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Computer-Aided Design AND APPLICATIONS

Exploring Human-Computer Interaction in Database Marketing of E-commerce Stores Through AI-Powered CAD

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Abstract. This research investigates how HCI principles can be applied to design intuitive interfaces that facilitate data-driven decision-making in marketing campaigns. By integrating machine learning algorithms with CAD tools, we analyze consumer data to identify patterns and trends that inform targeted marketing strategies. Traditional marketing methods need to be adapted to the e-commerce environment. In contrast, database marketing methods can be well integrated with e-commerce. E-commerce store database marketing is becoming stronger daily with the help of the development of information technology. Its theoretical system and mode of operation are also increasingly perfected with the development of marketing theory and the testing and enrichment of marketing practices. This article combines machine learning to construct the e-commerce store database marketing system. It uses advanced statistical techniques and computers to synthesize different data into an organized e-commerce store database. In addition, with the support of algorithms, this paper conducts experimental research on system performance. Through experimental research and analysis, the system proposed in this paper can effectively improve the effect of e-commerce marketing.

Keywords: Machine learning; e-commerce; database marketing,Human Computer Interaction
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1 INTRODUCTION

With the popularization of the Internet, the improvement of technology, and the renewal of consumer concepts, online shopping has gradually become fashionable. Moreover, the Internet-based shopping mall makes commodity transactions more accessible, practical, and cost-effective. It will become a brand-new corporate sales model and occupy a considerable share of corporate sales. Compared with physical shopping malls, electronic shopping malls are not restricted by time and space, have low costs, have unlimited customers, and offer high-quality services. It is also a rapidly developing sales model. The online mall attracts customers and consumers on the ground to the Internet. The

cost mainly lies in the consumption of network expenses, logistics, and inventory, which saves investment in storefronts and personnel. At the same time, the network can provide timely feedback on customer product needs and user experience. Professionally speaking, it is a new shopping method in which the entire transaction process, from negotiation, contract signing, loan payment, delivery notification, etc., is completed through the Internet, web, and shopping interface technical mode, and it is an integral part of e-commerce [19].

In the past, companies had firm control over consumers. However, in the age of e-commerce, this control is transferred to the buyer's hands. Moreover, consumers have more information and can decide what to buy, where, and when [8]. For example, salespersons usually purchase car insurance. However, car buyers can now compare prices online before entering the dealer's car showroom. The Internet has had a profound impact on marketing functions. Customer market segmentation is gradually being built based on a complete understanding of customer behaviour information rather than traditional demographic methods. With more and better information, promotions and marketing activities will be more targeted.

At the same time, distribution channels will increase exponentially, and as manufacturers can sell their products directly to consumers, traditional intermediary organizations will face increasing threats. In addition, companies must adopt the marketing model of the Internet age to respond to the changes mentioned above. The availability of technology and information is constantly changing the way companies communicate with customers [16]. Database marketing is the process of collecting data from the system. The data can be in electronic format or visual format. The data includes past, present, and potential customer information. Companies must maintain data integrity by constantly monitoring customer purchasing activities and asking customers.

Moreover, companies must use data for marketing strategies to promote personalized customer relationships. In an e-commerce environment, a merchant or an enterprise can use database methods to improve marketing performance. These methods include continuous understanding of customers, continuous improvement of customer service, a better understanding of the market, adequate information about competitors, more effective management of sales activities, and better communication with customers.

After a merchant or enterprise has established a customer database, it needs to analyze the customer database from the following aspects: how many customers the company has, which products the customers buy, which market segments these customers belong to, which distribution channels the customers prefer, and which customers the company cannot lose. Therefore, building a customer database is the first step in establishing a long-term customer relationship. Only by knowing what kind of products individual consumers buy can merchants provide relevant quotations for these customers, and merchants or enterprises can also reduce costs through these data.

This article integrates machine learning technology with Human-Computer Interaction (HCI) principles to study the data volume marketing system of e-commerce stores. It constructs the system architecture according to their business needs, ensuring user interactions with the system are intuitive and user-friendly. Moreover, this paper analyzes the system's performance in real-world scenarios, leveraging HCI to enhance user engagement and satisfaction. Integrating machine learning and HCI constructs an intelligent system suitable for developing e-commerce stores, facilitating more effective data-driven marketing strategies, and fostering competitive advantage in the e-commerce landscape.

2 RELATED WORK

Unlike traditional general marketing, database marketing collects, retains, and utilizes data at the individual level [5]. The individual here can be a single customer, a single family, or a single corporate entity. These individuals are not "anonymous customers" in general marketing but are

targeted with unique names and surnames. This means that in database marketing [21], the company's market analysis and marketing decisions are planned and implemented individually, so it is marketing on a one-to-one basis [6]. At the same time, this also shows that marketers can directly contact and communicate with many individual customers within a period so that they can quickly trace and evaluate the effectiveness of contact with each customer and make timely adjustments. The amiability, customizability, traceability, and evaluability of the results that come with "individualization," as well as the rapid interaction of the process, constitute a particular aspect of database marketing. The functional evaluation of database marketing is based on this aspect [17].

