which human beings are more successful to solve them. Today's, the gas company anticipates the rate of each subscriber consumption in the subsequent periods by the subscriber average consumption in previous months. This kind of anticipation does not have the adequate precision. A precise model of this kind of anticipation can be a useful supporter for the company decision making. One of the main reason of utilizing these neurotic network techniques by gas company is the large mass of data gathered from the subscribers and the gas company interactions. The main 4 purpose of anticipations are:

1. Consumption rate anticipation
2. Consumption pattern presentation
3. Customer based principle observation
4. Consumption control models presentation

1. the consumption rate anticipation: in this article, it has been tried to anticipate the rate of subscriber consumption precisely. The organization will be able to estimate the next period consumption of the customer. In this Anticipation, the neurotic networks model as well as 400 educational data sample have been used in order to learn the neurotic network function.

2. The consumption pattern presentation: An organization manager can determine the managing patterns and methods for future terms by this The best part is determination of management method and solution before next period consumption.

3. the customer based principle observation: These days, the gas company is printing some alerting sentences about the way of gas consumption and how the organization encounters with the subscribers who consume gas a lot. This message is printed for every consumer even those with low rate consumption. This will be opposed to the customer based principle. So the gas company can write a warning message on the bills of consumers with high rate of consumption and also write a sentence to

thank the customers with low rate of consumption. This is one of the best outcomes of this paper.

4. The consumption control models presentation: the gas company can print a suitable warning message on the current period bills in order to control the consumption rate in next periods. Also the manager can present a good controlling Pattern.

2.The neurotic net method

The artificial neurotic networks are patterns for information processing and they have been structured like the biological neurotic network. The main element in this pattern is the new structure of its information processing system. These networks consist of a large number of neurons with inner strong connection. There are a lot of different artificial neurotic networks such as: multilayer presspetron networks, kuhnn, hopfield they are taught by various educational methods like feedback error method each natural neuron is composed of three main part: cell body ,dendrite, axon and a space between axon and dendrite called synapse[4].

In human brain, one cell collect signals by very small structures called dendrites. The neurotic cell transmits a fast electronic pulse through along and thin pillar called axon. this extends to thousands of branches. At the end of each branch, there is a structure known as synapse changes this activity to electronic affects which excite or calm the related neurotic cell. When a neuron receives the activator message, It sends a pulse in to axon too learning takes place by synapses effect change, so the effect of one cell on other cells will change. The neurotic cells are able to find patterns in data. You may never aware of them. In order to know if a neurotic network acts correctly or not, the total square of erros is used. Our purpose is to minimize the rate of this error. One of the applied methods is Gradient Descent. In this method, we are following a rule which guide us toward the error. This rule is[6]:

$w_{ij}(n+1)=w_{ij}(n)+\Delta w_{ij}(n)$

Where Δw_{ij} (n) is the learning rate and w_{ij} (n) is the Wight select randomly at the beginning.

3.Learning

Supervised learning: in this method, an educational collection has been considered and the learner acts based on a input and gains an output. Then these outputs can be evaluated by a teacher. Some differences in learner behavior will happen. They are based on differences with the desirable output.

Unsupervised learning: in this method, the educational collections are not used during learning and there is no need to desirable output information. There is no teacher and the proposed is too discovering the patterns or the characteristics in input data.

Reinforcing learning: in this method, there is no instructor as a trainer. The learner is taught by his her own experiments. One primary strategy is considered in this state. Then this system acts in that way and receives a response from its environment. Then this response is surveyed to see if it is suitable or not. The learner will be awarded or punished according to that response. If the learner is punished, that mistake will be made less next times and also if he /she is awarded, the learner will do that action cause the reward.

