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Analysis of implementation for big data techniques in consumer behavior

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Abstract. Consumer behavior can refer to both the purchasing behavior of consumers towards goods and the decision-making behavior of consumers when choosing goods, the research in this field involves psychology, marketing, and other disciplines. As a popular data mining and processing technology, big data technology has powerful information analysis capabilities. Therefore, with this in mind, applying big data technology to consumer behavior research can greatly improve the efficiency. This study focuses on the implementation for big data techniques in consumer behavior, including application scenarios, application methods, as well as application efficiency. The AIDMA, AISAS, and SOR models are suitable for using big data analysis technology. Big data technology helps enterprises influence external factors in consumer behavior factors, thereby influencing consumer decision-making behavior through internal perception factors. Overall, these results aim to collect and summarize relevant knowledge about consumer behavior and big data for future scholars to investigate and explore the implementation schemes.

Keywords: consumer behavior, big data analysis, AIDMA model, AISAS model.

1. Introduction

1.1. Background of the consumer behavior theory

Between the 19th century and the beginning of the 20th century, economists firstly attempted to combine the knowledge of economics and psychology for research related to human behavior. The term conspicuous consumption was initially introduced in a book The Theory of the Leisure Class written by American sociologist Thorstein B Veblen, and it served as a straightforward description of the early stages of consumer behavior. Then the economic crisis that broke out in the 1930s made supply and demand a top problem to the western companies. Meanwhile, the development of productivity and the improvement of consumption level after World War II led to a gradual diversification and personalization of consumers' behavior. Many enterprises realized that corresponding adjustments were needed to gain an advantage in the competition. Therefore, during this period, consumer behavior theory began to be widely applied, and there appeared more and more research directions about it, for example, Psychologist Mason Hale used the projection effect to study consumer behavior motivation, and American scholars Geist and Brown studied on the consumer loyalty of brands [1]. In the 1960s, the development of consumer behavior research accelerated, research methods gradually increased, and the

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research scope also expanded. The quantity and quality of relevant literature significantly improved, and finally the consumer behavior was officially recognized as an independent discipline. In 1968, Engel, Conrad, and Blackwell from Ohio State University jointly published the first textbook of this discipline, Consumer Behavior. Consumer behavior is a beneficial discipline for both producers and consumers. It not only helps consumers to understand their own consumption behavior, improve their own quality and achieve scientific consumption, but also helps enterprises to attract more consumers from a long-term perspective to maximize profits [2], because consumer behavior is helpful for product positioning, market segmentation, and distribution channels selection, which assists enterprises to develop marketing strategies and enhance competitiveness [3]. Furthermore, consumer behavior research can also contribute to the protection of the national ecological environment and the formulation of macroeconomic policies.

1.2. Development of the big data technology

Recently, the booming technologies such as artificial intelligence and cloud computing have completely changed the research methods in many fields, including consumer behavior. The big data analysis technology is a highly efficient and suitable tool for consumer behavior research [4], and big data research methods have often been compared with traditional research methods. Traditional marketing research methods such as questionnaires and interviews often require a significant investment of manpower and resources. The collected data may be biased and cannot reflect the true needs of consumers, resulting in low efficiency and accuracy. Therefore, marketing strategies such as advertising and promotion developed by using traditional research methods often target the entire group with a wide coverage, but cannot achieve significant effects, while the big data technology can use internet technology tools to collect, record, and analyse real-time data such as consumer browsing records, shopping records, and social media behavior, in order to quickly understand the interests, preferences, shopping habits, and lifestyle habits of shoppers, better predict consumer demand and market trends, and develop more accurate marketing strategies [5]. The basic reason is that from an individual perspective, the big data consumer models can provide more personalized service and receive real-time feedback to optimize products more quickly, and from a group perspective, it can provide enterprises with more refined consumer group positioning to improve customer retention at a deeper level.