Database marketing was initially developed from the two concepts of direct marketing and relationship marketing in industrial marketing. It means using all the stored information about the enterprise and customer relationship to assist in personalized communication and create sales performance. Since the 1990s, database marketing has been a hot topic. However, due to an insufficient understanding of the significance and potential of database marketing in supporting marketing decision-making and strategic development, enterprises have only been in a stage of discussion and exploration for database marketing for an extended period. Database marketing only exists as a direct selling tool [18]. From the perspective of the development history of the United States, database marketing was mainly used in direct marketing before the 1980s, such as direct mailing, catalogue marketing, telephone marketing, and TV marketing [7]. In the 1980s, with the enhancement of computer capabilities and the progress of database technology, as well as the intensification of competition caused by the saturation of the mass market, many marketers in the non-direct sales field adopted the concepts and techniques of database marketing in their business wars [13]. By the mid-1990s, Donnelley Marketing's survey showed that 56% of retailers and manufacturers had marketing databases, and 10% were planning to build marketing databases.

Moreover, 85% of retailers and manufacturers believe that by the end of the 20th century, they will need a robust marketing database to support their competitive strength. The literature [2] included information on subscriber demographics, farm area, and quality of crops in the database. Moreover, it used this information to provide personalized magazines for different subscribers. The contents of the magazines and the advertisement inserts therein may differ for other subscribers. The contents and advertisements of these magazines are adapted to the needs of each subscriber. In addition, most U.S. financial institutions strive to establish a database marketing system with IICIF as the underlying structure. They use this database file to select customers interested in new financial products and to target such customers to effectively carry out direct sales or online sales and other marketing techniques. Representative companies are National City Corporation, Old Kent Financial Corporation, etc. [15]. Database marketing has quietly emerged in China in recent years. Several database marketing companies emerged, such as Sinotrust, Beijing Century Microcode Marketing Consulting Co., Ltd. (microcode marketing for short), and China LOOP. In particular, microcode marketing is increasing at 100%, with a profit margin of more than 30% and a revenue scale of tens of millions. It is currently in a leading position [3].In addition to tobacco and banking, more and more local Chinese companies in telecommunications, hotels, IT, medical equipment and services, retail markets, media, and insurance have begun to use database marketing as a new competitive weapon. Moreover, with the gradual maturity of the commercial market, China's database marketing will fully enter the practical stage of rapid development in the next few years [4].

3 THE GRADUAL RETURN OF E-COMMERCE STORE DATA

Establishing a stepwise multi-factor regression equation is based on the principle of least squares. It uses stepwise regression to eliminate factors that have no or minimal effect on the dependent variable, pick out significant factors, and obtain the optimal regression model. However, whether the optimal model is suitable for forecasting should be evaluated based on actual conditions and requirements through model hypothesis testing.

The general form of the multiple linear regression model is given below[9]:

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_p x_p + \varepsilon \tag{1}$$

Among them $\beta_0, \beta_1, \cdots, \beta_p$ is $p+1$ unknown parameters, β_0 is called regression constant is called the regression coefficient, Y is the dependent variable, the independent variable, epsilon is a random error. The above formula is a multiple linear regression model[11]. When $p = 1$, The above formula is a univariate linear regression model. For random error ε, We often assume:

$$E\ \varepsilon\ = 0 Var\ \varepsilon\ = \sigma^2 \tag{2}$$

The theoretical regression equation is:

$$E\ y\ = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_p x_p \tag{3}$$

When considering specific practical problems, if n sets of observation data $x_{i1}, x_{i2}, \cdots, x_{ip}; y_i\ , i = 1, 2, \cdots, n$ have been obtained, the model can be expressed as:

$$\begin{cases} y_1 = \beta_0 + \beta_1 x_{11} + \beta_2 x_{12} + \cdots + \beta_p x_{1p} + \varepsilon_1 \\ y_2 = \beta_0 + \beta_1 x_{21} + \beta_2 x_{22} + \cdots + \beta_p x_{2p} + \varepsilon_2 \\ \qquad\qquad \vdots \\ y_n = \beta_0 + \beta_1 x_{n1} + \beta_2 x_{n2} + \cdots + \beta_p x_{np} + \varepsilon_n \end{cases} \tag{4}$$