4.Back propagation algorithm

For learning the weights of a multilayer network, the back propagation algorithm is used. In this method, we use the Gradient Descent method to minimize the square of errors between the network output and the end function. This algorithm is so: a net with N input nods, N hidden nodes and N output nodes is established. Give each weight a small random number change the amount of each weight [6]: $W_{ji}= W_{ji}+ \Delta W_{ji}$

Where $\Delta W_{ji} = \eta\delta jXji$

BP algorithm is usually used thousands of times. It will be repetitive before the end of the task. Some different conditions can be applied to end the algorithm. Pause after some certain repetitions stop, when the error is less than a determined rate. Stop when the error in confirmation collection examples does not follow a special rule the weights change rule can be considered so that the weight change in Nth repetition depends on weight change in the previous repetition.

ΔW_{ji} (n)= $\eta\delta jXji + \alpha\Delta W_{ji}$ (n-1)

Where the amount of α is: 0<=α<=1

Adding the momentum prevent not to be trapped in local minimum by moving in previous line in error level and also doesn't let place on smooth surfaces.

5.Anticipation

Today's, anticipation is the essential part of humans life, from the weather anticipation to the prediction of sport events. Prediction is not a new concept, but it has existed since early ages. Now, this subject is more significant by methods like the neurotic network and data mining. A series of a chronic observational collection which has been arranged based on time. In other words It can be said a time series is a series of data gained by observation of one phenomenon during time. We consider a time series as an alternative observation of one variable and the goal is anticipation of that variable for other data.

6.Time series modeling by box Genkins

Method ARIMA are useful to describe the behavior of some time series. To make this model, we use a method with three repetitive stages. First, we make an experimental model out of previous data,

and then uncertain parameters are predicted. Afterward, we analyze the results and assess the system accuracy and precision. If it is precise and suitable, it will be used to anticipate [8].

7.Data collecting

One of the main challenges in this article is data and data collecting. In this paper, an information bank with 400 educational data has been used in order to present a suitable model. Establishing a suitable data base by the gas company subscriber's information can have a significant effect on anticipation accuracy and reliance coefficient. The fields and factors used in educating model have been mentioned in table 1. In this table values and the fields varieties exist. The above data have been saved in SQL server. By saving data in informational bank, it is easy to use it in modeling neurotic systems in WEKA software.

Table 1. The stored data structure

values	Type	title
Service ,commercial, cosmetic	fibrous	Partnership type
Spring-summer-fall-winter	fibrous	season
Villa-apartment, other	Fibrous	Building sort
North, west, east or south of city	fibrous	address
-	fibrous	consumption

8.Data erasing

It means the error recognition and removing errors and the in compatible data so as to gain data with higher quality. If data comes from similar resources like data bases or files, we may have some error like typing mistakes, in correct data and also files with no value. If there are different resources such as web based information system or questionnaires, we will have more error and data erasing will get more importance. To acquire precise and compatible data, we must unite the data and omit the extra data. Figure 1 is an example of data distribution provided by WEKA software.

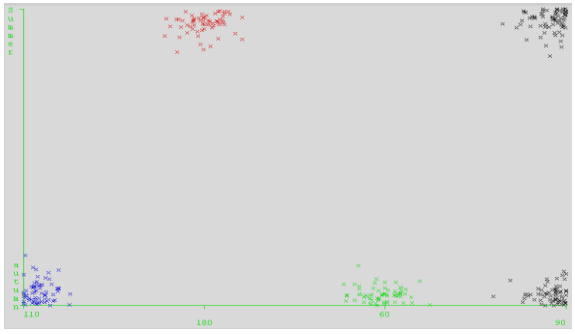

Figure 1: Show scattering data

9.Proposed model

The modeled neurotic network parameters are mentioned in table 2. In these system simulations, it is observed that when a certain weight increases it gradually enhances until the end of the learning process. A synapse weight hardly ever increases or decreases alternatively. So a parameter called momentum is put in weight variance gradient to affect. Therefore if a weight increases alternatively, it will raise in an unusual way and also if a Wight is going to decrease alternatively. Its reduction rate abnormally will decrease consecutively. This parameter is called momentum and create motional to change the weights. It helps the system reach the convergence state in less time. The same as previous parameter, we can use momentum in accurate systems where every sample is important, but in inadequate system this value should be chosen lower. In the structured model, the precision rate and precision error of anticipation is as follow:

Correctly classified instances: 73.1988%

Incorrectly classified instances: 26.8012%

Table 2. Neural network parameters of the current paper

Scheme	Multilayer Perceptron
Instances	347
Attributes	5
Test mode	3-fold cross-validation
Learning Rates	0.3
hidden layers	3
Momentum	0.2
epoch	500

In figure 2, a modeled neurotic network is able to be seen by WEKA software. Figure 3 surveys the accuracy rate by different parameters of learning. The model has the most accurate precision when the learning rate is 0.2.

