Evaluation of e-Commerce Websites using an Optimized RBF Algorithm based on Fruit Fly Algorithm

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Keywords: Fruit Fly Algorithm, RBF Algorithm, e-Commerce Website, Optimized Algorithm, Evaluation.

Abstract: Developments of e-commerce modes have brought in increasingly fierce competition. The RBF algorithm can perfectly and accurately evaluate e-commerce websites, thus providing quantified competitive index of e-commerce. Furthermore, evaluation can be more accurate by using an optimized RBF algorithm based on fruit fly algorithm. With this optimized RBF algorithm, the work accurately calculated the evaluation results of e-commerce websites, thereby resolving the competition issues of e-commerce sites fundamentally.

1 INTRODUCTION

Developments of the Internet have led to a rise of e-commerce websites and brought in fierce competitions among these websites. In this context, e-commerce websites hold a very important position in economy. The major topic of current discussion is how to quantify the evaluation of e-commerce websites. The RBF algorithm is the general method to do the evaluation. However, due to some impracticabilities and defects, this method needs to be optimized. Therefore, an optimized RBF algorithm based on fruit fly algorithm is proposed. This new algorithm has been applied into the evaluation of e-commerce websites.

2 DEFINITION OF THE RBF ALGORITHM

RBF, known as the radial basis function, is a single contact feedforward neural network. RBF has been widely used in pattern recognition and signal processing. Results have shown this method is feasible. Advantages of RBF are obvious: simple network structure and strong nonlinear approximation ability. In practice, center parameters of neurons need to be identified when using RBF algorithm. Center parameters can be selected in two ways: directly select from machine training samples, or use clustering method. Both methods have flaws, thus the application of RBF algorithm is limited.

3 STRUCTURE OF THE RBF NEURAL NETWORK ALGORITHM

RBF neural network consists of three layers: input layer, middle layer (also known as hidden layer) and output layer. Detailed analyses for each layer are made to study the structure of RBF neural network algorithm further.

3.1 Input Layer of the RBF Neural Network

The input layer, including the initial source points, is the entrance of data. Composed of sensing units, source points are connected with external neural network. Their primary function is message passing. Messages are directly transferred into input layer without any transform. Such input layer used to collect data can be found in any neural network.

3.2 Hidden Layer of the RBF Neural Network

When messages are collected by input layer, they will be sent into hidden layer. Hidden layer is the processing layer of the RBF neural network. In this layer, input message will be subjected to non-linear transformations by RBF, and therefore they can have higher dimensions. In mathematical perspective, hidden layer is the processing unit of the RBF neural

Changrong R.
Evaluation of e-Commerce Websites using an Optimized RBF Algorithm based on Fruit Fly Algorithm.
DOI: 10.5220/0006025003120315
In *Proceedings of the Information Science and Management Engineering III (ISME 2015)*, pages 312-315
ISBN: 978-989-758-163-2

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network, where combines all core parts and realizes the internal conversion of input data.

3.3 Output Layer of the RBF Neural Network

When data are transferred from input layer to hidden layer, core module functions will perform non-linear transformations on data to make them linearized. After a series of data processing, linear data are generated. These data are sent to output layer and can provide input layer with activation responses.

4 ALGORITHM DESIGN OF THE RBF NEURAL NETWORK ALGORITHM

Algorithm design is a network-based design approach. In some applications, the RBF algorithm design should achieve quantification and linearization. Generally, algorithm design has two steps: the first is to determine the kernel function of hidden layer, which is the RBF; the second is to adjust the RBF. By analysis, RBF will not affect the performance of network. RBF is called in the form of nonlinear function, and then can be used to determine the central value and width, adjust the algorithm and so on.

4.1 Network Algorithm Design based on the RBF Neural Network Algorithm

During the process of network algorithm design, the neural network design can be divided into following steps:

The first is to construct the neural network. The neural network works as the general framework. Key points in its construction are to determine the different layers and its overall structure. Specifically, the source of sample data from input layer can determine the network structure. Moreover, middle layer and output layer can determine neurons and kernel functions.

The second is the initialization process. When network is constructed, different data are input to it according to demands. After weight values are initialized, initial data can be obtained.

The third is the internal training. After initialization, the network needs to be trained by input and output tests with sample data.

The fourth is simulation. After the completion of the above, network simulations can be processed.

