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Retraction

Retracted: Corporate Marketing Strategy Analysis with Machine Learning Algorithms

Wireless Communications and Mobile Computing

This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope
(2) Discrepancies in the description of the research reported
(3) Discrepancies between the availability of data and the research described
(4) Inappropriate citations
(5) Incoherent, meaningless and/or irrelevant content included in the article
(6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

References

[1] H. Nan and M. Hu, "Corporate Marketing Strategy Analysis with Machine Learning Algorithms," *Wireless Communications and Mobile Computing*, vol. 2022, Article ID 9450020, 13 pages, 2022.

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Research Article

Corporate Marketing Strategy Analysis with Machine Learning Algorithms

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In the continuous development of Chinese enterprises, the ability to use reasonable and scientific marketing strategies is directly related to the economic benefits and social development of the whole enterprise and even society. This paper explains the importance of standardized enterprise marketing strategies based on machine learning, and on the basis of grasping the characteristics of large capacity, variety, fast flow, and high value of big data, this paper outlines and analyzes the problems that generally exist in China's enterprises in machine learning-based marketing, so as to provide improvement ideas for measures to improve enterprise marketing and provide benchmarks for enterprise promotion, in order to achieve a market economy based on machine learning, maximize the overall benefits, and achieve healthy development.

1. Introduction

In the new era environment, enterprises are faced with an increasingly complex market environment, and in such an environment, it is important to carefully and correctly recognize the advantages of the new era and effectively use them so as to ensure the effectiveness of marketing activities [1]: first is increasing the interaction between marketing departments and audiences. Enterprises can rely on the new era to let people understand the marketing products and marketing objectives, and in this process, enterprises take the initiative to communicate with the audience, get a lot of feedback information, and adjust the marketing plan in response to the feedback information; second is to improve the speed of information dissemination [2]. Third is to reduce marketing costs. The advertising cost in traditional media marketing is very high, which is often unaffordable for many enterprises, while the marketing cost of the new era in product marketing is low, which can reduce marketing investment and expand corporate profits [3, 4].

In general, the profound impact of machine learning on enterprise marketing is mainly manifested in the following aspects.

(1) Realizing accurate marketing

Old marketing concepts and methods are limited by the level of science and technology at home and abroad and are similar in market demand segmentation and purchase prognosis, making it difficult to achieve accurate positioning of consumer data. In the era of machine learning, corporate marketing can fully integrate consumer databases such as web browsing, key information search, and purchase records to understand and analyze consumer demand for products, match consumer preferences with consumer habits, and provide related products, thus improving consumer purchase efficiency and transaction speed [5]. At the same time, it can also create personalized and membership-based products or services for a small number of customers with individual needs, creating new business value. In this process,

the company not only becomes more and more profitable but also contributes to the long-term development of the company, realizing a win-win situation for both consumers and the company.

(2) Analysis of consumer behavior

In the era of machine learning, the consumption behavior of potential future consumers can be analyzed by collecting data from inside and outside the company [6]. Internal data refers to information on customer registration, product purchase transaction records, etc.; external company data refers to information linked to the Internet and social media [7]. Combining these two aspects of data for forecasting helps identify factors that influence potential customers' willingness to consume, so that targeted marketing plans can be made and sales operations can be driven. Machine learning consumption management is shown in Figure 1.

(3) Effective management of customer relationships

In the context of machine learning era, enterprises can study past marketing data deeply through database, establish two-way connection between enterprise goods and consumers, track changes in consumer demand in time, analyze consumer needs, find key customers who create high value, and improve customer satisfaction and loyalty [8]. By establishing a good long-term relationship with customers, enterprises can help build customer loyalty and enhance the core competitiveness of their business. Machine learning to mine user information is shown in Figure 2.

In the face of the rapidly changing environment of the new era, enterprises want to achieve innovation and breakthroughs in marketing, must actively change the traditional model, the establishment of the new era of marketing as an innovative concept, and to promote the transformation and upgrading of enterprise marketing activities under the advantages of the new era [9]. In the change of marketing concept, to avoid entering the bottom-up misunderstanding, the correct approach is to actively change the concept of business leaders, recognize the important value of the new era of marketing and top-down leadership to learn together with the new era of marketing-related knowledge and methods, fully exploit its marketing advantages, and lay the foundation for marketing reform [10–13]. In addition, we should pay attention to adapt to the new era environment, correctly understand the possible negative impact, and develop contingency plans to reduce the risk in the new era marketing. It can be said that in the marketing promotion, we should adhere to the unified management method and change the loose one-sided management of the bad situation, to create good conditions for the development of the new era of marketing.

In order to successfully achieve the goal of innovative enterprise marketing based on the new era platform, we must pay great attention to platform building in this process, relying on the new era marketing platform, to promote the innovative and orderly implementation of marketing activities [14]. To ensure the effectiveness of the platform con-
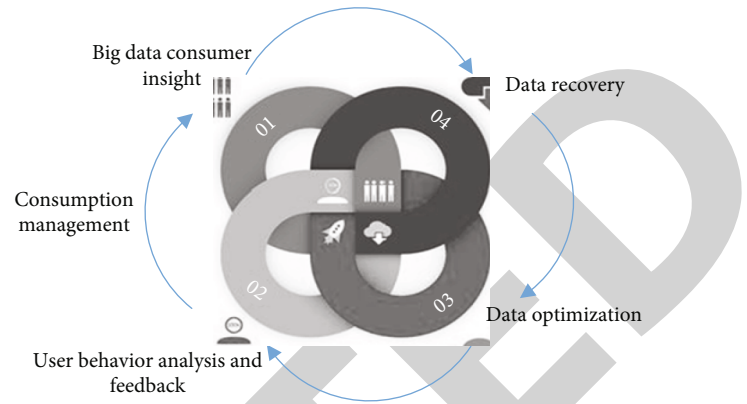

Figure 1: Machine learning consumption management.

struction, first, there should have an effective development and expansion of network marketing path. User information reception methods and consumption habits have undergone radical changes; in this case, companies need to adapt to the new changes and actively build portals to show a comprehensive range of product information, to enhance the audience's understanding of product and service information, and to stimulate the desire to buy. Second, pay attention to the active use of mobile marketing platform. In addition to the independent construction of corporate websites, companies also need to focus on a variety of new platforms, especially mobile marketing platform, with the new platform to organize exciting marketing practices, do a good job of updating information, and improve the effectiveness of marketing. Of course, enterprises also need to cooperate with certain marketing platforms, such as Jingdong, Taobao, and Alibaba, to improve product exposure and increase marketing influence.

