

Demonstration of Bigdata Analysis Implementation in Predicting Consumer Behavior

Yahan Zhang^{1, *}

¹School of Management, University at Buffalo, Buffalo, United States

*Corresponding author: yahanzha@buffalo.edu

Abstract. The rise of personal computers, cell phones, and other smart gadgets has ushered in a new era of enormous data generation, sharing, and use. In the big data age, there has been a significant shift in consumer purchasing behavior due to the high transparency and quick flow of information. Consumers are becoming more logical in their purchasing decisions, paying more attention to the observable advantages that brands offer, and placing greater importance on the individualized services that businesses offer. With this in mind, this article explains some of the functions and analytical techniques of big data analysis in forecasting customer behavior. To be specific, the basic concepts and models of bigdata are introduced. Subsequently, the corresponding applications based on the state-of-art big data analysis techniques are demonstrated. The research of changes in customer behavior will assist businesses in promptly adjusting their marketing plans and winning the first chance in the harsh market rivalry. These results shed light on guiding further exploration of consumer behavior analysis in the new era.

Keywords: Bigdata; Consumer Behavior; Prediction.

1. Introduction

Consumer behavior generally refers to a consumer's purchasing habits and real product consumption. Consumer behavior, according to Hoyer, MacInnis, and Pieters, includes services like traveling, looking for videos on YouTube, making donations to the UN Children's Fund, participating in activities, having experiences, and using ideas [1]. It also refers to how a person makes a physical purchase. The combination of perceptual, cognitive, behavioral, and environmental elements is a key component of consumer behavior [2, 3]. Engel defines consumer behavior as the many activity's consumers take to purchase, use, and dispose of consumer products as well as the decision-making actions that lead up to and influence these activities [4]. The process of consumer behavior is ongoing. Understanding consumer behavior necessitates knowledge of how consumers use and dispose of things after use or consumption in addition to how they obtain goods and services. Consumer behavior research should investigate and comprehend customers' assessment and selection processes before they purchase goods and services, along with their usage and disposal processes once they have them. The only way to fully comprehend customer behavior is in this manner.

The network generation is the digital world. Consumers will have access to a broader variety of information sources and more information in the Internet era, influenced by the big data era [5]. Through the analysis of big data, customers may learn more about the items, which will considerably improve their ability to make autonomous decisions and provide them with more knowledge about the products. The rise of big data will alter conventional consumer behavior, and new types of behavior will progressively emerge within the big data era.

The consumer sector is the first of two key sectors that big data has an impact on. Through the statistics of the web and information systems, people would gather a considerable amount of data about the providers. As an outcome, big data is participating in the expansion and transformation of the marketing and sales industry. The chief factor is that businesses are capable of anticipating customer purchase behavior by using big data effectively. With the use of Big Data-related technology, organizations can concentrate their sales to various clients by gathering data about their requirements and executing targeted tactics to give them comprehensive advice. For instance, Project 7's mint gum, which utilizes the revenues from sales to plant trees, is promoted in Walmart's postings [6].

While tracking and analyzing in-depth historical consumption records, in the beginning, was the first step toward a deeper understanding of consumer behavior, there is now a shift from understanding consumer behavior to understanding consumer intent, expanding from tracking customer purchase records to new data sources like cookies, social media platforms, mobile devices, and search engines. The data from internet purchases, clicks, and shopping patterns, as well as the data from social networking websites and search engines, are all being incorporated by many businesses and brands into their entire strategy. The study focuses on integrating all the valuable data for thorough analysis and assessment of new practical solutions, not only on how to mine this data. Traditional consumer behavior research reports also evaluate consumer data at a macro level, restricting it to understanding customers' current spending behavior, and classifying the acquired data primarily to arrive at conclusions. One can extensively segment the data at all levels by connecting data sources from different platforms using big data technologies. This allows researchers to understand consumers' pre-action and post-action habits, which helps us generate comprehensive marketing plans.

2. Basic Description of Bigdata

Doug Laney created the phrase "Big Data" in the early twenty-first century. In layman's terms, Big Data is the collection, analysis, processing, and exploitation of massive amounts of text, image, audio, and video data online. In addition to the issue of data size, Laney proposed a well-known definition (also known as the 3Vs) to explain what "big data" is: Volume, Velocity, and Variety. The acronym 3Vs stands for three things: vast data, fast data generation, and numerous sorts of data drawn from various sources [5]. The main advantage of Big Data over traditional data is in three areas: first, the enormous amount of data and the depth of the different sorts and aspects of data that are being gathered from people and organizations. The second is the speed at which data can be collected. The third is the diversity of data, which can be obtained from a wide range of sources, including devices in the network, smartphone GPS technology, and social media posts. Depending on the type of business, different sources of information have varying degrees of value. A mainstream market service or product, for instance, ought to be more familiar with social media than an industrial company. Fig. 1 presents a typical bigdata analysis procedure.