1.3. Motivation and framework of the article

This paper is inspired by previous papers, as there are many directions in which big data technology is applied to consumer behavior research. The author wants to summarize certain laws of the models by understanding several commonly used models of consumer behavior research and attempting to identify similarities and differences among them, and then a clear structure of a big data model applied to consumer behavior can be provided for future scholars to refer to and study. The following content is roughly divided into four parts, with a total of approximately 2500 words. The first part provides a brief introduction to commonly used models and evaluation indicators of big data analysis technology. The second part introduces the three common and efficient models based on big data applied in consumer behavior research. The third part discusses the limitations of current big data technology in analysing consumer behavior and outlooks for future research. The fourth part is conclusions.

2. Basic description of big data technology

The big data models are beneficial for researchers to effectively organize, apply large amounts of data, and quickly and accurately mine and analyse information. Usually, data models can be divided into three types from the perspective of application hierarchy: conceptual models, logical models, and physical models [6]. Big data models are more refined and diverse based on this, such as data warehouse models, data mining models, and machine learning models.

Among numerous big data analysis models, there are three common ones. The first one is the event analysis model, which can monitor users' behavior on different platforms in real-time, and achieve stronger analysis capabilities through different attribution indicators and customized indicators. It can

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be used to study the impact of a certain behavioral event on the enterprise. By studying all the factors associated with the occurrence of the event, researchers can explore the reasons, interactive effects, and other factors behind user behavior events. The second type is the retention analysis model, which is an analysis model used to measure user engagement and activity. By deeply understanding user retention and turnover, key factors affecting sustainable product growth can be identified to guide market decision-making, improve products, and enhance user value. The third type is the funnel analysis model, which is a method of analysing the conversion effects of a user's application of a certain business service through a series of steps [7]. Its characteristic is to analyse the conversion rate of these large business links by solidifying specific analysis processes or business links, and flexibly define the conversion process among multiple steps, identify key loss links and influencing factors, and then analyse users' behavior for targeted optimization actions, which is similar to the path analysis.

3. Three scenarios about consumer behaviors models based on big data

3.1. Scenario 1: AIDMA model based on big data

The AIDMA model represents attention, interest, desire, memory, and action. These five words describe the psychology and behaviors of consumers, and serve as a guiding process for businesses to guide consumers, transform them from unknowns to acquaintances and then to buyers. The AIDMA model was widely used during the early days of traditional media and the internet, and it still plays an important role for businesses in the market now [8].

Therefore, applying big data analysis technology to the AIDMA model also has certain practical value. Specifically, the five parts of the model can be divided into five steps to analyze separately. The first step is to attract consumers' attention. Nowadays, there are too many noteworthy things, but it is a little difficult to grasp the characteristics of the noteworthy things. Big data technology can summarize the common characteristics of consumer choices by collecting and analyzing massive consumer data, allowing businesses to grasp the methods of attracting consumers. In other words, big data technology cannot help businesses innovate, but it can ensure that businesses can attract a certain number of consumers. Through the results of big data analysis, businesses can showcase the most attractive products to consumers. The second step is to make consumers interested in the product. If the first step of catching attention is a common behaviors, then the second step of arousing interest is a personalized behaviors, which is also one of the most powerful functions of big data analysis technology. By mining, extracting, and analyzing a large amount of individual consumer data, big data techniques can construct a consumer profile, which is the behavioral characteristics of the consumer, this enables businesses to provide personalized services more conveniently and accurately, which is also one of the main demands of consumers in this era. The third step is to make consumers have a desire for the product. In fact, for products that arouse their interest, consumers tend to learn more information before deciding to purchase. From a psychological perspective, this is because consumers need to rationalize their purchasing behavior. If they have sufficient knowledge of the product, they can convince themselves that it is useful for them. Therefore, businesses need to provide sufficient and effective product information, so they also need to select information carefully. Big data technology can help businesses perform better in this aspect, it can analyze the correlation data between consumers and products in the database to summarize the most useful product information for consumers, for example, for a bottle of milk, people may be most concerned about the content of protein and calcium, instead of the content of sugar and water, so the first two items can be emphasized while ignoring the latter two when displaying information. The fourth step is to leave a memory for consumers, which can be called a backup solution to the third step. If consumers do not purchase the product after the first time they know it, which is very likely, how can one ensure that consumers will come into contact with the product again? After all, the more consumers meet products of interest, the greater the likelihood of purchasing them is. There is an effective way to leave a deeper impression on consumers by comparing products. Big data technology can provide merchants with information about products of other brands. Through big data analysis, merchants can know the most advantageous features of their products, and focus on promoting them to consumers in

