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# Application and Practice of Web Data Mining in Ecommerce Based on BP Neural Network Algorithm

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**Abstract.** With the development of computer network technology and database technology, the ecommerce industry has also experienced rapid growth, generating massive amounts of transaction data every day. Web data mining technology based on BP neural network algorithm can achieve targeted collection, organization, and analysis of this data, mining novel information with potential application value for merchants from a large amount of random and noisy data, which can serve as a powerful reference for business decisionmaking, improve customer satisfaction, reduce customer churn, and explore potential customer resources.

**Keywords.** BP neural network; Electronic commerce; web data mining; Business enterprises; client

## 1. The Necessity of Web Data Mining in E-commerce Applications

With the rapid development of computer network technology and the gradual acceleration of modern life pace, more and more users, especially the new generation of users, attach great importance to the value of time. When shopping, they would rather spend more money to save time and devote themselves to more meaningful work, creating greater value. Therefore, e-commerce has emerged and flourished. Traditional physical stores have tried online stores and modified them using the Internet.

In the early stages of e-commerce development, only a small number of merchants settled on e-commerce platforms such as Taobao and JD.com, which could share a large amount of traffic dividends. They obtained high profits with extremely low customer acquisition costs. Gradually, as the number of merchants settling in skyrocketed, the platform was unable to allocate enough traffic to them, causing traffic to peak and the traffic dividend to disappear. Merchants have to pay for advertising or directly purchase expensive platform traffic in order to attract traffic. This leads to a significant increase in the cost of acquiring customers for merchants and a decline in profits. How businesses can effectively extract valuable information from massive data such as user browsing history, consumption history, favorite products, and user reviews as a reference for adjusting decisions, maximizing user needs, attracting consumers, and improving customer conversion rates has always been an important issue. Data mining technology based on BP neural networks has played a unique advantage in these areas.

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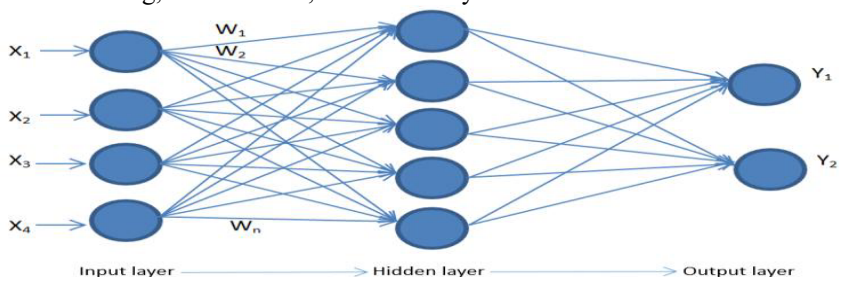
## 2. Overview of Web Data Mining Using BP Neural Network Algorithm

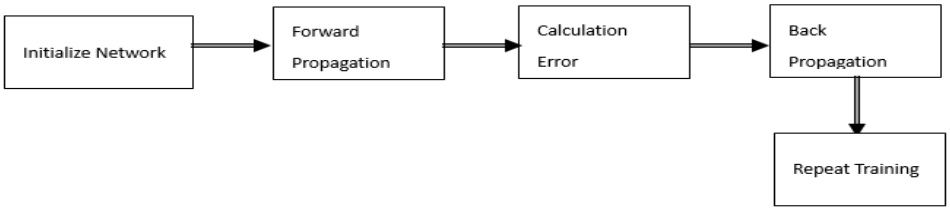
### *2.1. BP Neural Network Definition*

The error back propagation network model is called BP neural network model for short, which is one of the most common artificial neural network models, including input layer, hidden layer and output layer, each layer is composed of multiple neurons, the input of the lower layer is actually the input of the upper layer, the model is shown below. The Circle, XI, WI and Yi represent neurons and their inputs, weights and outputs, respectively. The BP Neural Network has the superstrong computation ability in the numerical data processing aspect, simultaneously also manifests the thought, the storage and the study ability in the processing knowledge aspect, at present, it is widely used in data mining, robot control, decision analysis and other fields.




### *2.2. Workflow of BP neural network algorithm*

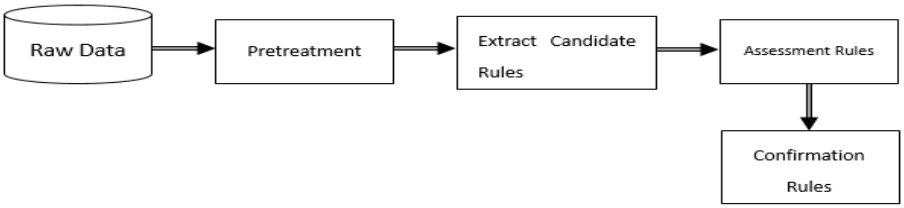
The work flow of BP neural network algorithm is mainly divided into five stages as shown in the figure below. Firstly, the network structure is determined, and then the weight matrix is initialized with uniform distribution or normal distribution. Then, after the training data is input into the network, the output of the upper layer neuron plus the weighted input is taken as the input of the current neuron, and the output of the neuron is obtained through forward propagation. The third step uses the loss function to calculate the difference between the predicted value and the true value; The fourth step is to modify the weight matrix according to the error backpropagation; Loop through steps two to four, through several iterations, when the error between the network output and the expected output is less than the threshold or reaches the maximum number of training stops.