Enterprises to carry out new age marketing must pay attention to the standardization and innovation of marketing content, because in line with legal norms is the basis of the new age marketing and the prerequisites, while the new age marketing content in the theme, corporate culture publicity, product introduction, etc., must also be compatible with the mainstream values of society [15]. The ideal new age marketing program is to help companies achieve the expected benefits and objectives, while generating good social benefits, helping companies expand their brand influence, create a positive, positive brand image, and increase customer stickiness [16]. In the process of innovating and improving the new era marketing content, we should not only pay attention to the full display of product features but also actively use emotional marketing, hunger marketing, event marketing, experience marketing, promotional marketing, and other methods to expand its content. For example, Xiaomi cell phone pays special attention to the use of microblogging hunger marketing and network marketing methods, and it only took three years to complete 30 billion yuan in sales [17].

In order to enrich and expand the new era marketing methods, the first thing to do is to build a high-quality new era marketing team, providing online consultation, communication, feedback, and other services for the
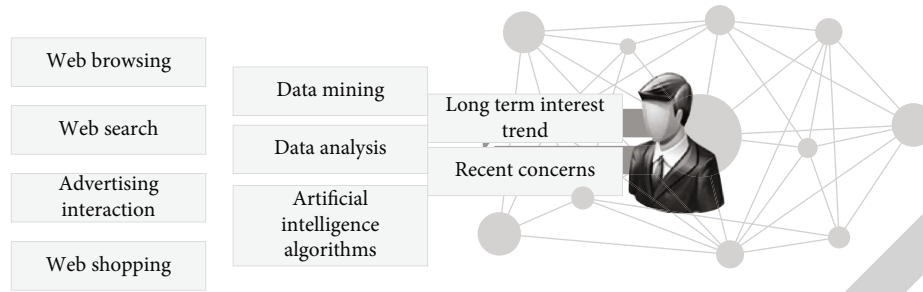
FIGURE 2: Machine learning mining user information.

audience, so that consumers can feel the sincerity of the enterprise in the process of comprehensive experience of online and offline quality services [18]. In the construction of talents, enterprises should consider that the talents who can adapt to marketing in the new era should have both enterprise marketing ability and new era operation application ability, so in the construction of talents, we should grasp this goal, through internal training and cooperation with universities, etc., to create a pool of excellent talents, using special talent management methods, to play the professional advantages of marketing management talents in the new era marketing. In addition, in the process of expanding marketing tools, it should be developed in the direction of diversification. Specifically, enterprises should be based on the actual and actively introduce mobile clients, mobile APP, WeChat public number, microblogging, short video, etc., to build a three-dimensional and diverse new era marketing system to meet the growing consumer information needs. In addition, enterprises also need to develop and explore in the direction of self-media and actively look for consumer opinion leaders in microblogging forums and joint marketing with big names and big V, in order to further expand their influence.

2. Related Work

Machine learning technology is comprehensive, which means that on the basis of efficient collection of basic data and unit data, computers use coding systems to gradually carry out data loading, data aggregation, and data analysis work on them, and finally, the obtained data information chain will be regionalized, thematic, and accurate for effective analysis in order to achieve diverse processing of data functions [19].

At the application technology level, it mainly uses the existing radio frequency identification technology and the corresponding IP communication technology. Generally speaking, machine learning can provide visualization and visualization of data development trajectory. It can respond to the development direction of data in time and then make scientific, reasonable, and accurate prediction and adjustment according to the degree of change.

Marketing refers to the business sales situation that is carried out by a company in response to the market. Marketing strategies in the context of machine learning are studied in the process of building a company for social development. Machine learning is diversified form, collecting data in various sources and forming a huge database. Its capacity is extensive, with different types of information content, carrying a huge amount of information. Machine learning has developed extremely fast in recent years, and its rich information value has led to more and more people to invest in the study of the value of machine learning and apply these technical tools to the development of various product industries. In this competitive and stimulating market environment, which occupies a pivotal position, marketing needs to be given top priority in response to the need to develop and enhance the competitiveness and sustainability of companies. Marketing is characterized by the relationship with customers, to maintain friendly relations with them and to maintain old customers while strengthening the development of new customers. Understand the consumer tendencies of customers and consult their attitudes towards products [20].

In the process of marketing in the era of machine learning, enterprises are required by the relevant state departments and within the industry sector to switch their development concepts, innovate marketing methods, and create new corporate marketing systems. However, many business units do not pay enough attention to this, which hinders the progress of marketing upgrades carried out by enterprises. Due to insufficient attention at the enterprise leadership level and insufficient level of personnel responsible for the management practice of machine learning technology, the relevant staff has a greater arbitrariness in data collection and analysis, resulting in the lack of original value and relevance of the collected information is a common problem at this stage.

Whether or not adequate market research is conducted is directly related to the degree of development of a company's marketing. Conducting adequate market research in the age of machine learning helps companies make marketing decisions. However, some companies lack research awareness, do not pay attention to market research, and do not know enough about internal customer consumption data or external industry trend data, which hinders good communication between consumers and businesses, resulting in the lack of competitiveness of products or services in the market and the gradual loss of the original market share [21].

Many companies are limited by backward management concepts and imperfect systems in marketing efforts. In marketing, enterprises are more concerned about the consumer's consumption ability and the products suitable for marketing,

ignoring the consumer's experience, which in the long run will bring a series of negative effects on the business development of enterprises [22]. Moreover, a single marketing tool is also a common problem in marketing. In the marketing process, the product is introduced to consumers in the form of advertising, highlighting the advantages of the product, which satisfies the aesthetic experience of consumers, but in the actual use of the product, there is a lack of interaction between the product and consumers [23]. Failure to be able to relate to the user's life, in the details, fail to take into account the behavior habits and consumption patterns of different consumers, uniform design style makes the user in the use of a certain influence. Therefore, marketing should pay attention to the user experience and focus on promoting the concept of different designs for different people. In terms of marketing channels, there is the problem of nonuniform channels, and manufacturers and enterprises are prone to form conflicts, which is not conducive to the marketing work [24]. After the launch of a new product, the use of inappropriate marketing channels can be detrimental to the promotion of the product. The marketing channels of enterprises also need to make timely adjustments according to the changes in the market situation and social environment [25].

