



Design and Implementation of Enterprise Refined Marketing System Under the Background of Big Data

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Abstract. In this paper, by adopting big data technology and methods, and combining with Java and Spring MVC framework, the construction of enterprise refined marketing system is completed, and the purpose of providing better service for enterprise refined marketing system is achieved by building the system. The construction of refined marketing system is based on customer segmentation. Through big data technology operations such as data collection, data preprocessing, data analysis and mining, it has realized the function of improving the convenience and efficiency of enterprise data query and decision-making, which is conducive to broadening marketing channels and improving customer satisfaction. At the same time, it is also helpful to promote the refined management of enterprise marketing, and finally realize the improvement of marketing efficiency. The application of the system to the marketing system has promoted the pace of refined development of the system and achieved the enterprise goal of low-cost and sustainable development. In addition, the refined marketing system also provides powerful materials for marketing.

Keywords: Refined · Marketing · Visual Analysis · Cluster Analysis

1 Introduction

Marketing is a function, which is an activity, process and system that creates, communicates, spreads and transmits customer value for the benefit and brings economic value to customers, partners and the whole society. It mainly refers to the process of a series of activities carried out by marketers aiming at the market, such as business activities and sales behaviors [5]. The content of marketing research is divided into two parts. One is marketing practice, which includes product strategy, pricing strategy, distribution channel strategy, promotion strategy and marketing combination strategy. The second is marketing management, which consists of marketing strategy, planning, organization and control. With the continuous maturity and development of the market economy, the personalized needs of consumers are gradually increasing, which has formed a trend. In addition, the competition among enterprises is also increasing. Therefore, in the face of the ever-changing and fierce marketing environment, its common marketing means can no longer meet the needs of consumers and enterprises. It has become the primary

consideration for enterprises to improve marketing efficiency by formulating refined marketing strategies. In the era of big data, through big data collection, processing, mining and other technologies, it is very easy to grasp the characteristics of consumers' consumption behavior, so that enterprises can be targeted in the process of formulating marketing strategies and achieve the effect of precise marketing [1]. Therefore, this paper holds that the enterprise refined marketing system based on Web technology and big data technology not only provides accurate data support for the marketing system, but also strengthens the customer information management resources, which is conducive to making the enterprise marketing system more targeted and innovative, thus promoting the further development of enterprise business.

2 Introduction of Related Application Technology

2.1 Big Data Technology

Big data technology refers to the technology of quickly obtaining valuable information from various types of data, and it plays a key role in social governance and enterprise management. In other words, many countries and large enterprises have included big data in their development strategies and regarded it as a key chip for future development. The key technologies of big data processing generally include collection, preprocessing, storage and management, analysis and mining, presentation and application [2]. Big data collection refers to massive structured, semi-structured and unstructured data obtained through RFID radio frequency data, sensor data, social network interactive data and mobile Internet data, which is the foundation of big data knowledge service model. Preprocessing technology is mainly used to analyze, extract and clean the received data. The storage and management technology is to use the memory to store the collected data, establish the corresponding database, and manage and call it. The analysis and mining technology is a process of analyzing the collected data, extracting useful information and forming conclusions, and deeply studying and summarizing the data by using appropriate statistical analysis methods. Mining refers to extracting hidden, unknown and potentially valuable information from massive, incomplete, noisy and fuzzy practical application data. The presentation and application technology is to analyze the characteristics and preferences of users' behaviors through pie chart, histogram, relationship chart, radar chart and classification chart [10].

2.2 Hadoop

Figure 1 is a Hadoop architecture diagram. Hadoop is composed of tools such as HDFS, MapReduce, HBase, Hive and ZooKeeper. Pig is a data analysis platform, which provides a simple operation and programming interface for data parallel computing. HDFS, firstly the file system, is mainly used to solve the problem of data storage; secondly, it is distributed, and its functions can only be realized by the combination of many servers. It is composed of Namenode, Datanode, Block, SecondaryNamenode and other elements. MapReduce is a programming model, which is used for parallel computing of large-scale data sets. Its advantages are easy programming, simple programming interface for users,

