

# Research on User Behavior Analysis Based on Big Data Technology

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**Abstract:** Big data technology refers to the ability to efficiently extract high-value information from multiple sources and massive amounts of data. It is an important achievement in the development of information technology and has significant application value in the field of user behavior analysis. Against the backdrop of rapid development of the digital economy and industry transformation, the role of e-commerce in the market system is increasingly prominent, and the scale of platform users continues to expand. In order to promote high-quality and sustainable development of the e-commerce industry, e-commerce platforms urgently need to use precise marketing methods to provide personalized products and services according to user needs, thereby improving user conversion rates and platform operating efficiency. This article takes e-commerce users as the research object. Firstly, it elaborates on the data characteristics and types of e-commerce user behavior. Secondly, it summarizes the relationship between big data and user behavior analysis, as well as the application value of big data technology in e-commerce user behavior analysis. Finally, it proposes scientific and effective application strategies, aiming to provide reference for e-commerce platforms to achieve accurate recommendations, optimize service strategies, enhance user experience and market competitiveness by mining user consumption preferences, potential needs and behavioral characteristics.

**Keywords:** Big data technology; E-commerce users; Behavioral analysis; Precision marketing

**Online publication:** April 22, 2026

## 1. Introduction

In the context of the in-depth development of the digital era, with the comprehensive popularization of the Internet, users are constantly generating massive data when using various online services, covering text, image, audio, video and other types. How to efficiently mine valuable information from these complex heterogeneous data has become an urgent problem in the current digital field. User network behavior data contains the core needs, consumption preferences, and behavioral patterns of users. In depth analysis of these data can provide important support for platform optimization services and precise demand matching. Currently, the e-commerce industry is developing rapidly with a significant increase in user base. Traditional user behavior analysis is difficult to adapt to the platform's refined operational needs due to insufficient data processing and analysis depth. E-commerce

user behavior data covers browsing frequency, purchase history, shopping cart and collection information, consumption time nodes, and other content. As a core digital technology, big data technology has been widely applied in the e-commerce field with its powerful data processing and mining capabilities. With the help of big data technology, e-commerce platforms can deeply analyze various user behavior data, accurately capture user consumption preferences and potential needs, achieve personalized product and service push, effectively enhance user stickiness, and promote high-quality and sustainable development of the e-commerce industry. Based on this, this article focuses on e-commerce scenarios and conducts in-depth research on user behavior analysis methods based on big data technology, which is of great significance.

## **2. Characteristics and types of e-commerce user behavior data**

### **2.1. Characteristics**

#### **2.1.1. Real time performance**

E-commerce user behavior has significant real-time generation characteristics, and users' browsing, bookmarking, adding purchases, and other operations on the platform are all real-time data signals. In a fiercely competitive market environment, the ability of platforms to quickly collect, transmit, and process behavioral data directly affects marketing response efficiency. By relying on real-time data feedback, the platform can timely perceive users' current needs and intentions, dynamically adjust marketing strategies, significantly improve the accuracy and timeliness of marketing, reduce user churn, and enhance user experience and satisfaction.

#### **2.1.2. Massive quantity**

Currently, the e-commerce industry is developing rapidly with the support of national policies, and the user base is continuously expanding. The daily user behavior data generated by platforms is showing exponential growth, forming massive datasets. These data are reflected in the large number of users, high frequency of behavior, and coverage of behavior trajectories across all time periods, categories, and channels. By utilizing technologies such as big data distributed processing and cloud computing, data processing and analysis can be completed, extracting high-value patterns from massive amounts of information and providing reliable support for operational decision-making.

#### **2.1.3. Dynamics**

User consumption needs and preferences continue to dynamically change with factors such as consumption scenarios, seasonal trends, and personal habits. E-commerce user behavior data is dynamic, and single time period data is difficult to fully reflect users' real needs. The platform needs to establish a long-term and sustainable data collection mechanism to capture users' current purchasing needs and preferences in real time, accurately capture the changing trends of users' needs, adjust marketing plans in a timely manner, enhance users' willingness to repurchase, and increase revenue.

