The Application of Big Data Technology in Network Marketing

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Abstract. In today's Internet technology era, the analysis of big data technology can help marketers better analyze user behavior, user preferences and market hot spots, so that enterprise network marketing programs get better marketing results. Therefore, in the context of big data technology, network marketing should fully consider and plan network marketing countermeasures according to the characteristics of big data. This experiment is carried out in the background of big data technology, analyzes the characteristic details and differences of big data technology in network marketing and real marketing, and summarizes and summarizes the corresponding marketing theory and development as the research theoretical basis. And through big data technology to the network marketing strategy analysis and comparison. Based on the logical relationship reasoning algorithm, this paper constructs the leading network marketing system and marketing strategy in the era of big data by analyzing the development status quo of big data technology network marketing. Experimental results show that using data mining and data analysis technology to analyze customer behavior data, establish the best network marketing strategy and make real-time adjustment strategy, in the enterprise, network community platform, between customers to form a marketing closed loop, in solving the breakthrough of network marketing at the same time to bring higher value to customers.

Keywords: Big Data Technology, Network Marketing, Logical Reasoning Algorithms, Precision Marketing.

1. Introduction
With the continuous maturity of big data technology, China has gradually entered the era of big data economy. The marketing strategy of enterprises can not remain unchanged. It needs to follow the development of the times for continuous optimization and improvement. It is necessary to pay attention to the marketing strategy brought by the network economy. For the traditional marketing methods, both reservation and appropriate abandonment should be made [1]. At present, China's marketing strategy should gradually adapt to the current market situation, and constantly update and optimize the marketing strategy based on modern technology. The traditional marketing method can bring certain economic benefits for enterprises in the past. However, with the continuous development of the economic era, there are more and more disadvantages in the traditional market economy [2].
There are many unscientific places in time and space. The traditional market mainly takes enterprises as the main part. However, due to the continuous popularity and popularization of information network and large data technology, more and more people have begun to like the network consumption mode, this can break the irrationality in time and space [3].

Big data can be called massive data. By using the mode with strong insight, information processing ability and decision-making ability, a large number of data resources can be generated by analyzing the information obtained through cloud computing [4]. In fact, big data is a profound change of social information resources in the information age, which will involve the development of all enterprises. As the core element and foundation of network marketing, the work quality of marketing department has an important impact on the development of enterprises [5]. Therefore, in order to improve the productivity of enterprises, enterprises should make full use of big data to reconstruct the network marketing mode, so as to stimulate the enthusiasm of employees and increase the activity of enterprises [6].

Using big data to realize network marketing and hierarchical management of its marketing methods can realize personalized development of network marketing and greatly improve user experience [7]. With the extensive promotion of big data technology and the continuous optimization and upgrading of big data analysis technology, disseminate data and user feedback, and further adjust and optimize the network marketing plan to ensure that the network marketing plan can adapt to the changing market [8]. The application of big data technology should run through the whole process of network marketing, that is, the planning, implementation, feedback and evaluation of network marketing, and play an important guiding role in the decision-making of each link [9]. Use big data to further analyze user behavior and preference, do a good job in network product research, and improve the accuracy of content marketing content positioning and target group positioning. In the context of big data, users’ browsing habits, product demand and consumption behavior can be rapidly digitized [10].

2. The Establishment and Analysis of the Algorithm

2.1 Logical Relationship Reasoning Algorithm

The number of incorrect actions increases as the relationship path length increases. Therefore, if the corresponding reward is given for each step, a large amount of computational costs are wasted, and in order to reduce the calculation costs, the settings for the incentives in this article are as shown in the following formula:

\[ R_{GLOBAL} = \begin{cases} +1 & \text{the path} e_{target} \\ -1 & \text{other} \end{cases} \]  \hspace{1cm} (1)

Using the cosine function to set up a diversity bonus function to calculate the similarity between the currently discovered path and the path that has been obtained, the function is set as follows:

\[ r_{DIVERSITY} = -\frac{1}{|F|} \sum_{f=1}^{|F|} \cos(P, P_i) \]  \hspace{1cm} (2)

Where, \( P = \sum_{i=1}^n r_i \) represents the embedded path \( r_1 \rightarrow r_2 \rightarrow \cdots \rightarrow r_i \) of the relationship chain.