We set:

$$y = \begin{bmatrix} y_1 \\ y_2 \\ \vdots \\ y_n \end{bmatrix} \tag{5}$$

$$X = \begin{bmatrix} 1 & x_{11} & x_{12} & \cdots & x_{1p} \\ 1 & x_{21} & x_{22} & \cdots & x_{2p} \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ 1 & x_{n1} & x_{n2} & \cdots & x_{np} \end{bmatrix} \tag{6}$$

$$\beta = \begin{bmatrix} \beta_1 \\ \beta_2 \\ \vdots \\ \beta_n \end{bmatrix} \tag{7}$$

$$\varepsilon = \begin{bmatrix} \varepsilon_1 \\ \varepsilon_2 \\ \vdots \\ \varepsilon_n \end{bmatrix} \tag{8}$$

Formula (4) can be simplified as:

$$y = X\beta + \varepsilon \tag{9}$$

The above formula is called the matrix form of the multiple regression model.

The least squares estimation of the parameters is similar to the one-variable linear regression model. In the multiple linear regression model, the least-squares estimation vector $\hat{\beta} = \hat{\beta}_0, \hat{\beta}_1, \cdots, \hat{\beta}_p$ of the parameters is searched; that is, the sum of squared deviations is searched[20]:

$$Q\ \beta_0, \beta_1, \cdots, \beta_p\ = \sum_{i=1}^{n} y_i - \beta_0 - \beta_1 x_{i1} - \beta_2 x_{i2} - \cdots - \beta_p x_{ip}\ ^2 \tag{10}$$

The minimum value of $\beta_0, \beta_1, \cdots, \beta_p$ is reached; that is, it is searched for $\hat{\beta}_0, \hat{\beta}_1, \cdots, \hat{\beta}_p$ to satisfy:

$$\left.\begin{aligned} & Q\ \hat{\beta}_0, \hat{\beta}_1, \cdots, \hat{\beta}_p \\ & = \sum_{i=1}^{n} y_i - \hat{\beta}_0 - \hat{\beta}_1 x_{i1} - \hat{\beta}_2 x_{i2} - \cdots - \hat{\beta}_p x_{ip}\ ^2 \\ & = \min_{\beta_0, \beta_1, \cdots, \beta_p} \sum_{i=1}^{n} y_i - \beta_0 - \beta_1 x_{i1} - \beta_2 x_{i2} - \cdots - \beta_p x_{ip}\ ^2 \end{aligned}\right\} \tag{11}$$

$\hat{\beta}_0, \hat{\beta}_1, \cdots, \hat{\beta}_p$ is the least square estimate of the regression parameter $\beta_0, \beta_1, \cdots, \beta_p$.

This process can be achieved by seeking extreme values in multivariate calculus. The specific calculation is as follows: the unknown parameters are calculated for partial derivatives, and if these partial derivatives are equal to 0, then it can be known that $\hat{\beta}_0, \hat{\beta}_1, \cdots, \hat{\beta}_p$ satisfies the system of equations:

$$\left.\begin{aligned} & \frac{\partial Q}{\partial \beta_0} \mid \beta_0 = \hat{\beta}_0 = -2\sum_{i=1}^{n} (y_i - \hat{\beta}_0 - \hat{\beta}_1 x_{i1} - \hat{\beta}_2 x_{i2} - \cdots - \hat{\beta}_p x_{ip}) = 0 \\ & \frac{\partial Q}{\partial \beta_1} \mid \beta_1 = \hat{\beta}_1 = -2\sum_{i=1}^{n} (y_i - \hat{\beta}_0 - \hat{\beta}_1 x_{i1} - \hat{\beta}_2 x_{i2} - \cdots - \hat{\beta}_p x_{ip}) x_{i1} = 0 \\ & \frac{\partial Q}{\partial \beta_2} \mid \beta_2 = \hat{\beta}_2 = -2\sum_{i=1}^{n} (y_i - \hat{\beta}_0 - \hat{\beta}_1 x_{i1} - \hat{\beta}_2 x_{i2} - \cdots - \hat{\beta}_p x_{ip}) x_{i2} = 0 \\ & \frac{\partial Q}{\partial \beta_p} \mid \beta_p = \hat{\beta}_p = -2\sum_{i=1}^{n} (y_i - \hat{\beta}_0 - \hat{\beta}_1 x_{i1} - \hat{\beta}_2 x_{i2} - \cdots - \hat{\beta}_p x_{ip}) x_{ip} = 0 \end{aligned}\right\} \tag{12}$$