### *2.3. Application of BP neural network in web data mining*

The data mining process of the BP neural network algorithm involves four steps to analyze and mine useful patterns from a large amount of web data: preprocessing, cleaning, and denoising incomplete and inconsistent web raw data to obtain a complete

and pure dataset; Extract feature itemsets from the preprocessed dataset, generate candidate rules, and convert the data into data that is easy for users to express and use; Evaluate the generated rules with coverage and confidence as the main indicators, and ultimately determine the useful rules that can be used for data analysis and decision-making. The specific process is shown in the following figure.




## 3. The Specific Application of BP Neural Network Algorithm in Web Data Mining in E-commerce

As a powerful data mining tool, neural networks are completely open to users compared to traditional data mining techniques. They have strong capabilities in processing large-scale data and reading non-linear data. Neural networks have outstanding abilities in adaptability, non-linearity, and parallelism, which can further improve the accuracy of data mining. The data mining based on BP neural network algorithm improves the professional knowledge base on the basis of traditional data mining, and incorporates professional knowledge into the system through knowledge processing methods during the mining process. This can greatly enhance the effectiveness and practicality of mining in e-commerce.

### *3.1. Help businesses and enterprises establish marketing decisions.*

In traditional marketing methods, businesses or enterprises often waste a lot of manpower and material resources by posting advertisements offline, distributing flyers, or promoting through various media forms. The result of this is that those who don't need it turn a blind eye to it and discard it, while those who need it don't see it and don't get it. Companies are completely unable to accurately develop potential customers and expand customer channels in multiple dimensions. After using the BP neural network algorithm in data mining technology, the network log information can be reasonably mined through its powerful computing power, extracting useful information for business and enterprises such as customers' interests, purchasing habits, job nature, and consumption level. Then, with the help of a series of new generation information technologies such as the Internet of Things and big data, products can be targeted and pushed to interested customers, which can improve customer attention and adhesion, and promote customer conversion.

### *3.2. Assist merchants and businesses in analyzing customer value.*

The purpose of e-commerce is to facilitate transactions, and only by having customers can transactions be facilitated. Therefore, only by fully analyzing customer value can enterprises understand and grasp the customers who can bring the most value to the

enterprise, adjust service models, recommend cost-effective products to customers, provide personalized services, and continuously meet customer needs. Analyzing customer lifecycle value and inferring customer cross selling trends are two important aspects of data mining techniques for analyzing customer value. The data mining technology based on BP neural network algorithm uses association analysis method to find the browsing history, purchase history, return and exchange record information of each customer, and organizes and analyzes this information to obtain the customer's lifecycle value, and selects the most important stakeholder customers; By using sequence pattern analysis method, the probability of customers inevitably or highly likely to purchase product B when purchasing product A is obtained, and the purchasing behavior and preference trend of customers are predicted.

### *3.3. Assist customer service staff in implementing customer classification.*

Every day, e-commerce merchants or enterprises receive a large amount of customer browsing or transaction information. Customer service categorizes customers with the same or similar attributes into the same category, which facilitates better customer management and maintenance in the future. In recent years, with the continuous improvement of customer demand, the monotonous service requirements are no longer sufficient, and they are more pursuing spiritual enjoyment. Renowned Japanese marketing expert Lianji Hirashima once said that early customer consumption behavior was purposeful consumption, while current consumption is instrumental consumption. Therefore, stylization and personalization are the pursuit goals of customers in the current environment. This way, customers can gain a sense of satisfaction and familiarity, which is beneficial for stabilizing existing customers and continuously developing potential customers. In order to better meet customer consumption needs, the BP neural network algorithm is applied to data mining technology, greatly improving the classification and analysis capabilities of traditional data mining techniques. Customer service personnel classify and archive customer information with different attributes based on the consumption behavior reflected by different customers, making it convenient to provide and meet the specific needs of different categories of customers.

### *3.4. Helps optimize the website structure.*

Through the case study of "beer and diapers" in Wal Mart supermarket in the United States, it can be found that when dads go to the supermarket to buy diapers for their babies on weekends, they often bring themselves a beer. After long-term testing, it can be seen that customers often have correlations when purchasing products, such as bread and milk, beverages and paper cups, and so on. E-commerce websites should fully consider the relevance of user access to product pages when designing and developing. In order to facilitate customers' search and purchase of products, the BP neural network algorithm is applied in web data mining technology. Through path analysis technology and WebLog mining, the most frequently visited paths can be inferred on an e-commerce website, and closely related products can be placed on these web pages. Improve the navigation structure of the website, add hyperlinks between these product information pages, play a role in prompting and guiding customers when choosing products, stimulate purchasing desire, and increase the sales volume of various products.

## 4. Conclusion

The BP neural network algorithm is one of the most frequently used network models nowadays. Web data mining technology based on this algorithm is applied in e-commerce, which can help merchants and enterprises timely obtain users' customer characteristics, browsing history, purchasing behavior, etc., and analyze users' interests, hobbies, and consumption tendencies from them. According to the customized and diversified needs of customers, business decisions can be adjusted in a timely manner to improve users' sense of identity and satisfaction. Only in this way can e-commerce enterprises continue to develop steadily.

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