#### **2.1.4. Diversity**

E-commerce user behavior data has a wide range of sources and rich types, with obvious diversity characteristics. The data content includes browsing history, collection history, search keywords, shopping cart operations, evaluation feedback, etc. The data format not only includes structured orders and user information, but also includes semi-structured or unstructured text evaluations, click logs, etc. The data structure and format of different

types of data also have certain differences, which puts higher requirements on data processing and analysis, and provides a basis for understanding user needs and behavioral logic.

## **2.2. Types**

### **2.2.1. Purchase behavior data**

There are two main types of purchasing behavior data for e-commerce users. One is user product purchase information data, such as product type, purchase time, transaction price, etc. The platform can develop personalized promotion plans based on this to enhance users' willingness to repurchase. The second is payment related data, such as payment methods, payment times, etc., which can reflect users' payment habits and provide data support for the platform to optimize payment processes, improve shopping experience and transaction success rates.

### **2.2.2. Browsing behavior data**

Browsing behavior data is mainly used to determine the level of user interest and potential needs for a product. For example, if a user stays on a product page for a long time and repeatedly browses, it usually indicates that their interest is high, and the platform can continue to push related products. At the same time, browsing behavior data not only includes product page browsing information, but also includes users' complete browsing trajectories. By analyzing browsing trajectories, the platform can optimize product page layout, improve user browsing experience, thereby increasing user purchase probability and revenue.

### **2.2.3. Interactive behavior data**

Interactive behavior data refers to the records of user evaluations, favorites, likes, shares, and other actions generated on e-commerce platforms, which have high application value. Among them, positive reviews can be used as promotional materials for platform recommendations and product displays, enhancing users' willingness to purchase. Conversely, negative reviews can help platforms and merchants locate product issues, optimize labeling or improve services in a timely manner by analyzing keywords, and enhance user shopping experience and purchase intention.

### **2.2.4. Search behavior data**

The search behavior data mainly includes the product keywords entered by users and the click records of search results. When users have clear shopping needs, they often search for target products by entering specific keywords. The platform analyzes these keywords to directly grasp the core needs of users and provide direction for accurate push. At the same time, analyzing user search result click data can understand their preferences for product attributes, optimize search result ranking, and improve user selection efficiency and click through conversion rate.

### **2.2.5. Social behavior data**

Social behavior data includes users' attention information to e-commerce stores, hosts, and product sharing records. The platform can timely push store updates, discounts, and promotions to users based on their attention data, thereby improving purchase conversion rates. At the same time, by analyzing users' shared content and communication channels, e-commerce platforms can collaborate with external platforms to carry out collaborative marketing, broaden product promotion paths, and enhance marketing coverage and influence <sup>[1]</sup>.

### **3. The relationship between big data and user behavior analysis**

Currently, big data has become a trend that widely permeates scientific research and commercial applications. This technology can construct virtual digital images of the real world through digital means, mine the laws of real-world behavior, and provide reliable and sensitive technical support for user behavior analysis. Big data can accurately capture subtle changes in data, use diverse analysis models to conduct descriptive and predictive analysis, and provide scientific decision-making basis for various subjects. Meanwhile, big data is also defined as a service-oriented tool that can create practical value for enterprises and users, suitable for business entities of different scales. Currently, big data applications have covered multiple industries, such as manufacturing companies utilizing them to improve warranty management, equipment monitoring, and logistics scheduling; Retailers use data to achieve precise recommendations and efficient customer interaction; Technology companies improve the accuracy of voice interaction through massive data analysis; Financial institutions use big data to strengthen risk prevention and fraud detection; E-commerce companies use methods such as behavior event analysis, retention analysis, and funnel analysis to comprehensively analyze user behavior and enhance user consumption experience. These fully reflect the important role of big data in user behavior analysis and industry development <sup>[2]</sup>.