After sorting, we can see that $\hat{\beta}_0, \hat{\beta}_1, \cdots, \hat{\beta}_p$ satisfies the following equations:

$$\begin{cases} l_{11}\hat{\beta}_1 + l_{12}\hat{\beta}_2 + \cdots + l_{1p}\hat{\beta}_p = l_{1y} \\ l_{21}\hat{\beta}_1 + l_{22}\hat{\beta}_2 + \cdots + l_{2p}\hat{\beta}_p = l_{2y} \\ \vdots \\ l_{p1}\hat{\beta}_1 + l_{p2}\hat{\beta}_2 + \cdots + l_{pp}\hat{\beta}_p = l_{py} \end{cases} \tag{13}$$

and

$$\hat{\beta}_0 = \overset{n}{y} - \hat{\beta}_1 \overset{n}{x}_1 - \hat{\beta}_2 \overset{n}{x}_2 - L - \hat{\beta}_p \overset{n}{x}_p \tag{14}$$

Among them, for any $\alpha = 1, \cdots, n$ and $j = 1, \cdots, p$, there are:

$$l_{ij} = l_{ji} = \dot{\alpha}_a \left(x_{ai} - \overset{n}{x_i} \right) \left(x_{aj} - \overset{n}{x_j} \right) = \dot{\alpha} x_{ai} x_{aj} - \frac{1}{n} \dot{\alpha} x_{ai} \quad \dot{\alpha}_a x_{aj} \tag{15}$$

$$l_{iy} = \dot{\alpha} \left(x_{ai} - \overset{n}{x_i} \right) \left(y_a - \overset{n}{y} \right) = \dot{\alpha} x_{ai} y_a - \frac{1}{n} \dot{\alpha} x_{ai} y_a \quad \mathring{a}_a y_a \tag{16}$$

It is written as a matrix:

$$X' \; y - X\hat{\beta} \; = 0 \tag{17}$$

The above formula is the ordinary equation of the multiple linear regression model.

To facilitate the estimation of the parameters in the model, we introduce the following assumptions[10]:

Hypothesis: The independent variable $x_1, x_2 \cdots, x_p$ is a deterministic variable, not a random variable, and $rank \; X \; = p + 1 < n$; that is, X is a full-rank matrix. According to the hypothesis, $X'X$ is the total rank so that we can get:

$$\hat{\beta} = \; X'X^{\;-1} X'y \tag{18}$$

4 E-COMMERCE STORE DATABASE MARKETING SYSTEM BASED ON MACHINE LEARNING

E-commerce store database marketing is becoming stronger day by day with the help of the development of information technology, and its theoretical system and mode of operation are also increasingly perfected with the development of marketing theory and the testing and enrichment of marketing practices. This article delves into the marketing environment's evolution and the marketing theory's development process, focusing on the role of Human-Computer Interaction (HCI). It explores how direct marketing serves as the predecessor and foundation of e-commerce store database marketing, emphasizing the importance of HCI in optimizing user interactions with marketing strategies. Additionally, it highlights how management information systems form the technical basis of e-commerce store database marketing, underscoring the significance of HCI in ensuring seamless user experiences within these systems. By integrating HCI principles into the design and implementation of marketing strategies, businesses can enhance user engagement and satisfaction, ultimately driving the success of e-commerce marketing initiatives. Secondly, e-commerce store database marketing is a means and tool of relationship marketing and integrated marketing, and customer relationship management is the goal of e-commerce store database marketing. The following models can be built [12] (Figure 1).

Generally speaking, e-commerce store database marketing involves five basic processes: data collection, data storage, data processing, finding ideal customers, and using and improving data [1]. Enterprise customer data can come from market research, past sales records, sales promotion records, Yellow Pages, or professional information providers. For example, collect valuable customer information, such as the customer's name, age, occupation, home address, telephone number, customer preferences, and behavior patterns, business transactions between customers and the company, specific data on customer purchases (purchase frequency, purchase volume), Purchase time and place, etc. When collecting information, please pay attention to its truthfulness and applicability and avoid making it messy and disorderly.

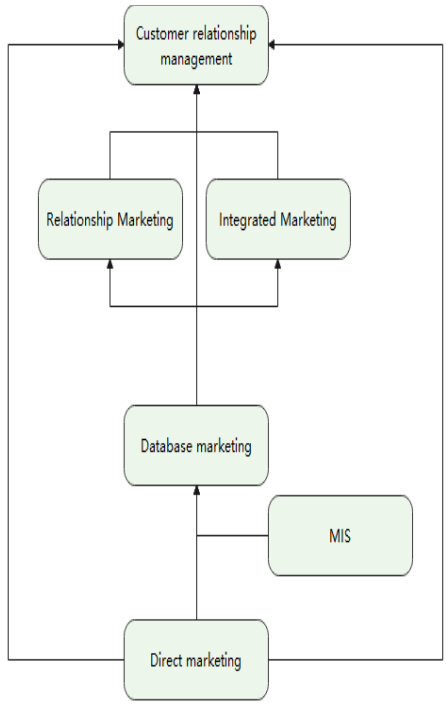

Figure 1: The related conceptual model of e-commerce store database marketing.