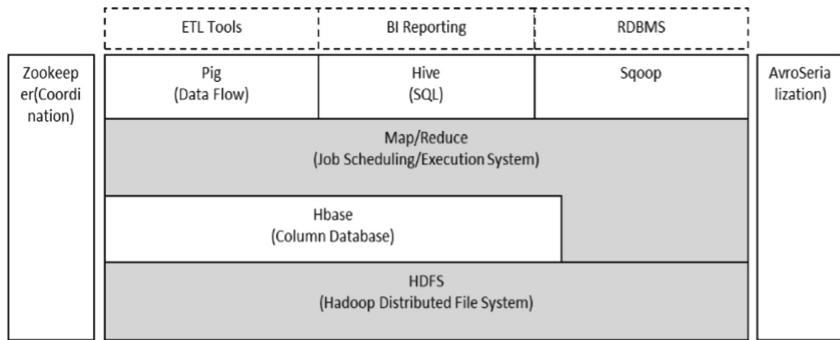


Fig. 1. Hadoop architecture diagram

good scalability, scalable computing power and throughput, high fault tolerance, and offline data processing. The file system HDFS is the MapReduce engine used to execute MapReduce programs. HBase is mainly used to store unstructured and semi-structured loose data, and store data in the form of tables. Hive, used for statistics of structured log data, realizes storage function by mapping structured data file into a table, and can also provide query function of SQL. ZooKeeper is mainly used to solve the problem of data management in distributed applications. It has the functions of distributed application configuration management, unified naming service, state synchronization service and cluster management.

2.3 B/S Architecture

B/S architecture is Browser/Server architecture. Browser refers to the Web browser, which involves less transaction logic. Server refers to the server, where the main transaction logic is implemented. B/S architecture has three layers. The first layer is the presentation layer, which is mainly used to complete the interaction between users and background information, such as the output of query results. The second layer is the logic layer, which uses the server to complete the application logic function of the client. The third layer is the data layer, which is used to perform various operations after receiving the request from the logical layer, and then feed back the results to the logical layer. Figure 2 shows the three-tier structure of B/S architecture.

The common B/S architecture mode “Client-Server-Database Mode” in daily design is shown in Fig. 3.

The client initiates an Http request to the server, and the Web service layer of the server parses the Http request and sends it to the application layer of the server. Then, it exchanges data with the database by invoking the business logic. Finally, the data result is rendered into Html and returned to the client [9].

2.4 Spring MVC Framework

Spring MVC is a request-driven lightweight Web framework based on Java language to realize Web MVC design model. The framework uses the MVC architecture idea