Companies will manifest the marketing opportunities they have ushered in in the era of mobile Internet and machine learning by implementing hard-won precision marketing. In the past, during the research process of marketing management activities conducted for enterprises, the process of market segmentation and prediction of the market was relatively rough and failed to accurately position the market. In the context of today's Internet and machine learning era, enterprises should be able to introduce advanced information technology and means into their own marketing work practices, emphasizing their own information processing capabilities for machine learning and achieving accurate positioning according to customer centricity [26]. Since Internet machine learning has many important functions such as information collection and analysis, they can effectively help companies understand different groups of people, their consumption habits, and requirements for products, as well as their preferences for consumption. This enables the company to achieve the desired benefits of precision marketing. The ability to ensure a win-win situation with customers helps to change marketing strategies. By supporting machine learning, companies are able to innovate and transform their marketing programs to meet the growing and evolving demand for products and services in the machine learning era in the coming years, effectively identifying the marketing opportunities that the machine learning era presents, increasing customer strength and resilience, and ensuring effective connections [27]. Today, special attention is paid to improving quality of life consumption levels, and companies facing this situation simply need to change their past marketing strategies to succeed in this phase. In the environment of the machine learning era, companies can analyze and master all aspects of information by building databases and provide customer satisfaction while ensuring marketing effectiveness and providing consumers with higher and better quality and both customer satisfaction and loyalty based on the actual needs of consumers. By allowing our company to do its best to maintain good customer relations despite intense competition and great pressure to grow, the company can still occupy a favorable position [28].

3. Methodology

According to the traditional marketing system, a new system based on machine learning is established based on the characteristics, combined with various technical means of machine learning.

3.1. Market Research

3.1.1. Market Environment. Through data mining, data sharing, web crawlers, and other technical means, we can more accurately understand and perceive changes in the state of the market environment. We can seize the great opportunities brought by the market demand and avoid the negative impact on the enterprise due to the change of market condition. In terms of macro environment, we can use large computers, data mining algorithms, and many other indicators on industrial development and realize the visualization of the results. In terms of perception of the micro environment, using micro marketing channel enterprises, customers, competitors, and other indicators, through deep learning algorithms, to establish a micro environment model, can be dynamic observation at any time.

3.1.2. Consumer Behavior. By conducting extensive market research and industry surveys, some consumer behavior data can be collected. More importantly, it is through cooperation with Taobao, Jindo, and other large e-commerce companies and offline stores to accurately understand consumers' consumption needs and to predict their future consumption behavior.

3.2. Market Strategy

3.2.1. Market Segmentation. Data mining algorithms are used to analyze the consumers in the market, design prediction algorithms to determine the market segmentation criteria, and divide consumers into a number of potential customer groups. Overcome the biggest "expensive" problem of market segmentation and no human intervention, with low cost, good results, and other characteristics. Using machine learning technology, it is even possible to achieve complete market segmentation, as well as comprehensive standard segmentation, where the entire market is segmented from multiple perspectives. Baidu, one of the most powerful machine learning companies in the country, has made many leaps in market segmentation. For example, by opening Baidu Maps, it can achieve automatic navigation through human dialogue alone; by opening Xiaodu smart speaker, it can achieve intelligent and visual control of all home appliances; by using AI fundus screening all-in-one machine, it can achieve diagnosis of eye diseases; by using

EasyDL customized image recognition tool, it can identify real and fake jadeite, fake and inferior Chinese medicine, etc.

3.2.2. Target Market. On the basis of market segmentation, deep learning algorithms are used to learn the laws from a large amount of market data, make identification judgments, determine the target market, and meet certain submarket needs of it with corresponding products and services. Using the powerful data analysis means of machine learning, while making the products more precise and specialized, in theory, it is even possible to achieve complete market coverage and maximize the profit of the enterprise. Data mining technology has great potential for finding target markets. For example, the correlation algorithm in data mining technology has been used to find the exact relationship between electricity consumption and consumer products.

3.2.3. Market Positioning. Through big data analysis means to grasp the current market situation of similar products, comprehend their own product attributes, and to determine a unique market positioning. Create a distinctive and unique image for the company's products. To leave a deep impression on customers, occupy their own position in the market and enhance the vitality and relevance of the product. For example, in Taobao interface, as each user has different consumption history data, the interface presented is different, so the products sold in Taobao are more targeted and can attract consumers to consume. In fact, Alibaba, with its technical service advantages in Taobao, Alipay, and Ali cloud, has already formed a wide range of industrial layout in retail, automobile, and finance by deeply integrating machine learning technology.

3.3. Marketing Strategy

3.3.1. Marketing Mix. Through big data algorithm, deepen the analysis of marketing data and accurately grasp the market demand. Through deep learning algorithms, determine the marketing strategy and realize the marketing strategy combination model, to achieve the optimization of the marketing effect and can realize the real sense of precision marketing. Xiaomi, for example, has launched a machine learning-based marketing 1.0 solution, including data linkage and media linkage. Through intelligent algorithms, it can gain deeper insight into users' needs and deliver the right ads to the right users more accurately.

3.3.2. Marketing Budget. Using machine learning data mining technology, we can accurately determine the various resources required by each department to achieve marketing objectives and reasonably adjust the marketing budget. This will greatly improve the effectiveness of the budget, improve the management level of the enterprise, and optimize the input-output ratio of the enterprise.

3.4. Marketing Activities

3.4.1. Marketing Plan. In determining the specific marketing plan, through the deep mining and understanding of market data, the use of machine learning technology can better and accurately analyze the situation and clarify the product sta-

tus, market conditions, competitive conditions, and macro environmental conditions. It can also better predict the opportunity risk, assist the marketing plan maker, determine the marketing objectives, understand the financial risks, achieve closed-loop, completely control the entire marketing plan, and timely adjust the plan according to external changes are insufficient.