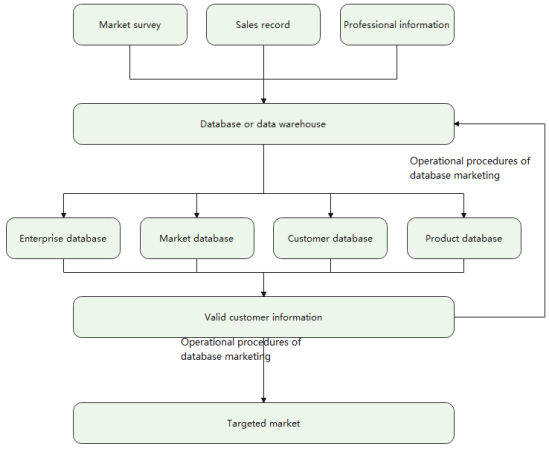

Figure 2: Operational procedures of e-commerce store database marketing.

The customer e-commerce store database can be used to analyze the data and information provided by the customer and generate more information on the decision; it can directly accept orders, carry out direct mail orders, evaluate the success of marketing, make specific demand forecasts, etc. The customer e-commerce store database is the basis for marketing the e-commerce store database.

Data processing. Using advanced statistical technology, computers integrate different data into an organized e-commerce store database and then, with the support of a variety of robust software

systems, produce what the product development department, marketing department, public relations, and other departments need. Detailed e-commerce store database.

Find target customers. According to the typical characteristics of the most used types of customers, a computer is used to outline the customer model of a particular product. This type of customer group has some common characteristics, such as industry, scale, etc., from which the ideal target customer group can be selected. Based on mastering the characteristics of customer needs, purposeful use of marketing methods, such as strengthening customer brand loyalty or stimulating customer needs, tap potential customers. This is a critical step in e-commerce store database marketing. Whether the data processing process algorithm is reliable and effective and how the result will directly affect the final effect of e-commerce store database marketing is decisive for the enterprise's marketing. Use the data to improve the e-commerce store database. The e-commerce store database data can be used in many ways: to decide to send promotional coupons to specific customers and what new products to develop; according to customer characteristics, it is more effective to judge how to make advertisements. Determine the customer's purchase level and brand loyalty based on the purchase record. At the same time, the information collected with the development of various marketing activities will continue to increase and improve so that the data can be continuously updated to promptly reflect the changing trends of customers so that the e-commerce store database can adapt to the needs of business operations.

The ensemble learning based on supervised clustering is divided into three stages: data preprocessing, supervised clustering, and learner integration. As shown in Figure 3, the first is the preprocessing stage, which removes some noisy data in the data set and performs measurement. Consistent treatment of the outline. Then, supervised clustering is performed on the majority of samples, clustering into multiple data clusters with the same amount of data as the minority samples, and combined with the minority samples to become a balanced data subset of various categories. Finally, the BP neural network is learned for these subsets, and multiple essential learners are obtained, voted, and integrated here [14].

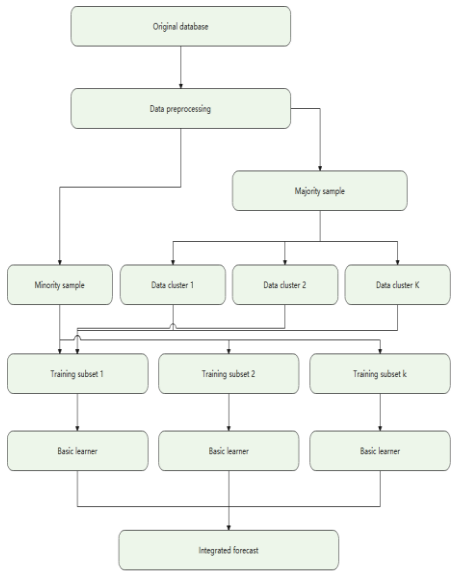

Figure 3: Integrated learning model.

The reason for choosing an algorithm based on supervised clustering is that we consider that there is an inherent connection between the data in most samples (that is, a large number of non-

responding customers), and most samples may have small data clusters themselves. To discover and explore the internal connection between data samples, as shown in Figure 4, there may be multiple small data clusters with internal connections for most classes. Therefore, this paper uses a supervised clustering algorithm to prove the impact between small data clusters and their effects on machine learning performance. First, we discover the hidden data clusters in these majority class samples. Then, we can get multiple data clusters with the same data samples as the minority class.