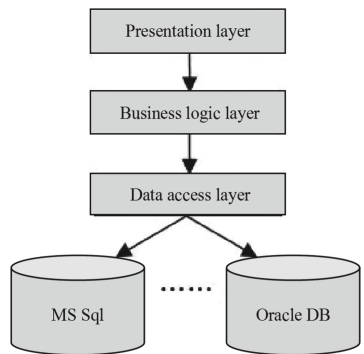


Fig. 2. Three-layer structure of the B/S architecture

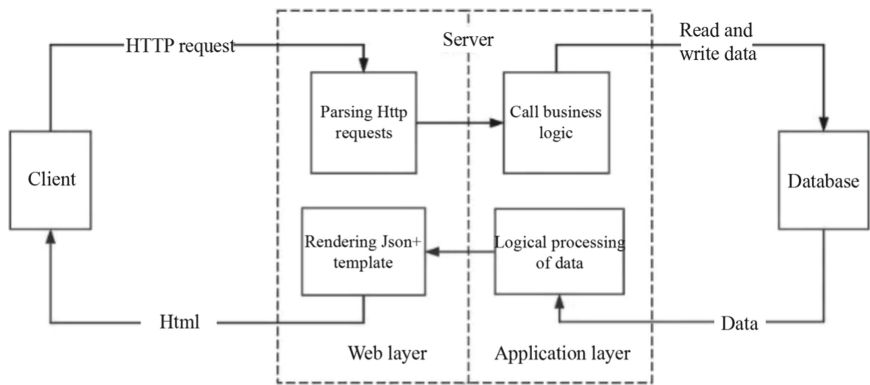


Fig. 3. Client-Server-Database mode

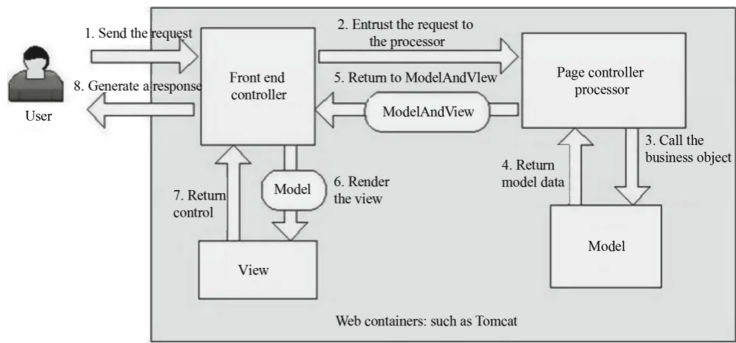


Fig. 4. Spring MVC processing request flow

to simplify the development steps by decoupling the Web layer. The MVC framework refers to the model-view-controller framework. The flow of Spring MVC processing requests is shown in Fig. 4.

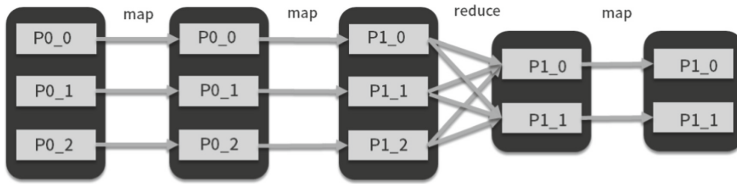


Fig. 5. MapReduce Workflow

The user sends a request to the front-end controller, and the front-end controller requests the page controller to search for the request. The page controller will first map the request to the HandlerExecutionChain object, then call the processor to execute the request, and finally use the processor to return the result to ModelAndView. At this time, the front-end controller will send a request for view analysis to the view parser, and then send the data to the view. After the view parser parses, the result will be returned to the front-end controller, and then the front-end controller will respond the result to the user.

2.5 Development Environment

The development environment of the system is divided into two parts, one part is the deployment of big data architecture, the other part is the development of Web application.

Part I: Deployment of big data framework functions. The system needs to make use of the tools of Flume, Sqoop, HDFS, Spark and MapReduce in big data, and deploy these tools in Hadoop 2.7.2 framework. MapReduce is responsible for multi-node computing such as task transfer, load balancing and fault-tolerant processing. The way mapReduce processes data can be abstracted as map and reduce process. Map is a one-to-one mapping of data, which is usually responsible for data conversion. Reduce is generally responsible for completing the aggregation work, and the specific workflow of MapReduce is shown in the Fig. 5.

The core design of Hadoop is MapReduce and HDFS. HDFS accesses application data in streaming access mode, which makes it have the characteristics of high throughput, so it is very suitable for applications with large data sets. Its architecture is shown in Fig. 6. The architecture adopts master-slave architecture, and an HDFS cluster includes a NameNode node and several DataNode nodes, in which the NameNode node is responsible for data management, and the DataNode node is used to save data in files. MapReduce is responsible for multi-node computing such as task transfer, load balancing and fault-tolerant processing.

Part II: The design of the system is based on B/S architecture, JS is the client development language, Java is the server development language and MySQL is the database, in which the development framework of Java language is Spring MVC and the operating system is Windows. The software configuration requirements of the environment are as follows: download and install Java jdk1.6, and add environment variables. When installing eclipse, you need to pay attention to the consistency between eclipse version and jdk version. Download server tomcat 6.0. When configuring server environment variables, it should be consistent with jdk, and tomcat should be configured in

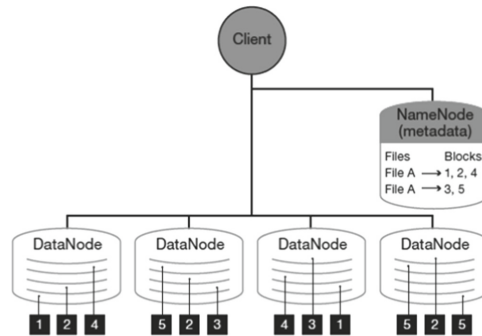


Fig. 6. HDFS architecture

eclipse. Secondly, install the database MySQL-5.6.26, and set the environment variables. After the test installation is successful, connect MySQL in eclipse, download and unzip MySQL driver mysql-connector-java-5.1.5, and place the jar package in tomcat installation directory under common/lib.

With the help of related technologies, we have determined the environment and configuration of the system development, thus ensuring the feasibility of the technology and management of the design and implementation of the enterprise's refined marketing system.