4.2 Design Flow of Neural Network Algorithm

When constructed the infrastructure of neural network, the design flow of this algorithm should be considered. This work contributes to obtain corresponding network architecture and perfect test environments. The first step is to select the cluster center, whose value determines the initial width. The input data serve as distance criterion of center layer, and their volume determines the number of clustering in the network. The second step is to update weight values. Updated values are determined by the instantaneous values of certain functions with the input of all samples.

5 OPTIMIZED RBF NEURAL NETWORK BASED ON FRUIT FLY ALGORITHM

Many studies have been done on the structures and composition simulations of RBF neural network. In practice, one problem is that post optimizations are needed due to some limitations of RBF neural network. However, the fruit fly optimization algorithm (FOA) has improved the RBF neural network algorithm.

5.1 Fruit Fly Optimization Algorithm

FOA is a calculation method proposed by a teacher in Taiwan. This method calculates in an evolutional way to achieve certain purposes. When fruit flies look for their food, they use their keen sense of smell and vision to quickly locate the food. FOA is a global optimization method derived from the way fruit flies forage.

5.2 RBF Neural Network based on FOA

FOA is a calculation method derived from the process that fruit flies forage. In practice, FOA requires a step decomposition to achieve its goals, so it can be divided into following steps:

(1) Group locations of fruit flies should be initialized and then recorded.

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(2) The distance of random search for fruit flies needs to be determined. Random location data can be calculated by certain functions.

(3) Random directions of fruit flies' motion represent the possible directions of food. In this experiment, because the position of food is unknown, the reciprocal of distance will be estimated by the distance between fruit flies and the base point.

(4) Fruit flies search their food according to odor concentration. Therefore, the decision function can be obtained by calculating the odor concentration.

(5) The optimal concentration of food odor is determined by the decision function.

(6) The food location can be determined according to the calculated group location data of fruit flies.

6 E-COMMERCE WEBSITE EVALUATION USING AN OPTIMIZED RBF ALGORITHM BASED ON FOA

Optimized RBF neural network based on fruit fly algorithm has overcome the shortcomings of RBF neural network. Using optimal locations of FOA is the best way to construct a RBF neural network. Now the question is: how to use optimized RBF neural network based on fruit fly algorithm to evaluate e-commerce websites?

6.1 Competitive Index Evaluations of e-Commerce Websites using an Optimized RBF Neural Network based on Fruit Fly Algorithm

The analytic hierarchy process(AHP), a common used analytical method, applies to evaluations of e-commerce websites. AHP is proposed by an American scientist. It is a hierarchical and structured analysis method combined with quantitative analysis. AHP is a universal method that can effectively solve practical problems. Therefore, AHP can be used to evaluate the e-commerce website.

6.2 Data Determination in Input and Output Layers of RBF Neural Network

Input layer is a crucial port in RBF neural network to connect to external data. To determine the input data of e-commerce websites, the competitive index needs to be calculated. Input data which need to be determined can be scored by calculating the expectation. Scores can largely reflect the competitiveness of these e-commerce websites. In this way, the reference value of input data will be more reliable. This process is equivalent to the data initialization in FOA. In the later calculation process, the best data can be obtained by referring the input data and using the designed network.

6.3 Competitive Index Calculation using AHP

AHP obains its corresponding data by calculating different evaluation indexs. Weight values are key indexs in the calculation process, in many cases, the level of weight values will directly affect the final results. To shorten the testing process, kernel functions will perform nonlinear conversions in different layers .

6.4 Application of Competitive Index Evaluations of e-Commerce Websites using RBF Neural Network Algorithm

When use the RBF neural network to evaluate the competitive index of e-commerce websites, the process can be divided into the following steps.

The first is to input the competitive index data. Experts' evaluations can be used as reliable initial data.

The second is to use these data to create a sample database, this database will work as the initial reference. Neural network is also established by these data, then researchers will conduct tests and simulation trainings on it.

The last step is do the calculation with data models, so as to obtain the competitive index standard of e-commerce websites.

7 CONCLUSIONS

This work analyzed the functions of different layers in RBF neural network design. The output of RBF neural network should not be affected by input layer and nonlinear transformations. To meet this requirement, researchers can set corresponding parameters in different input ports. In practice, FOA are used to overcome the limitations of RBF neural network. So RBF neural network based on FOA are

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adopted in the evaluations of e-commerce websites. Specifically, nonlinear data extracted from websites are conversed in middle layer, and eventually they transformed into linear and quantified data. FOA can be used to find the optimum point, and therefore the most authentic quantitative data of e-commerce websites are obtained. In conclusion, it is effective for people to use RBF neural network based on FOA to do evaluations of e-commerce websites.

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