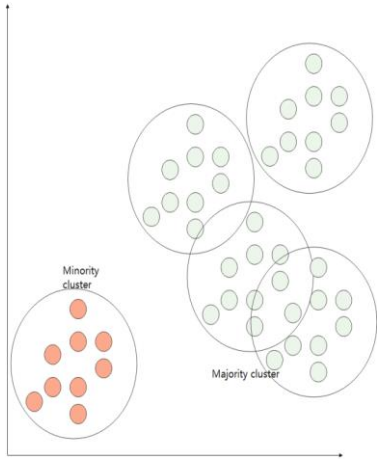

Figure 4: Data clusters in the unbalanced category data set.

The life cycle of an e-commerce store database marketing project includes six stages. The order of the stages needs to be fixed, and they need to be adjusted forward or backward according to the actual problems, the results of each stage, and the specific tasks of the next stage. Figure 5 is a detailed modelling flow chart. The e-commerce store database marketing system model is shown in Figure 6.

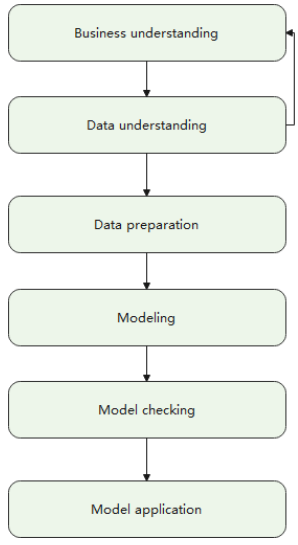

Figure 5: Flow chart of e-commerce store database marketing modelling.

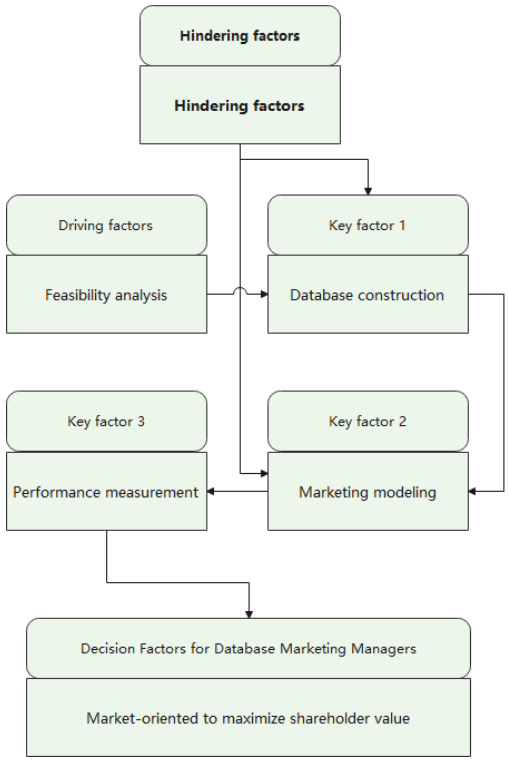

Figure 6: E-commerce store database marketing system model.

The system model of e-commerce store database marketing includes the driving factors that must be considered before the implementation of e-commerce store database marketing, the three critical aspects of e-commerce store database construction, marketing modelling, and performance measurement in the implementation process, and the obstacles and management decision-making factors that affect the implementation. The guidance process provided by the system includes feasibility analysis, e-commerce store database construction, and marketing modelling based on careful consideration of management decision-making factors and obstacles and the final performance evaluation of the implementation effect. Based on performance, the implementation of each process is optimized and regulated so that the e-commerce store database marketing forms a continuous cycle system. The driving factors of the e-commerce store database marketing system are shown in Figure 7.

We take driving factors as input, performance evaluation as output, and form a cyclic system with other factors. Feasibility analysis, e-commerce store database construction, marketing modelling, and performance measurement are the main steps in implementing e-commerce store database marketing. Obstacles and managerial decisions have a one-way impact on the two critical processes of e-commerce store database construction and marketing modelling and affect final performance results. The construction of the marketing e-commerce store database is the process of selecting the construction level of the e-commerce store database and collecting, sorting, and integrating relevant data to meet the enterprise's business requirements. This process requires establishing a special project team to achieve, as shown in Figure 8.

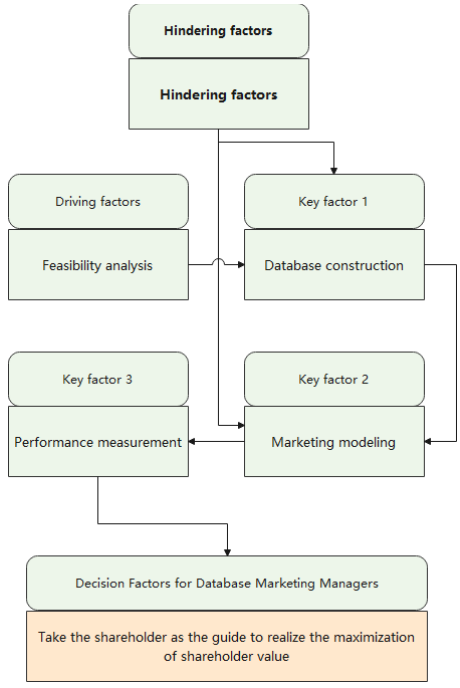

Figure 7: Driving factors of e-commerce store database marketing system.