### **4. The application value of big data technology in e-commerce user behavior analysis**

#### **4.1. Enhancing the value of data**

In the era of digitalization and informatization with the rapid development of the Internet, networked information is growing exponentially, resulting in information overload, uneven quality, scattered and disordered information resources, and it is difficult for traditional extraction methods to efficiently mine valuable information. Big data technology relies on distributed computing, deep learning, and other methods to integrate and analyze heterogeneous data from multiple sources, structuring fragmented information. For example, through association analysis of user browsing, searching, and other behavioral data, potential needs and preferences can be fully explored, data value can be activated, and powerful support can be provided for accurate decision-making on the platform.

#### **4.2. Reduce operating costs**

Traditional e-commerce operations require a large amount of manpower to carry out data processing and customer maintenance work, which is costly and inefficient. By using big data technology, automated information classification and user profiling can be achieved, reducing manual input and effectively saving operating costs. At the same time, accurate services can be achieved through user behavior analysis, preventing resource idle waste and improving utilization efficiency. For example, in the marketing process, big data can accurately target users, reduce ineffective promotion expenses, and further reduce operating costs.

#### **4.3. Strengthen risk management**

The internet is open, and although the production, dissemination, and dissemination of information are extremely convenient, it can bring information security and credit risks. Traditional risk control methods have slow response times and limited coverage, and cannot reduce the impact of risks on e-commerce enterprises. Therefore, it is necessary to use big data technology, which can collect and deeply analyze dynamic data in real time, build a multidimensional risk assessment system, accurately identify abnormal behaviors, and through data association

analysis, provide early warning of network attacks, dynamically monitor user credit, timely discover hidden dangers, provide support for risk disposal, build more efficient risk control mechanisms, and improve the security and stability of e-commerce platform operation.

## **5. The application strategy of big data technology in e-commerce user behavior analysis**

### **5.1. Data collection and preprocessing to provide support for subsequent tasks**

Data collection and preprocessing are key foundational steps of big data technology in analyzing e-commerce user behavior, which can directly affect the accuracy and application effectiveness of subsequent analysis. E-commerce platforms should obtain information from multiple dimensions and scenarios, using distributed crawlers, API interface docking, IoT sensors and other diverse technologies to achieve comprehensive collection and aggregation of multi-dimensional user behavior data such as browsing trajectories, search keywords, favorites and purchases, transaction records, user comments, etc. At the same time, they should strictly comply with data compliance requirements and ensure user privacy and security through data anonymization technology. In response to the differences between structured and unstructured data, the platform can establish a standardized preprocessing process, which sequentially carries out data cleaning, integration, transformation, and specification. It can use anomaly detection algorithms to remove invalid data, convert comment texts into emotional labels through NLP technology, and use PCA algorithm to compress data size and improve processing efficiency. E-commerce platforms should also unify the data standards of various business systems, clarify user behavior fields, collection frequency, and format specifications, and avoid data conflicts and omissions; Introduce automated cleaning tools to filter out abnormal data such as false touches and brushing orders through a rule engine, and fix behavior link breakage issues caused by cross device and cross page interactions. At the same time, establish a dynamic data quality monitoring system to provide real-time warning and verification of abnormal fluctuations, ensuring the authenticity, completeness, and reliability of user behavior data, and providing solid data support for subsequent work <sup>[3]</sup>.