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this regard. The fifth and final step is that the consumer ultimately agrees to purchase the product. Big data technology can collect these transaction data in this final step, further expand and refine the consumer profile, thereby increasing the probability of the next purchase by this consumer [9]. Overall, big data technology can be helpful in all five steps of the AIDMA model. In the first, third, and fourth steps, there is a commonality analysis of consumer groups, products, and merchant groups. In the second step, there is a personalized analysis of consumers, and in the fifth step, there is an expansion of consumer profiles, each step of the application helps to increase the probability of final consumer purchase.

3.2. Scenario 2: AISAS model based on big data

The AISAS model is a new consumer behavior analysis model proposed by Japanese Dentsu company in 2005. It focuses on consumer behavior in the era of the Internet and wireless applications and has made changes based on the AIDMA model. The AISAS stands for attention, interest, search, action, and share. It is reconstructed based on the market characteristics of the network era [10]. The AISAS model and the first two steps of the AIDMA model are similar, with the main difference being the third and fifth steps.

The third step of AISAS is consumers' search for products. In the era of the booming internet, people have learned to use search engines to find the products they want, but now once consumers are interested in a certain product, they do not just listen to the information displayed by the merchants, but actively search for information related to the product, to make more rational consumption. The development of the Internet has helped consumers open up their marketing perspective, which is good for consumers and not bad for businesses [11]. By analyzing market data through big data and effectively summarizing from massive consumer browsing records, businesses can not only provide information that makes their products the most advantageous, but also provide the most reasonable information. The fifth step is consumers' sharing behavior. The Internet era not only makes it easier for consumers to search for information, but also makes it easier for them to share information. Moreover, people's desire to share information on the Internet seems to be stronger than in reality. Therefore, compared to the media age, in the Internet age, a consumer's view of a product can have a greater impact on other consumers, at the same time, consumer opinions become the key information that needs to be collected in the big data analysis, as consumer opinions can retroactively affect consumer choices. By collecting these related data, feedbacks can be provided to the initial big data analysis steps, forming a virtuous cycle in the consumer decision-making behavior chain.

Therefore, big data technology can still be important to every step of the AISAS model, as shown in Figure 1. Even in searching and sharing steps which are different from the AIDMA model, big data technology can still be helpful to businesses, thanks to its powerful ability to collect, process, and summarize data, it allows businesses to keep up with the trend of the times while capturing the common and individual characteristics of consumers [12].

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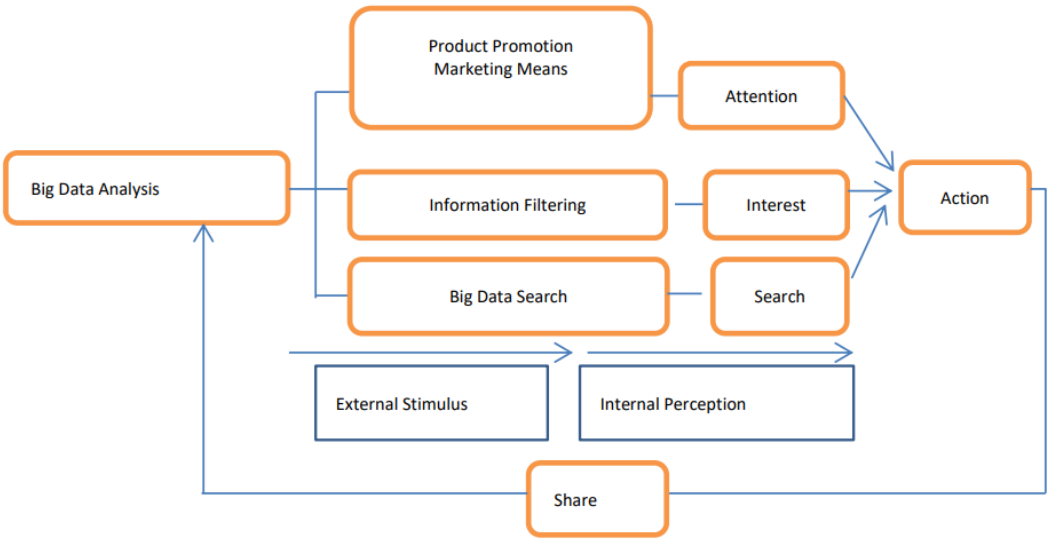