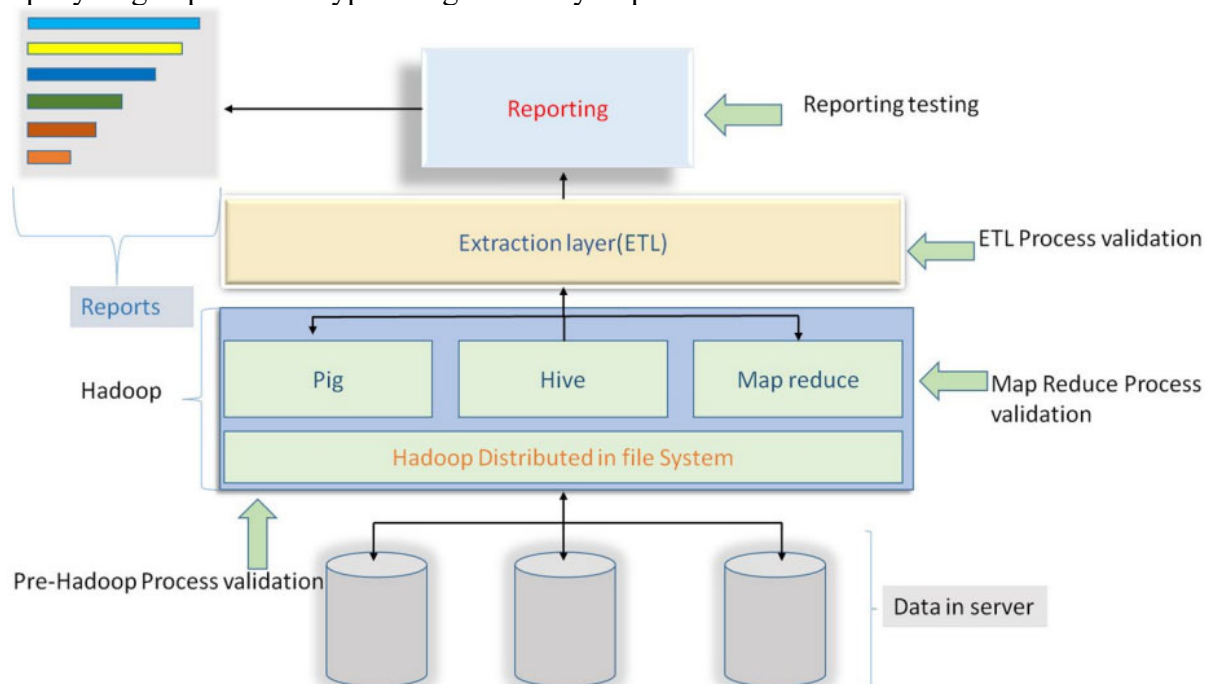


Fig. 1 A sketch of big data analysis procedure.

There are two other V's that are crucial in gathering, examining, and drawing conclusions from big data: value and veracity. Veracity, often known as data quality, is important because not all consumer-related Big Data is reliable. Finally, value involves removing unnecessary and useless material in order to make the remaining data usable [6]. Contemporarily, as the Internet and the information sector have grown, the era of extensive use of big data in business models has gradually arrived. The proper and adequate use of big data can help companies understand their customers, target resources, plan production, and carry out services so that they can provide clients with what they want or need when they need it.

3. Traditional Consumer Behavior Prediction

Since the consumer decision prediction process model is a conceptual model and a methodological exploration, it does not need to be proven per se. Therefore, the core of the problem is whether companies can predict consumers' decisions by using big data. With the right use of big data, companies can predict consumers' purchase decision behavior. Firstly, high information technology provides the physical basis for predicting consumer decision-making behavior. With the development of hardware facilities such as computer computing speed, hard disk storage, sensors, mobile communication devices, and satellite positioning systems, supported by software such as Internet social networking sites, web pages, mobile apps, and emails, information about people's behavior is becoming easier to capture, and people's traces are becoming easier to catch. For example, eBay has created a "data hub" intranet site that allows data scientists to share data and analytics without replicating existing data. eBay has built a social network around analytics and data [7, 8]. This analysis allows companies to better understand the demands of consumers.