3.4.2. Marketing Organization. Machine learning reduces the size of the marketing organization and also enhances the management capabilities of the marketing organization. It can make full use of wireless, network, and mobile class tools, such as cell phone APP and WeChat applet, to improve the effectiveness of the marketing organization and to achieve the real sense of intelligent management and intelligent presentation. At present, the more common software in cell phones include Taobao and Jingdong. Without exception, machine learning algorithms are used. Each consumer's consumption behavior and consumption records affect the marketing organization behavior of enterprises, to ensure the realization of the marketing effect.

3.4.3. Marketing Control and Implementation. Even if companies in the same industry adopt the same marketing strategy, the effect sometimes varies greatly, mainly because of the difference in the control and execution ability of marketing organizations. Machine learning technology can track and evaluate every aspect of marketing activities to ensure the effectiveness of marketing. Big data algorithms can also be used to clean and standardize data such as annual plans, profitability, and productivity, and then, mine and present them. This helps managers to improve the efficiency of marketing control and execution.

As shown in Figure 3, the basic procedures of marketing can usually be summarized as follows.

At present, in terms of an enterprise, the distribution of marketing objects mainly shows the following characteristics: First, the age of marketing objects obviously tends to be younger. As shown in Figure 4, the population of an enterprise is mainly concentrated in the age group of 18-34 years old, accounting for more than 76% of the total consumer population, with an average age of about 30 years old. It can be inferred that the main audience of a company is young people. Second is the unbalanced structure of the occupational distribution of marketing objects. The different occupations also show different tendencies to the market.

As shown in Figure 5, the highest percentage of the consumer population in a certain enterprise is company employees. Fresh breath, healthy oral hygiene will affect personal mood and personal self-confidence; in attending various social occasions, it helps to maintain a good personal image, but also for all kinds of social, it increases confidence. And mouthwash sterilization effect is obvious; the effect of fresh breath is very good, so the product in the white-collar staff class is a daily care necessities. Individual business people, students, faculty and staff, and medical personnel accounted for a relatively high proportion, but also the future expansion of the mouthwash market target group. Third, the consumer population distribution southeast-
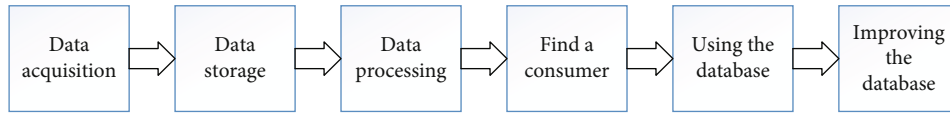
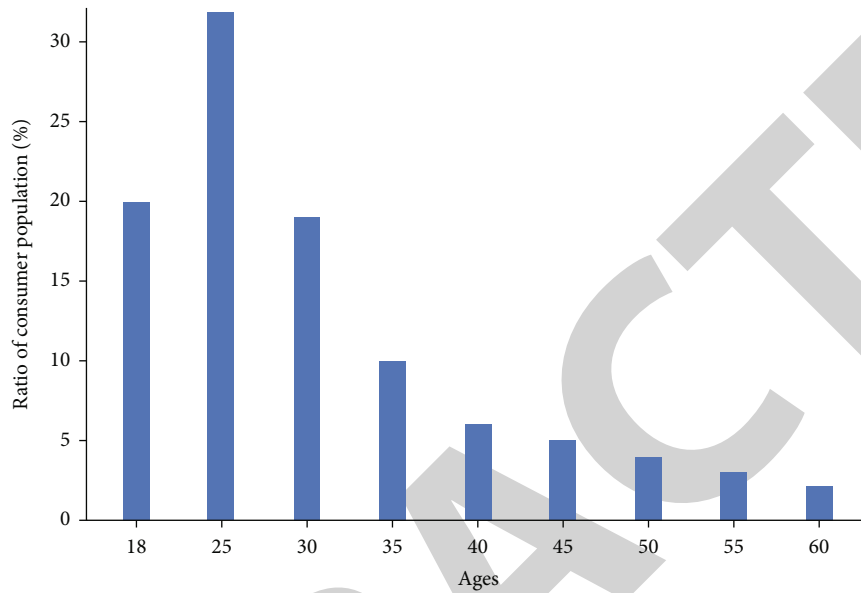FIGURE 3: Marketing basic operating procedures.

FIGURE 4: Age structure of a company's consumer population.
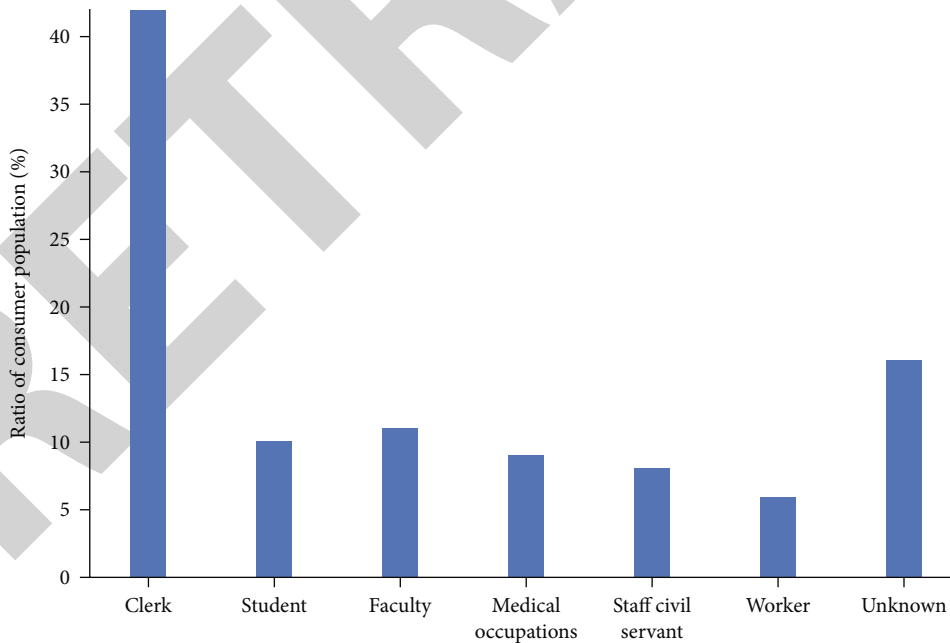
FIGURE 5: Occupational structure of a company's consumer population.

northwest differences are obvious. China's population distribution would have shown a highly dense population in the southeast; the northwest population is particularly sparse.