3 Requirements Analysis

3.1 System Requirements Analysis

The overall functional requirements of the system can be divided into three stages. The first stage is data collection. At this stage, the system needs to realize the comprehensive and quick functions of the collected customer data, so the collection tools need to have comprehensive searching performance [3], such as searching the footprints left by customers in daily life. The second stage is the data processing. The data obtained at this stage is logical and accurate, which requires that the data must be cleaned to remove duplicate values, noise values, etc. in the data, and this part of the data is calculated. The third stage is analysis and presentation. The data displayed in this stage is diverse and intuitive, which allows users to fully understand the relevant information of customers, such as consumption level, type of products purchased.

In addition to the above requirements, there are technical requirements, and the data that users finally get is valuable data. Therefore, it is necessary for the system to use big data mining tools to discover potential data information.

3.2 Global Design

The system adopts B/S architecture and is divided into three parts: presentation layer, business logic layer and data access layer. In the presentation layer, users log in to the system with the help of browsers. The business layer is the functional layer of the system,

including the functional modules of data acquisition, data processing and data analysis. The data access layer is used to centrally store customer data, such as basic information of customers, browsing records, order information and other information. However, with the development of network technology and modern information technology, customer data grows geometrically, which will eventually lead to downtime of enterprise customer storage data system. Therefore, this system establishes the connection between database and big data platform with the help of gateway, which not only expands the data storage capacity, but also realizes the functions of quick data query [7].

4 Detailed Function Realization

The users of enterprise refined marketing system are enterprises, and the target groups are customers. The design of the system is based on subdividing customer groups, which divide customers into Class A customers (those who have the ability and desire to buy), Class B customers (those who have purchasing power but are hesitant) and Class C customers (those who have no desire to buy). Then, by means of data collection, data storage, data cleaning, data calculation and query, and data visualization technology in big data technology, the characteristics of customer consumption behavior and product usage are summarized. By means of data mining analysis tools such as association rules and cluster analysis, valuable target customer groups are identified, and the combination and positioning of products are made clear, so as to realize cross-selling to customers and further improve decision-making efficiency [6]. The following is a description of some functions of the system.

4.1 Data Acquisition

Data acquisition refers to obtaining customer data information by means of web crawler technology and Flume tools, in which the web crawler process is shown in Fig. 7.

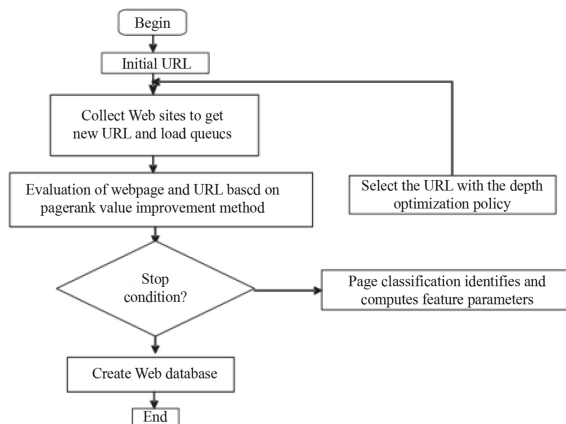


Fig. 7. Network crawler process

As can be seen from Fig. 5, the working path of data collection starts with setting a seed URL, entering and analyzing other URLs in the selected web page, tracking deeper URLs and web page contents through circulation, and then calculating parameters until reaching the specified depth or characteristics, and then parsing and storing the data. Using web crawler technology can ensure the comprehensiveness, integrity and non-repetition of information sources [8].

Web crawler technology can automatically collect all pages that customers can access. Flume collects customer log data, such as customers' purchase and browsing records in online stores. Sqoop is used to transmit the collected data to HDFS, then Spark and MapReduce tools are used to calculate the data, and finally the data is stored in MySQL database.

The data preprocessing process is hidden in the above-mentioned storage process, which is divided into four steps. Firstly, data cleaning is carried out for all kinds of abnormal situations of the obtained data, including missing values, outliers and noise values, abnormal range and type values. Then, the sample data is increased by data splicing, and then the data is transformed by means of normalization, binarization and function transformation. Finally, data aggregation, sampling and dimension reduction are used to reduce the data volume and dimension, delete redundant information and improve the accuracy of analysis [4].