At the same time, in order to avoid getting caught up in the same relationship, this article sets up a decision network for it, as shown in the following formula:

\[ \pi_{\theta}(s, a) = p(a|s; \theta) \]  \hspace{1cm} (3)

\[ J(\theta) = E_{a \sim \pi}(a|s; \theta) \left( \sum_t R_{s_t, a_t} \right) \]

\[ = \sum_t \sum_{a \in A} \pi(a|s_t; \theta) R_{s_t, a_t} \]  \hspace{1cm} (4)

The gradient drop method update parameters are as follows:

\[ \nabla_{\theta} J(\theta) = \sum_t \sum_{a \in A} \pi(a|s_t; \theta) \nabla_{\theta} \log \pi(a|s; \theta) \]  \hspace{1cm} (5)
\[ \approx \nabla \theta \log \pi (a = r_t | s_t ; \theta) \]  

(6)

Make 5 action selections for each round. The fragment ends after 5 selections, regardless of whether the target relationship node is reached or not. At the end of each fragment, update the relationship network, as shown in the following formula:

\[ \nabla \theta \sum_{t} \log a \prod_{t} (a = r_t | s_t ; \theta) R_{total} \]  

(7)

Among them:

\[ R_{total} = R_{GLOBAL} + r_{DIVERSITY} \]  

(8)

2.2 Marketing Efficiency Budget Control Algorithm

For a formula and a given marketing factor metric, the steady-state work point of its system meets the following formula:

\[ l_e(x, u, z) = \min_{x, u} \{ l_e(x, u) | f(x, u) = 0, x \in X, u \in U \} \]  

(9)

Through the problem of efficiency optimization of the above-mentioned formula, the course describes the problem of marketing efficiency prediction control optimization, the formula is:

\[ \min_{u} J(x, u) = \int_{0}^{T} l_e(x(t), u(t)) dt \]  

(10)

Conversion of performance metrics: Optimisation issues for marketing efficiency forecast control, turning them into reference tracking MPC issues. First of all, the economic indicators of the original optimization problem are transformed, i.e. the new performance indicators are constructed by increasing the Lagrange relaxation items as:

\[ L(x, u, \lambda) = l_e(x, u) + \lambda f(x, u) \]  

(11)

Based on the above-mentioned new performance indicators after Lagrange relaxation, the solution can be equivalent to:

\[ \min_{x, u} \{ L(x, u, \lambda) | f(x, u) = 0, x \in X, u \in U \} \]  

(12)

Therefore, the Lagrange function can be used instead of the economic target function for performance optimization. Consider the issue of equal constraint optimization:

\[ \min_{z} l(z) \]  

s.t. \( h(z) = 0 \)  

(13)

\[ l(z^* + \Delta z) \approx l(z^*) + \nabla l(z^*) \Delta z + \frac{1}{2} \Delta z^T \nabla^2 l(z^*) \Delta z \]  

(14)

3. Experiment

3.1 Model Prediction

First, the prediction model is established, that is, the network marketing channels and internal structure are predicted by using the theory of capital structure in the system, so as to make informed decisions about the specific content of the scale of marketing. And its long-term and short-term structure; second, marketing forecast decision-making model, including the selection and evaluation of various projects and other intelligent decision-making model; third, inventory forecast decision-making model mainly includes the enterprise's inventory early warning, inventory structure analysis, economic order volume and other major intelligent marketing decision-support model.

For big data enterprises, big data tools, such as SCWS, JIEBA and other word-splits, have basically met the requirements of a variety of natural data management and processing (Language Nature Process NLP). A large amount of data is divided into TF-IDF (term frequency-invm.se document f'equency) to evaluate the importance of network marketing, mainly based on the number of times it appears in the network marketing data and the frequency of its emergence as a reference, mainly to assess whether there is a good ability to distinguish. That is:
\[ w = \frac{n_{1,1}}{\sum n_{k,j}} \times \log \left( \frac{|D|}{1 + |[f: t, e, d_i]|} \right) \]

The above indicates the number of times it has occurred, the sum of the number of appearances, \(|D|\) the sum of the total quantity, and the \(1 + |[f: t, e, d_i]|\) trend of change in the economic management of the enterprise.

The card side test is performed on it, and the formula is as follows:
\[ x^2 = \frac{N(ad - bc)^2}{(a + c)(a + b)(b + d)(c + d)} \]

Among the children: \(N\) for the total number; \(a\) for the number that contains \(w\) but does not belong to the \(t\) class; \(b\) for the number that contains \(w\) but does not belong to the \(t\) class; \(c\) does not contain the number that belongs to him; and \(d\) for the number that does not contain \(w\) and does not belong to the \(t\) class.

3.2 The Source of the Data
The data source of this experiment visited 100 enterprises in China to investigate and collect data samples. Secondly, 20 of these enterprises were issued questionnaire reports by way of questionnaires, 19 were received and 18 were effectively reported. Finally, in the background of the big data era, if you want to expand the market for network marketing, enterprises must find a new way, whether it is to change the data sample, or feasibility studies are very important.