Coupled with the impact of factors such as large differences in the level of economic development, make a business consumer population showing the characteristics in Figure 6.

It is a very obvious southeast-northwest division in the consumer population of a certain enterprise, with significant differences on both sides of the division. The color shades on

Figure 6: Regional distribution of a company's consumer population.

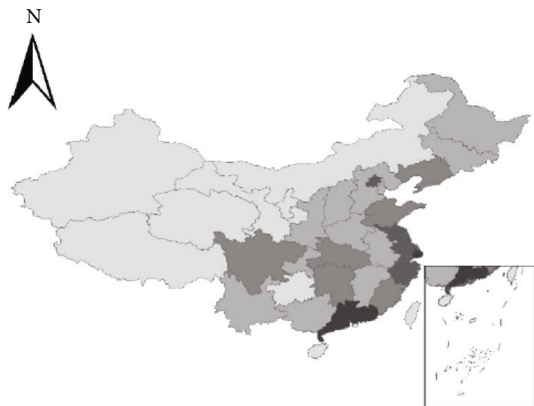the map can also be judged that the main consumer clusters are distributed in areas such as Guangdong and Shanghai, which indicates that Guangdong and Shanghai are the core areas of a company's consumers, and these two regions have a pivotal position in the marketing objectives of the flagship store. And Gansu, Qinghai, Xinjiang, Tibet, and other northwest regions and Inner Mongolia accounted for a very low proportion. Fourth, the marketing target must have online consumer purchasing power. Observe Figure 7, overall, for the relatively high average monthly consumption amount of the interval, the proportion of the purchasing population has been higher than the interactive unpurchased population, and for the relatively low average monthly consumption amount of the interval, the proportion of the purchasing population has been lower than the interactive unpurchased population. This indicates that the purchasers of a certain company need to have a certain level of spending power in order to improve the purchase conversion rate. Taking the average monthly consumption amount in the range of 0-499 as an example, the purchase percentage is 12% and the interactive nonpurchase percentage is 33%, which can be calculated that the number of purchases only accounts for 27% of the customers in the range of 0-499 yuan, while the interactive nonpurchase percentage is as high as 73%. In addition, because of the process of crowd placement, the bidding mode is adopted for each booth, which to a certain extent increases the cost of marketing in a store and also weakens the marketing effect.

The algorithm is more of supervised learning, and since it is supervised learning, it is necessary so that the model can make reasonable and effective classification according to the specific business is a very critical issue. For purchasing behavior, users with this behavior are generally taken as positive samples, and negative samples are in two cases: one refers to people who have not purchased after recent exposure (passive behavior); the second refers to people who have not purchased after recent browsing in the store (active behavior).

The proportion of different samples is in Figure 8. The actual purchase efficiency is very low. When the positive sample is the majority of the studied content and the negative sample is the minority, it is necessary to sample the pos-

itive sample and then select the negative sample according to the 1 : X method, such as the churn warning model. When the positive sample is the minority of the studied content and the negative sample is the majority, the positive sample is generally very small compared to the negative sample, so the negative sample needs to be selected based on the full retention of the positive sample. The negative sample is then selected in the ratio of 1 : X. X can be decided according to the number of appropriate, and it is generally recommended that 4 or 5 is more appropriate.

3.5. Unbalanced Adjustment of Positive and Negative Sample Ratio. The imbalance of the positive and negative samples will adversely affect the prediction effect of the model. Therefore, we need to adjust, combined with statistical knowledge, the following three measures are usually used to solve this problem. First, set penalty weights. For the positive and negative sample imbalance problem, the general idea is to assign different weights, the basic thinking is to assign a relatively small weight to a larger number, and vice versa, and assign a larger weight. If the platform itself supports, this adjustment idea is more simple and efficient. Second, use the combination integration method. This method of solving sample imbalance is somewhat similar to the principle of RF. For example, the negative samples can be split into 100 copies, and then, one copy of the negative samples can be drawn from the positive samples for training each time, which can have 100 results. The negative samples can be split. Third, sampling is performed to solve the sample imbalance. Sampling is a relatively simple way to solve the unbalanced sample distribution and is more suitable for solving the unbalanced distribution of large data. It includes oversampling and undersampling.

As shown in Figure 9, the principle of oversampling is to find a few classes in the positive and negative samples and to replicate the few classes to achieve the required proportion. The disadvantage of this method is that it may lead to overfitting if the sample features are small. As shown in Figure 10, the principle of undersampling is the opposite of oversampling, which first requires finding the majority of the positive and negative sample classes and then randomly reducing the data in the majority classes to achieve a balanced positive and negative sample, with the disadvantage that some data in the majority classes will be lost.

In summary, due to the limitations of the platform and the operability of the actual situation, this paper keeps the number of positive samples unchanged through undersampling. The number of negative samples is controlled randomly by shortening the time interval.