### **5.2. Building user profile tags to achieve accurate product push**

User profiling is an effective tool for analyzing user characteristics, understanding user interests, and developing product and operational strategies. It can rely on multidimensional user behavior data to construct labels such as attributes, interests, and consumption behavior, highly summarizing user characteristics, and achieving precise e-commerce marketing. Big data technology mainly supports portrait construction from three aspects as follows:

- (1) Multi-channel data collection, integrating user registration information, browsing trajectories, favorites and purchases, evaluation and interaction data, comprehensively capturing the behavioral characteristics of e-commerce users;
- (2) Design a hierarchical tag system: Taking Taobao platform as an example, tags can be divided into static tags and dynamic tags. Static tags contain basic information such as gender, age, and region, while dynamic tags include browsing history, favorites, purchase history, and duration of stay, achieving accurate clothing recommendations;
- (3) Achieve dynamic updating of tags, using algorithms and machine learning models to adjust tag weights in real time according to changes in user behavior, ensuring accurate and effective profiling. When users frequently browse a certain type of product, the system automatically updates interest tags and timely

pushes matching products, significantly improving recommendation accuracy and user conversion rates, and enhancing the market competitiveness of enterprises.

### **5.3. Precise advertising placement and personalized marketing activities planning**

On the one hand, big data technology can deeply mine demand preferences based on e-commerce user behavior data, achieve precise advertising placement, and effectively solve problems such as blind advertising placement, low conversion rates, and impact on user experience in traditional advertising. The platform pushes corresponding product advertisements based on user interests and sets up direct purchase links, which can improve user stay time and transaction efficiency. At the same time, selecting partners reasonably can reduce marketing costs and improve advertising conversion effects. On the other hand, big data technology can analyze user behavior data such as browsing, adding purchases, and payments, enabling platforms to accurately determine user purchase intentions and consumption capabilities, and provide data support for marketing activities. For high intention but price sensitive users, the platform can issue targeted limited time coupons and carry out short-term discount activities for 1–3 days to enhance users' sense of urgency in purchasing and stimulate their willingness to consume. This personalized marketing model can not only improve platform sales and operational efficiency, but also enhance user satisfaction and loyalty, achieving a positive interaction between the platform and users <sup>[4]</sup>.

### **5.4. Implement personalized recommendations and build a credit evaluation system**

The application of big data technology to analyze e-commerce user behavior also requires the implementation of personalized recommendations and the construction of a credit evaluation system. E-commerce platforms rely on big data analysis of user browsing, bookmarking, purchasing and other behavioral data to achieve personalized product recommendations. Through precise display on the homepage, continuous recommendation of similar products, and matching of related products, they simplify user operations and enhance shopping experience and e-commerce platform stickiness. Conducting refined marketing targeting user behavior sequences can continuously stimulate consumer willingness and enhance user loyalty. Moreover, in terms of credit system construction, e-commerce platforms integrate multidimensional data such as transaction records, complaint information, and social media activities. After cleaning, preprocessing, and feature extraction, machine learning algorithms are used to construct credit scoring models. At the same time, through algorithms such as logistic regression and random forest training optimization, objective quantitative evaluation of the credit of both parties in the transaction can be achieved. This system can be used for order review, merchant admission, risk control and other processes to ensure transaction security, provide a basis for platform supervision and dispute resolution, create a fair and transparent e-commerce trading environment, and promote the healthy and orderly development of the platform.

## **6. Conclusion**

In summary, under the background of digital transformation, e-commerce user behavior data presents distinct characteristics of real-time, massive, dynamic, and diverse. These multidimensional data contain user consumption preferences and potential needs, and are the core resources for the development of e-commerce enterprises. E-commerce enterprises can leverage the role and advantages of big data technology to analyze e-commerce user behavior, which is beneficial for improving data value, reducing operating costs, strengthening risk management, and laying a solid foundation for enterprise development. To improve the application effect of big

data technology, e-commerce enterprises need to build a full process application system, strengthen data collection and preprocessing to solidify the analysis foundation, rely on user profile tags to achieve precise push, use precise advertising placement and personalized marketing to stimulate consumption potential, combine personalized recommendation and credit evaluation system to enhance user experience and transaction security, form a closed-loop empowerment from data collection, analysis to decision-making, effectively reduce operating costs, enhance market competitiveness, and promote high-quality and sustainable development of the e-commerce industry.

## Disclosure statement

The authors declare no conflict of interest.

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