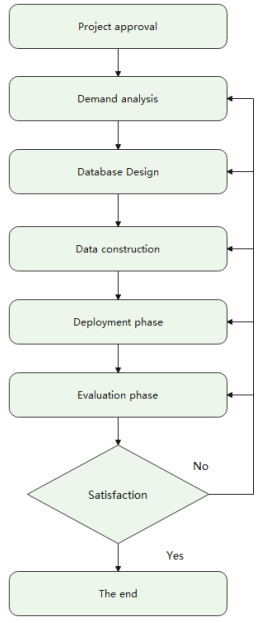

Figure 8: Construction process of marketing e-commerce store database.

The first is the project initiation stage. In the project initiation stage, the primary purpose is to understand the current situation and conditions of the enterprise, assess the level of the e-commerce

store database that needs to be built, and analyze the problems and solutions that need to be resolved. Through a series of demonstrations and evaluations, the objectives are confirmed and clarified, the input and output of the project and the potential risks are quantified, and the decision is made to start, delay, or cancel the project. The second is the need analysis stage. In the need analysis stage, the main task is to collect business and technical requirements, collect business goals and data subject needs, and submit a needs analysis report to identify the business purpose, meaning, information requirements, and user interface. These requirements will also be used in data warehouse design and other project phases. The third is the design phase. In selecting themes, the paper will focus on collecting detailed information requirements and designing the data warehouse architecture, including data, processes, and application models. Various information collection and verification methods are used in this stage, including data modelling, process modelling, seminars, and prototype display, to evaluate technical architecture, business requirements, and information requirements. The fourth is the construction phase. The construction phase includes the construction of a physical data warehouse and assembly, application and processing coding, and acceptance testing. The data warehouse manager and the end user's instructor should be familiar with the application at this stage. The fifth is the deployment phase. After displaying the data warehouse, operation, and application training are started in the deployment phase. After the deployment, the data warehouse manager maintains the data warehouse and makes necessary changes to the opinions put forward. The sixth is the evaluation stage. In the evaluation stage, the success of the project and its effect on the enterprise are evaluated. The evaluation is carried out in three steps. The first step is to assess the success and failure experience of the early project implementation and to announce the results of future efforts. The second step is determining whether the application configuration is realized as expected. If necessary, the plan must be adjusted. The third step is to evaluate the impact and benefits of the project on the enterprise.

5 SYSTEM TEST

This article builds an e-commerce store database marketing system based on machine learning and performs system performance verification after building the system. Database marketing can realize rapid information processing and precision marketing. Therefore, this paper conducts system testing through simulation research and system verification through simulation tests. First, this paper detects the effect of data processing on the e-commerce store database marketing system, and the results are shown in Table 1 and Figure 9 below.

NO	*Data processing*	*NO*	*Data processing*	*NO*	*Data processing*
1	*90.67*	*25*	*93.26*	*49*	*93.53*
2	*94.50*	*26*	*93.10*	*50*	*90.65*
3	*89.96*	*27*	*88.74*	*51*	*88.50*
4	*93.08*	*28*	*89.16*	*52*	*86.49*
5	*94.87*	*29*	*94.26*	*53*	*90.18*
6	*94.41*	*30*	*89.43*	*54*	*87.64*
7	*87.66*	*31*	*87.65*	*55*	*92.11*
8	*93.72*	*32*	*89.22*	*56*	*88.20*
9	*88.85*	*33*	*92.03*	*57*	*91.01*
10	*94.27*	*34*	*92.60*	*58*	*93.33*
11	*91.32*	*35*	*87.79*	*59*	*93.18*

12	*93.84*	*36*	*88.50*	*60*	*88.73*
13	*88.63*	*37*	*91.02*	*61*	*89.41*
14	*88.39*	*38*	*86.55*	*62*	*92.47*
15	*92.39*	*39*	*88.47*	*63*	*94.66*
16	*89.71*	*40*	*89.69*	*64*	*88.38*
17	*92.50*	*41*	*87.19*	*65*	*93.92*
18	*86.13*	*42*	*93.85*	*66*	*93.42*
19	*94.26*	*43*	*93.55*	*67*	*94.79*
20	*87.31*	*44*	*89.99*	*68*	*92.59*
21	*91.34*	*45*	*86.32*	*69*	*91.91*
22	*92.37*	*46*	*88.48*	*70*	*94.88*
23	*94.93*	*47*	*94.16*	*71*	*88.27*
24	*87.82*	*48*	*88.72*	*72*	*89.55*

Table 1: Statistical table of data processing effect of e-commerce store database marketing system.