4. Case Analysis

For the data of an enterprise, after preprocessing, the dataset has 203,516 pieces of data. The preprocessed data is split into the training and prediction data are configured in the ratio of 2 : 8. We use the configured training dataset to build 12 models based on four machine learning algorithms for training and then judge the goodness of the models by
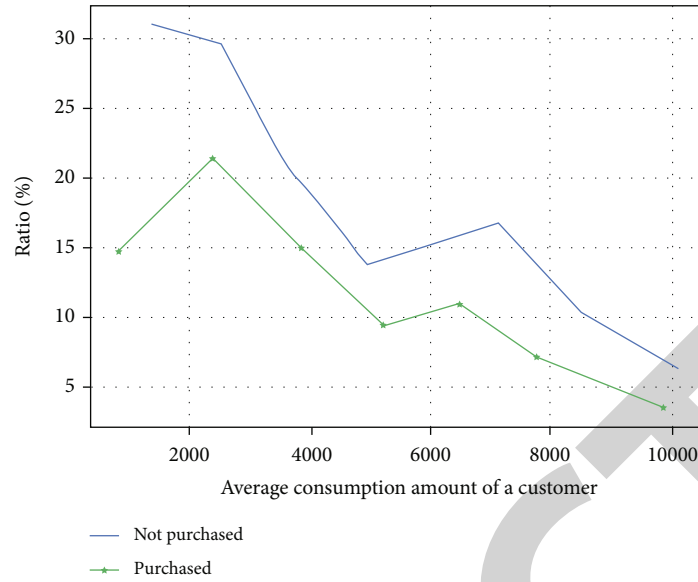
Figure 7: Distribution of the average monthly consumption amount of a business customer.
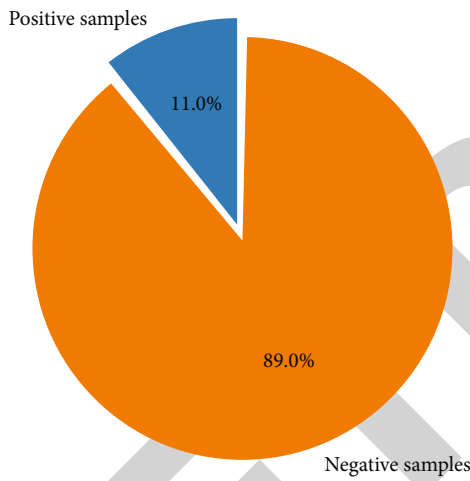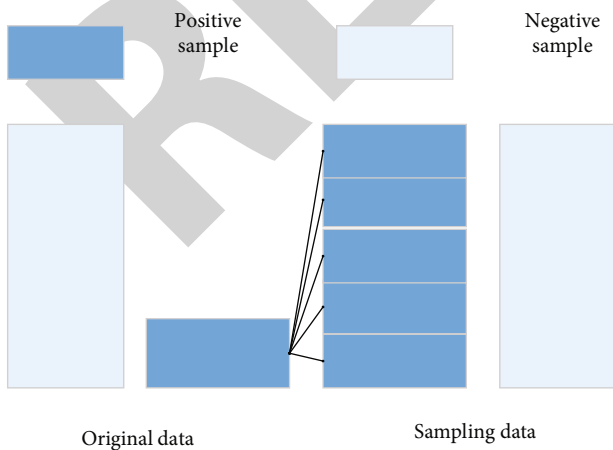

Figure 8: Percentage of different samples.

Figure 9: Oversampling principle diagram.

confusion matrix and model evaluation index. The confusion matrix of was obtained as in Table 1.

The confusion matrix of each model can be used to calculate the correctness, accuracy, and recall, which can determine the goodness, as in Table 2.

RF is widely used by scholars in constructing models due to its simple principle, better fitting effect, and the modeling process without excessive parameter settings. However, extra attention needs to be paid to three parameters that are more important in the RF model, as shown in Table 3.

The confusion matrix of each model can be used to derive the correctness, accuracy, and recall, so that the goodness is shown in Table 4.

In this paper, a SVM is used to construct the prediction model as in Table 5.

The confusion matrix of each model can be used to derive the correctness, accuracy, and recall, and thus, the goodness can be calculated as in Table 6.

In this paper, the GBDT model accompanying the platform is selected for parameter configuration. In this paper, different parameter combinations are selected according to GBDT model, and different results are obtained as shown in Table 7.

The confusion matrix for different models can be derived from different settings of the model parameters, as shown in Table 8.

The confusion matrix of each model can be used to derive the correctness, accuracy, and recall, so that the goodness is shown in Table 9.

Through the comparative analysis, it is easy to find that the model of GBDT3 works best, so the GBDT3 model is used for the testing of the training set and the subsequent application.

Through the comparison of model effects, the GBDT algorithm has the best overall effect compared with other machine learning algorithms, among which the GBDT3 model has the best performance. Therefore, in this paper,
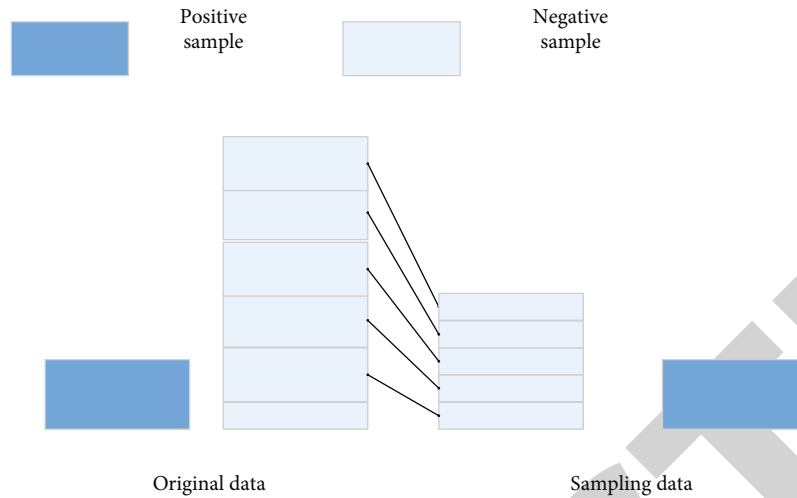
FIGURE 10: Principle diagram of undersampling.

TABLE 1: Confusion matrix of logistic regression model test dataset.

Model	Forecast category	Real category	
		Purchase	Not purchased
Logistic regression $L2$	Predicted purchase	3963	1642
	Predicted not purchased	4918	22324
Logistic regression $L1$	Predicted purchase	5224	1015
	Predicted not purchased	3692	22872

TABLE 2: Results of logistic regression model test dataset.

	Correct rate	Accuracy rate	Recall rate	$F1$value	AUC
Logistic regression $L2$	0.8001	0.7061	0.4456	0.5466	0.8383
Logistic regression $L1$	0.8566	0.8364	0.5859	0.6893	0.9027

TABLE 3: Confusion matrix of RF model test dataset.

Model	Forecast category	Real category	
		Purchase	Not purchased
RF 1	Predicted purchase	462	171
	Predicted not purchased	8365	24734
RF 2	Predicted purchase	1456	575
	Predicted not purchased	6476	24339
RF 3	Predicted purchase	2769	1351
	Predicted not purchased	8612	20156

TABLE 4: Results of RF model test dataset.