Secondly, cloud computing and other data analytics technologies provide the technical guarantee for predicting consumer decision-making behavior. The need to mine the value of big data is expanding, and big data analytics technologies have advanced dramatically in tandem. For instance, data mining techniques include clustering, categorization, extrapolation, forecasting, and variable selection, etc.; analytical techniques such as correlation analysis, latent variable analysis, and statistical inference; Recognition system, predictive models, cointegration, computational linguistics, data processing, satellite data, supervised and unsupervised learning, Simulink, wavelet analysis, time series prediction models, and visualization techniques are some examples of computational methods that take into account subsampling, complexity, and distributed computing [9]. Data analysts can now extract latent consumer behavior patterns and principles from complicated, chaotic, or dynamic big data thanks to the development of various big data processing and analysis tools.

Furthermore, the results of a recent scientific study offer a theoretical foundation for forecasting consumer decision-making behavior. Gajjar claims that by examining consumer purchasing patterns, it can be shown that the majority of human behaviors are influenced by characteristics such as culture, society, age, and occupation and that their predictability and repeatability closely resemble those of natural science [10]. Consumer behavior is impacted by six primary factors, according to Richard and Chebat [11], online conceptual frameworks, digital sentiments, digital entertainment, flowing, online dispositions, and buy intents. Thus, modern researchers' research provides an effective methodology for predicting consumer behavior.

4. Bigdata Analysis for Consumer Behavior Prediction

According to the model of consumer decision prediction process, companies can make six essential processes of "asking questions, tracking history, developing models, collecting data, evaluating data, and producing predictions" are what businesses need to master in order to understand customer decisions, according to the model of consumer decision prediction process.

As an illustration, consider the well-known "Beer and Nappies" Wal-Mart tale [12], asking a question is the first thing to do. The workers at Walmart observed that, in addition to the off sale of

convenience meals, flashlights, rain gear, and desiccants, beer sales also climbed dramatically when an unusual thunderstorm occurred in California, USA. Managers at Walmart were perplexed by this and sought to investigate the reasons behind the rise in alcohol sales. Monitoring the past was the next stage. Beer sales did fluctuate dramatically during downpours, except for those items that should have been top sellers, according to a comparison of previous historical data. Making a model was the third stage. Wal-Mart proposed that consumer psychology, customer behavior, and weather all had an impact on beer sales. Gathering data is step four.

Wal-data Mart's analysts gathered a lot of secondary data through their own data warehouse in response to the requirement to investigate the issue, and they also included the most recent barcode data pertinent to the research in the primary data analysis. Analyzing the data was the fifth phase. The data analysts first performed a content analysis, converted the categorical data into ordinal numbers, ran logistic regression and chi-square tests, and discovered that weather failed when the consumer gender variable was introduced, that weather could be removed as an influencing factor and that 63% of these customers who bought beer also bought diapers. This is an excellent observation, and the following simulation using the prediction model demonstrates the strong correlation between beer and diapers on the shopping lists of male consumers. Then one needs to make a prediction in step six. In light of this, Walmart management anticipated that the majority of the male customers would visit the store during inclement weather, purchase diapers for their kids, and bring some beer for themselves. In light of this knowledge, Walmart management thinks that young fathers are more inclined to purchase alcohol when they visit a store to buy diapers. Following the Walmart strategy, a typical organization of bigdata analysis framework is presented in Fig. 2.