Figure 1. several methods used on consumer behavior research [12].

3.3. Scenario 3: SOR model based on big data

The SOR model is a classic human behavior model evolved from the behaviorist SR model, proposed by Mehrabian and Russell in 1974. The three letters represent stimulus, organism, and response. When this model is used to analyze consumer behavior, it points out that consumer purchasing behavior is caused by stimulus, which come from physiological factors, psychological factors and external environment. Therefore, it is frequently employed to examine how customers behave when making purchases in an online shopping environment, with a primary focus on the motivating factors that influence consumer behavior [13].

By utilizing big data technology, external stimulus in the consumption process can be influenced to a certain extent, thereby changing consumers' internal perception and influencing purchasing decision-making behavior, as shown in Figure 2. Based on the above content, a formula can be used to represent the model:

$$Y = C_1 X_1(X_2) + C_2 X_2 + U \tag{1}$$

In formula (1), X represents various influencing factors, which includes internal and external factors, C represents the degree of correlation between influencing factors and the behavior, and U represents the error matrix, and Y represents consumer purchasing behavior of the product. By using Eq. (1) and Figure 2, data can be collected to analyze and validate the model. The external factors stimulated by big data are website quality, innovation level, and security factors, while the internal perceived factors are consumption attitude and perceived risk. Therefore, eight corresponding hypotheses can be made. The results of data collection and analysis show a positive correlation between external, internal factors, and consumer attitudes, while a negative correlation exists with the perceived risk.

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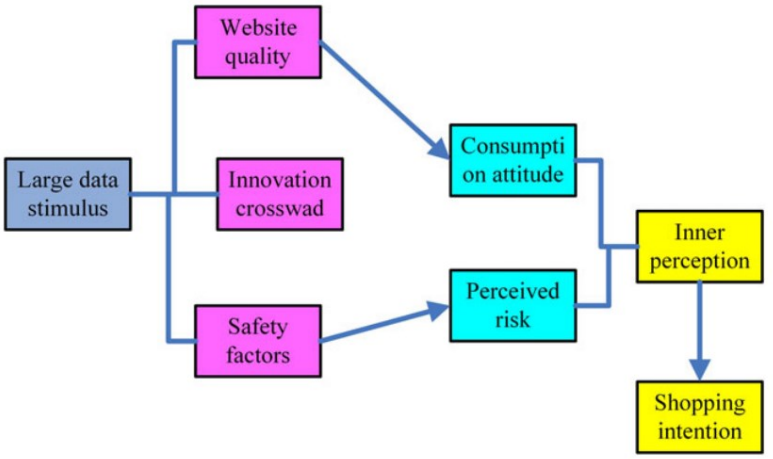

Figure 2. SOR model in big data environment [13]