	Correct rate	Accuracy rate	Recall rate	$F1$value	AUC
RF 1	0.7139	0.7313	0.0525	0.0978	0.7822
RF 2	0.7853	0.7176	0.1839	0.2925	0.7792
RF 3	0.6969	0.6719	0.2435	0.3570	0.7347

TABLE 5: Confusion matrix for linear SVM model test dataset.

Model	Forecast category	Real category	
		Purchase	Not purchased
SVM1	Predicted purchase	2203	1158
	Predicted not purchased	5602	23887
SVM2	Predicted purchase	2845	1670
	Predicted not purchased	6012	22685
SVM3	Predicted purchase	4512	2685
	Predicted not purchased	6817	18873

TABLE 6: SVM model test dataset results.

	Correct rate	Accuracy rate	Recall rate	$F1$ value	AUC
SVM1	0.7945	0.6545	0.2822	0.3946	0.6428
SVM 2	0.7685	0.6293	0.3211	0.4252	0.6573
SVM 3	0.7112	0.6266	0.3984	0.4872	0.6687

Table 7: GBDT parameter settings.

	Number of iterations	Maximum depth of tree	Minimum number of samples of leaf nodes	Learning rate
CBDT1	40	3	50	0.5
CBDT2	60	4	50	0.2
CBDT3	80	5	50	0.1
CBDT4	100	6	50	0.01

Table 8: Confusion matrix for GBDT model test dataset.

Model	Forecast category	Real category	
		Purchase	Not purchased
CBDT1	Predicted purchase	4472	1739
	Predicted not purchased	4424	23608
CBDT 2	Predicted purchase	6596	1347
	Predicted not purchased	2196	22650
CBDT 3	Predicted purchase	6825	1273
	Predicted not purchased	2212	22626
CBDT 4	Predicted purchase	4179	1112
	Predicted not purchased	4606	22852

Table 9: GBDT model test dataset results.

	Correct rate	Accuracy rate	Recall rate	$F1$ value	AUC
CBDT 1	0.8201	0.7198	0.5025	0.5920	0.8329
CBDT 2	0.8921	0.8306	0.7504	0.7885	0.9432
CBDT 3	0.8968	0.8427	0.7639	0.8012	0.9484
CBDT 4	0.8256	0.7901	0.4756	0.5938	0.8268

the data from the test dataset is substituted into the trained GBDT3 model, and the results are shown in Figure 11 by predicting the population with positive and negative samples as well as prediction samples.

In Figure 11, the positive samples correspond to the left axis, and the negative samples and predicted samples correspond to the right axis. For the positive samples, the smaller the proportion of 0-9 on the left side and the larger the proportion of 90-99 on the right side, i.e., the probability of being predicted as positive samples increases significantly with the increase of the prediction score, which means that the model has better prediction effect for positive samples. Conversely, for negative samples, the larger the proportion of 0-9 on the left and the smaller the proportion of 90-99 on the right, the better the prediction of negative samples. From Figure 11, it can be seen that more than 50% of the purchasing users (positive sample) are in the prediction score range of 80-99, and more than 75% of the interactive nonpurchasing users (negative sample) are in the prediction score range of 0-9, accounting for more than 50%, indicating that the positive and negative samples have good prediction

effects and also verifying that the GBDT3 model selected by comparing model effects does perform well. In addition, Figure 11 shows that the prediction sample is close to the negative sample, with more than 64% of the interactive non-purchasing users (prediction sample) in the prediction score range of 0-9, which is close to the percentage of the negative sample, and the similarity between the negative and prediction sample curves. Therefore, in the actual business operation, the threshold value of the prediction sample is set in the prediction band of 80-99 as our prediction population, and the application is placed through the platform.

The predicted population finally obtained by a company was applied to the shopping scenario of the 618 Tmall Mid-year Promotion campaign, and a table of predicted population data for the presale period, warm-up period, and outbreak period was generated by monitoring the daily placement perspective, as shown in Table 10. In this paper, only 6 indicators are listed according to the need of analysis, among which display refers to the number of exposures; consumption refers to the cost of the store consumed by consumers by clicking on the ads; click rate = number of clicks/show; collection and purchase rate = (collection baby volume + collection store volume + add shopping cart volume)/visitor; transaction conversion rate = volume of transaction orders/visitor; ROI = amount of transaction orders/consumption. For a company, the most concerned index is ROI, and when ROI = 1, it means that the amount of the store transaction is equal to its consumption cost; when the ROI is bigger, it means that the more the amount of business transactions, the better the marketing effect. From Table 10, we can see that the model predicts that the marketing method of selecting the crowd is better than 1 in all stages of ROI, especially in the outbreak period. The warm-up period is the second best, but the ROI can reach 3.49 in the case of high consumption, which is also good. In addition, although the ROI of the presale period is slightly lower than the other two stages, it brings a higher collection and purchase rate, which plays an invaluable role in the conversion of later transactions.