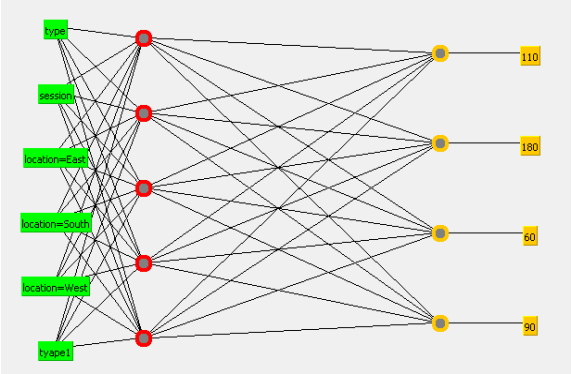

Figure 2: Neurotic Networks

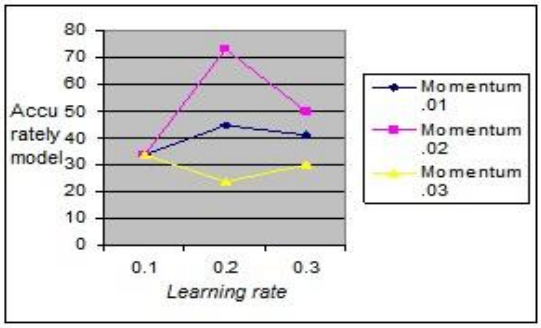

Figure 3: Accurately model

Table 3. the system evaluation

TP Rate	Precision	Recall	Class
0.66	١	0.662	110
١	٠.۴۲۲	١	١٨٠
٠.۶٧	١	٠.۶٧۶	۶٠
٠.۶٧	١	٠.۶٧۶	٩٠

In that figure the axis x shows the true consumed values and the axis y is the predicted results by the structured neurotic network model. The sign ✶ in this figure is the symbol of correct anticipation and is the symbol of the wrong one. Data shown by purple arrow has the real consumption value of 60, but in the wrong way is anticipated to have the consumption value about 180. The pointed out data by black arrow has the true consumption value of 180 and it also has an obtained value about 180, exactly the same as the real one.

In table 3, the accuracy and the system precision and error parameters are explained completely. It is necessary to know that giving weight to the network and connecting the nets are just done at the time of network training. At the time of using the net, there is no change in nets. The period of in traducing all data in educational packs to the network is called one Epoch, the more Epochs we have, the less MSE Errors will happen. So the designer should test the various Epochs after presenting the model. If the rate of MSE stays fixed in each time, the structure and the architecture of selected model is not suitable. The changes in weight must happen just at the time of education not at the time of utilization. This is a Very important point must be considered. The period when data of an educational package is in traduced to one network is called Epoch. When the number of Epochs increases, the MSE error decreases. So, the designer should check the different Epochs and the MSE error after his /her presentation. If we have fixed values of MSE in all stages, the chosen network structure and architecture will not be adequate.

10.Conclusion

In this article, the data of 400 gas company subscribers was gathered by questionnaire. Then a model based on neurotic network was presented. According to this, the rate of customer consumption can be anticipated in different seasons and places. There were many problems in data collection. we hope that gas and other involved companies help us in our later studies. The structured model has accuracy about 70% and this is one of the strength points of this article. Data storing has been done in SQL server software. To make this model we used WEKA software. The main problems of this article are the data shortage and the effect of lack of information such as the subscriber's job and area.

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