4. Results
4.1 The Market Size of Big Data Enterprise Network Marketing

![Figure 1](image_url) The market size of the economic development of big data enterprises from 2012 to 2020
As we can see from the chart above, before 2015, big data is not big enough, most enterprises are still unfamiliar with big data, less than 20% of enterprises recognize big data, and the development of enterprises in the network marketing benefits far better than before, after 2015 enterprise economic development market size is much higher than before 2015 by about 40%. The results show that after 2015 big data into a rapid development of things, more and more network marketing models using big data, and it brings convenience to enterprises to better drive its economic development.
Figure 2. The proportion of network marketing data used by enterprises using big data technology

According to figure 2 statistics, the difference between enterprises' access to information resources tends to have a great impact on the efficiency of network marketing. Surveys show that up to 57% of enterprises use big data on the Internet to integrate data such as online consumers and network marketing efficiency. In the network consumer's integration of data, the enterprise's use of big data technology survey, it is clear that the major enterprises on the use of big data and data is still relatively welcome.

Table 1. Sales of M-branded products for different marketing models

|                       | Monday. | Tuesday. | Wednesday. | Thursday. | Friday. |
|-----------------------|---------|----------|------------|-----------|---------|
| Traditional marketing models. |         |          |            |           |         |
| Sales.                | 106,    | 467,     | 345,       | 277,      | 92,     |
| Satisfaction.         | 2.07%   | 7.49%    | 6.02%      | 5.37%     | 1.89%   |
| Big data network marketing model. |         |          |            |           |         |
| Sales.                | 279,    | 479,     | 682,       | 896,      | 1034,   |
| Satisfaction.         | 3.11%   | 7.78%    | 12.59%     | 16.77%    | 25.98%  |

Comprehensive table 1 and Figure 2 we can see, enterprises in order to achieve a precise network marketing model, which pay attention to the design of marketing programs, to ensure that the design and consumer needs, from different aspects of the formulation of programs to enhance the accuracy of network marketing. Specific program design, on the one hand, the collection of a large amount of consumer data for in-depth analysis and discussion, to ensure that products enter the network market, enterprises can accurately understand or grasp consumer preferences, behavior, characteristics and different consumer needs, as a basis for different types of customers to accurately deliver relevant product information, so as to implement accurate network marketing strategy. On the other hand, after the implementation of precision marketing strategy, enterprises should do a good job of the original source or consumer feedback channels to obtain information analysis, listen to their views, implement relevant measures to meet their needs.

Table 2. Analysis of Big Data in Web Marketing 2016-2020

|                     | 2016. | 2017. | 2018. | 2019. | 2020. |
|---------------------|-------|-------|-------|-------|-------|
| Transactions (100 million yuan) | 1600, | 2153, | 2605, | 3167, | 3855, |
| Year-on-year growth. | 29.5% | 33.7% | 38.2% | 41.23%| 53.225%|
| Accounted for the proportion of transactions in the province. | 14.2% | 15.3% | 16.7% | 18.32%| 23.19%|

As can be known from Table 1, from the network marketing scale, along with the expansion of network consumption, transactions, the number of rural e-commerce is also increasing. By the end of December 201, 30,000 companies were marketing big data on the Web, adding 10,157 in 2017 alone, driving nearly 90,000 jobs. Through real-time communication between online enterprises and customers, we can grasp and respond to the differentiated needs of customers in a timely manner, and
establish mutual trust and interdependence with customers. Combined with big data and other Internet technologies, we can accurately tap into our customers’ effective needs, find our target customers, and optimize our online marketing strategy.

4.2 At This Stage of Network Marketing
First of all, the use of mobile network terminal marketing is a new network big data marketing model, with the popularity of smartphones, smartphones have become one of the main channels for people to accept information, consumers on mobile network terminals also have a greater degree of dependence, and the traditional advertising marketing model, mobile network terminals using big data technology has many advantages, but for this development of reality, enterprise managers need to recognize their own shortcomings, while introducing professional network big data talent to society, with advanced big data technology and information technology to innovate the content and form of their products.

5. Conclusion.
With the continuous maturity of big data technology, China has gradually entered the era of network economy, the marketing strategy of enterprises cannot be static, need to follow the development of the times for continuous optimization and improvement, to pay attention to the network economy brought about by the marketing strategy. China's marketing strategy should gradually adapt to today's market conditions, and constantly update and optimize the marketing strategy. Traditional marketing methods can indeed bring some economic benefits to enterprises in the past, but with the development of the times, the traditional market economy has more and more disadvantages, in time and space there are unscientific places. And according to the fundamental needs of consumers, with the help of corresponding technology to establish a large data precision marketing model, and in coordination with the enterprise and market departments, to achieve dynamic analysis of data, the establishment of intelligent marketing strategy, so as to enhance the effectiveness of enterprise network precision marketing.

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