The next step is to analyze the effect of the model prediction by comparing various marketing methods. From Table 11, other group 3 has the lowest ROI, although the collection and purchase rate is not bad, indicating that it is still possible to get some traffic through this marketing method, but at a higher cost. Other group 1 has the highest click-through rate of 9.28%, but the ROI is only 1.85, which can continue to be optimized by overlaying tags and then placed. The highest consumption of cross-category marketing, mainly because of the selection of too many other categories with a high relevance to a company mouthwash, can maintain ROI of 2.93 in this case, to a certain extent, indicating that cross-category marketing of this marketing approach can continue to use, but its operation process is too cumbersome. Similar people have the highest collection and purchase rate, but the transaction conversion rate is average. The conversion rate and ROI of the associates are the best among all marketing methods, mainly because the associates are for regular customers, who have a certain knowledge, understanding and loyalty to the product, and it is only natural that they are in the first place. The model predicts an
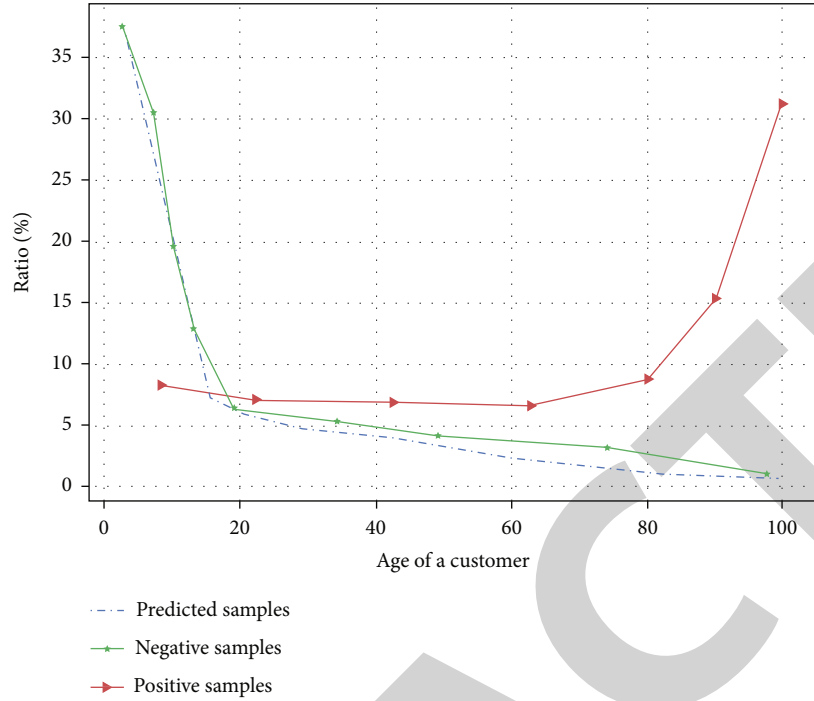
Figure 11: Test sample prediction effect.

Table 10: Model predicts the effect of different time periods of the crowd placement.

Time period	Showing	Consumption	Click rate	Bookmarking rate	Transaction conversion rate	ROI
Presales period (6.03-6.11)	18739	2883	5.00%	11.44%	1.43%	2.72
Prelaunch period (6.12-6.15)	65399	9510	4.68%	8.96%	1.82%	3.49
Explosion period (6.16-6.18)	41753	4883	4.58%	7.24%	2.98%	7.32
Total	125889	12275	4.77%	9.25%	2.08%	4.53

Table 11: Comparison of the effect of different marketing methods.

Marketing methods	Showing	Consumption	Click rate	Bookmarking rate	Transaction conversion rate	ROI
Affiliate crowd	48902	5710	3.57%	12.01%	4.19%	7.5
Model prediction	125885	17277	4.77%	9.25%	2.08%	4.52
Cross-category marketing	568857	82984	4.42%	9.33%	1.65%	2.93
Contact recruitment	565814	54774	4.09%	6.96%	1.25%	2.8
Similar crowd	224594	26133	4.63%	12.10%	1.22%	2.69
Competitor crowd	125738	15741	4.86%	9.09%	1.17%	2.25
Cross platform marketing	121908	12628	3.78%	7.57%	1.22%	2.13
Other crowd 1	120128	28980	9.28%	8.28%	0.93%	1.85
Other crowd 2	749428	73733	4.02%	10.18%	0.85%	1.79
Other crowd 3	192665	21938	4.17%	11.89%	0.69%	1.5
Total	192667	339898	4.77%	9.68%	1.52%	2.87

ROI of 4.52, second only to the cobranding crowd. The reason for this is firstly, the operation object of the joint-band crowd as described in the previous article is the old customers; secondly, if we look at the consumption of the joint-band crowd and the model prediction carefully, we can see that the consumption of the model prediction is much larger than that of the joint-band crowd, and the

ROI of the model prediction is slightly smaller due to the formula for calculating ROI.

Finally, the effect of model prediction application is analyzed from the perspective of the campaign as a whole. As shown in Table 12, the Queen's Day event (2019.03.01-2019.03.09) of an enterprise was selected for comparison with 618 in this paper, and the differences between the two

TABLE 12: Comparison of the effect of different promotional activities.

	Time period	Showing	Consumption	Click rate	Bookmarking rate	Transaction conversion rate	ROI
	Water storage period	515065	49664	4.46%	10.15%	0.54%	1.23
	Presales period	1336132	143025	7.22%	9.83%	1.88%	5.62
618	Preheating period	541928	80268	4.23%	9.21%	1.66%	2.87
	Explosion period	450798	66939	3.13%	9.44%	1.98%	2.3
	Total	2843923	229898	4.76%	9.67%	1.52%	2.98
	Presales period	243066	28935	4.85%	6.37%	1.15%	2.6
Queen's Day	Explosion period	38043	3606	3.28%	9.22%	0.61%	0.9
	Total	281109	32541	4.63%	6.65%	1.12%	2.24

events are that first, because the Queen's Day event is relatively short, there is less water storage and warm-up period in the allocation of time periods compared with 618. The overall comparison does not have a significant impact. The second is that the 618 campaign has increased the marketing method of model prediction while following the marketing method of Queen's Day. Locally, the consumption of the presale period and the outbreak period of the 618 campaign is much larger than that of the Queen's Day, and under such circumstances, the ROI of both phases of the 618 campaign still exceeds the effect of the Queen's Day. In general, the collection and purchase rate, transaction conversion rate, and ROI of 618 medium promotion activities are also greater than the corresponding indicators of Queen's Day.

In summary, by comparing multiple perspectives from small to large and shallow to deep, it is concluded that the marketing approach predicted by the model can effectively improve the marketing efficiency in the actual operation of a company.

5. Conclusion

The development environment faced by enterprises is rapidly changing, and traditional business mechanisms and marketing thinking have become obsolete. This paper points out the characteristics of grasping the current market opportunities and environmental resources and proposing marketing programs that need to be reasonably implemented. The advent of the machine learning era has brought increasingly obvious changes and impacts to all levels of society. The correct use of machine learning lays a solid foundation for improving social productivity. In the machine learning era, marketing practitioners should make full use of the technical means of machine learning to change the status quo of the marketing industry, improve the efficiency and relevance of traditional marketing activities, achieve customized and intelligent design of products, realize personalized and accurate marketing to customers, fundamentally improve the economic efficiency of enterprises, and enhance the vitality of products.

Data Availability

No data were used to support this study.

Conflicts of Interest

The authors declare that there are no conflicts of interest regarding the publication of this article.

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