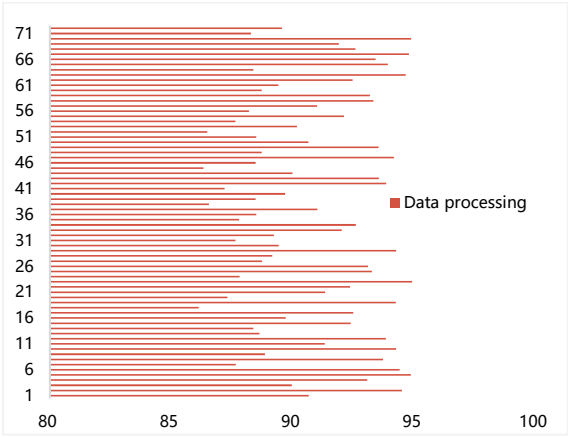

Figure 9: Statistical diagram of data processing effect of e-commerce store database marketing system.

The experimental research results show that the system constructed in this paper has a perfect data processing effect. This is the basis for the system's precision marketing effect verification. The results obtained are shown in Table 2 and Figure 10.

NO	*Precision marketing*	*NO*	*Precision marketing*	*NO*	*Precision marketing*
1	*85.3*	*25*	*89.8*	*49*	*81.6*
2	*88.8*	*26*	*84.8*	*50*	*82.3*
3	*85.0*	*27*	*88.0*	*51*	*83.6*
4	*84.4*	*28*	*81.6*	*52*	*91.4*

5	87.0	29	89.6	53	82.9
6	90.3	30	83.6	54	84.0
7	87.2	31	89.9	55	87.7
8	84.1	32	90.3	56	86.2
9	83.1	33	84.7	57	90.4
10	82.3	34	90.3	58	89.1
11	86.0	35	83.1	59	88.1
12	84.4	36	81.8	60	87.3
13	87.2	37	82.8	61	88.0
14	82.5	38	86.2	62	83.3
15	87.8	39	88.4	63	86.2
16	90.8	40	81.5	64	83.7
17	90.1	41	82.2	65	84.3
18	84.5	42	87.3	66	85.3
19	87.2	43	85.1	67	91.8
20	87.3	44	81.6	68	86.6
21	83.7	45	88.4	69	91.8
22	82.2	46	85.2	70	89.2
23	81.7	47	85.1	71	85.6
24	81.2	48	89.2	72	90.5

Table 2: Statistical table of the precision marketing effect of the e-commerce store database marketing system.

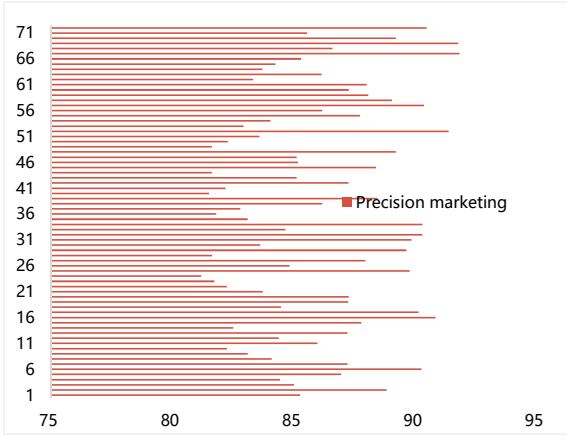

Figure 10: Statistical diagram of the precision marketing effect of the e-commerce store database marketing system.

The above research shows that the e-commerce store data marketing system constructed in this paper has a good precision marketing effect.

6 CONCLUSIONS

With the popularization of the Internet, e-commerce platforms have begun to rise. Currently, many e-commerce stores have been diluted because of too many products of the same type. Suppose an e-commerce store wants an advantage in the ever-increasing market competition. In that case, the critical way is that the e-commerce store needs to accurately identify the intended purchasers among a large consumer group to improve the efficiency of store marketing. Therefore, database marketing activities are one-to-one marketing for specific customers. The advantage of this approach is that customers will respond better because of more personalized marketing. The disadvantage of this method is that if the company uses customer information, it will help customers. Since the enterprise database stores thousands or millions of customer information, a sound information system is first required for practical database marketing activities. This paper develops an e-commerce store database marketing system using machine learning, emphasizing the integration of Human-Computer Interaction (HCI) principles. Through experimental research, it demonstrates the system's effectiveness in improving e-commerce marketing outcomes. By prioritizing HCI, the system ensures user-friendly interactions, enhancing user satisfaction and engagement. This integrated approach facilitates more informed decision-making and drives success in e-commerce marketing initiatives.

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