4. Limitations and future outlooks

At present, there are some limitations in the implementation of big data in consumer behavior, such as difficulty in obtaining data, some consumers are unwilling to disclose all personal information, especially certain sensitive information, and some data protection policies and relevant regulations may also make it impossible for enterprises to use some data. There are issues with data quality and accuracy, and large-scale consumer data extraction techniques inevitably have some errors, which may affect the accuracy of analysis. In addition, some data lacks practical significance or has high repeatability, which may cause distorted analysis results [14]. Therefore, building consumer behavior models faces many challenges. Moreover, algorithm interpretation can be challenging for non-professionals, so applying more complex and efficient algorithms may require professional data analysts. Big data technology and consumer behavior are constantly developing. In the future, consumer behavior will pay more attention to personalized and precise research to help enterprises achieve the goal of maximizing profits. Big data technology, combined with artificial intelligence, cloud computing and other technologies, gradually improves the efficiency and accuracy of analyzing data, which is precisely in line with the needs of consumer behavior analysis, Therefore, the connection between big data analysis and consumer behavior research will become closer in the future.

5. Conclusions

The implementation of big data technology in the field of consumer behavior is becoming increasingly widespread and mature. Consumer behavior analysis based on big data can enable enterprises to grasp market dynamics, optimize products and services, and thereby improve their competitiveness and profitability more accurately. Nowadays, the powerful ability of big data collection and analysis can help consumer behavior models play a more efficient role, such as the AIDMA, AISAS, and SOR models. Merchants can use big data tools to study and understand consumer behavior more efficiently, and thus develop more diversified, precise, personalized, and efficient marketing strategies, which can gain advantages in both the real economy and the online economy. At present, there are still limitations in the use of big data in consumer behavior research, such as data collection and privacy protection. However, in the future, big data and consumer behavior will develop towards a more efficient direction. This paper summarizes the application of big data technology in consumer behavior research and lists three common consumer behavior models for future scholars to reference and study.

References

[1] Erragcha N and Babay H 2020 S Social Media, Marketing Practices, and Consumer Behavior Leveraging Consumer Behavior and Psychology in the Digital Economy pp 27-45.

DOI: 10.54254/2755-2721/53/20241342

[2] Chintakayala P K and Young C W 2017 Using big data to understand consumer behaviour on ethical issues. Journal of Consumer Ethics vol 1(1) pp 43-47
[3] Zhong Y Z and Department M E 2018 Review of the use of big data in marketing. Journal of Hubei University of Education vol 15 p 17.
[4] Zhao J, Xue F, Khan S and Khatib S F 2021 Consumer behavior analysis for business development. Aggression and Violent Behavior p 101591.
[5] Li X 2022 Research on the Development Model of Network Precision Marketing Based on Big Data. Frontiers in Business, Economics and Management vol 5(3) pp 306-309.
[6] Wang Y Y, Li Y, Perry P and Liu Z C 2018 An Overview of Fashion Business Models in Big Data Environment. Environment Textile Bioengineering and Informatics Symposium Proceedings p 19.
[7] Padhy S and Shashi K D R 2018 Big data analysis using apache hadoop. IJARIIT vol 17 p 1.
[8] Storey V C and Song I Y 2017 Big data technologies and management: what conceptual modeling can do. Data and Knowledge Engineering vol 108(MAR) pp 50-67
[9] Li Y, Song L and Zeng Y 2019 Research on information security and privacy protection model based on consumer behavior in big data environment. John Wiley and Sons, Ltd p 10.
[10] Hennig A, Amodt A S, Hernes H and Vatrapu R 2016 Big social data analytics of changes in consumer behaviour and opinion of a tv broadcaster. IEEE International Conference on Big Data (Big Data) pp 3839-3848.
[11] Zhang C and Tan T 2020 The impact of big data analysis on consumer behavior. Journal of Physics Conference Series vol 1544 p 012165
[12] Pang L and Liu Y 2020 Construction and Application of a Financial Big Data Analysis Model Based on Machine Learning. Revue d'Intelligence Artificielle vol 34 p 3.
[13] Chen W, Zhang Q, Jin M and Yang J 2018 Research on online consumer behavior and psychology under the background of big data. Concurrency and Computation Practice and Experience vol 18 p 29.
[14] Rooderkerk R P, Dehoratius N and Musalem A 2021 Retail analytics: the quest for actionable insights from big data on consumer behavior and operational execution. Chicago Booth Research Paper vol 21 pp 2110-2139.