4.2 Decision-Making

By using data mining software tools such as visual analysis and cluster analysis to analyze and mine the basic data information stored in Hive, we can get relevant data, and then find our target customer group according to the customer's consumption model and data statistics. By using association rule analysis, other requirements related to customers' existing needs are found, and finally the goal of improving decision-making efficiency is achieved.

According to the data of customers' occupation, consumption preference, consumption time and so on, customers can be divided into three categories: A, B and C, and different marketing strategies can be formulated for these three categories of customers. The data source of these three types of customers is the data obtained through pretreatment and screening. Data processing is done by means of clustering analysis, association analysis and other tools in data mining to obtain data analysis results, and then intuitive, vivid, interactive and highly personalized data visualization charts are customized by means of Echarts visualization tool to achieve the goal of analyzing and mining valuable information. Through the analysis of the graph, the specific plan of market segmentation can be determined. Cross-selling marketing strategy can be adopted for any customer. It uses association rules and cluster analysis to study the characteristics of customers' consumption behavior, product usage and so on, so as to find the target customer groups of new products, and then provide customers with corresponding products. For example, for Class A customers, these customers are generally middle-class executives, business managers, etc. From the perspective of the structure of consumer goods, jewelry, women's wear and cosmetics are general luxury goods. From the perspective of brand positioning, luxury goods with fashion attributes are preferred. Therefore, limited edition and private customized products can be recommended to them, so as to improve the

customer's experience and create the noble temperament of customers, thus enhancing the stickiness with customers and further increasing the turnover of enterprises. Class B customers, who are generally more emotional and impulsive. According to the characteristics of this kind of customers, products with discount preferential policies can be provided to them, so as to stimulate customers' desire to buy, keep customers active and improve economic benefits. Class C customers can adopt the policy of bundling sales for such customers, such as holding free trials, distributing gifts and other activities, so as to achieve the goal of activating customer activity, and then expand the publicity effect of enterprises and improve their popularity. In this process, by accurately locating the customer groups, finding out the real needs of customers and using different marketing channels, we can improve the efficiency of decision-making and reduce unnecessary marketing channel expenses. At the same time, we can make the product mix and sales of enterprises more reasonable and scientific, greatly improve the success rate of product mix and sales, and bring a steady stream of benefits to enterprises.

5 Conclusion

Construction of enterprise refined marketing system innovatively applies big data technology to enterprise marketing research. Taking the realization of customer refinement as the breakthrough point, by using the technical means of data collection, data preprocessing, data mining and analysis, the consumer behavior characteristics of customers and the marketing situation of enterprises are deeply integrated, so as to make effective decisions. It not only breaks through the shackles of general marketing mode, but also solves the problems existing in current enterprise marketing, and realizes the expansion of enterprise marketing technology field. At the same time, it reflects the role of big data in enterprise marketing management, and provides new ideas for efficient operation of enterprises.

References

1. Chen Li (2015). Design Method and Implementation of Refined Marketing System of Group Enterprises in Big Data Environment. Zhejiang Sci-Tech University.
2. Du Xinyue (2018). Design and Implementation of Electric Power Marketing Audit Management System Based on Web Technology. University of Electronic Science and Technology of China.
3. Liu Shiran (2015). Design and Implementation of New Media Precision Marketing System for Publishing Industry. University of Chinese Academy of Sciences (School of Engineering Management and Information Technology).
4. Liu Yuanyuan (2019). Analysis on the Construction of Marketing System of State-owned Enterprises under Market Economy. China Journal of Commerce, (23): 83–84.
5. Mao Yin (2017). Design and Implementation of Targeted Marketing System for Telecom Broadband Development Based on Data Mining. Nanjing University of Posts and Telecommunications.
6. Sun Guoping (2014). Design and Implementation of Telecom Customer Maintenance System Based on Data Mining Technology. Xiamen University.

7. Tao Yiming (2016). Design and Implementation of Grid Marketing Management Information System for Telecom Industry. Jiangxi University of Finance and Economics.
8. Wang Yan (2015). Analysis of Power Marketing Strategy under the Reform of Electric Power Enterprises. *China High Technology Enterprises*, (27): 181–182.
9. Yang Bo (2018). Research on Precision Marketing Based on Big Data Mining. Xiamen University.
10. Zheng Xuemei (2019). Design and Implementation of Power Marketing Decision Support System. University of Electronic Science and Technology of China.

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