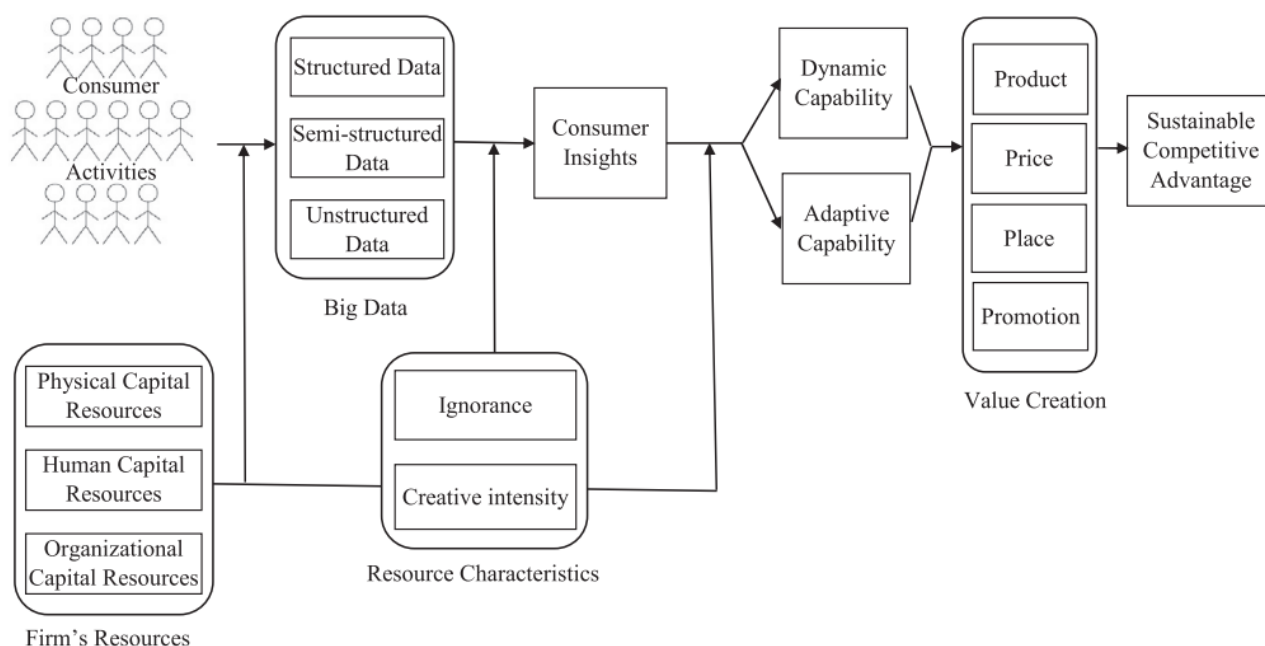


Fig. 2 A typical framework for bigdata analysis in consideration of consumer behavior.

5. Comparison

On account of the limitations of the traditional consumption model, consumers are unable to fully comprehend the product's post-use experience and are forced to rely on the product's brand to evaluate the product's quality and performance in an indirect manner. As a consequence, consumer reliance on the brand is quite substantial. Compared to traditional consumer behavior, in the environment of big data, consumers have greater and broader access to information, and they no longer judge a brand only primarily on advertising or marketing. Consumer decision-making is getting increasingly rational. Consumers are willing to spend more time and cognitive effort considering their product choices, paying more attention to the features, attributes, and advantages that brands possess, and

thinking carefully and comparing the differences between brands to make decisions that best meet their needs in the Big Data era. When a brand fails to match customer expectations, its loyalty to that product wanes. On the other side, in the age of big data, consumers may immediately submit their product purchase evaluations on social media and share them extensively over the Internet.

In the traditional consumer model, consumers can only judge a product through subjective analysis after they have access to the product information. In the context of big data, consumers can also judge a product based on different aspects such as website history, click-through rate, sales of shopping products, and customer feedback. E-commerce companies that sell online also post corporate information on the web, reducing consumer concerns about the security of transactions. It is also in the context of big data that online consumption has become the choice of more consumers than ever before, replacing the traditional model of sales. Consumers can find the goods they want on the web by the border, enhancing shopping efficiency and reducing the shopping options. With the influence of customers having access to a wealth of information about comparable items online because of big data, therefore they also won't shop blindly or buy similar items with low-cost performance, making consumers rational.

Different from in the past, consumers will also have a higher demand for the product. Maslow's Hierarchy of Requirements states that when consumers' relatively low demands [13]. Those related to health and safety, are satisfied, they are more likely to have higher-level needs such as the urge for self-actualization, respect, and human benefits. They purchase not just the commodity, but also the spiritual worth it provides. In the classic industrialized age, things were manufactured by a standardized machine, and all products were essentially homogeneous, trying to suit the most common demands of the majority of people. Because of the popularity of big data, consumers may now better comprehend a product. The mere presence of a product's appearance, performance, and quality in a shopping mall or on the Internet is no longer sufficient to meet consumer needs, and they increasingly value personalized services provided by businesses, that is, services that can meet their higher-level needs, prompting the traditional business model to change.

6. Limitations & Prospects

Big data's primary benefit is that it enables low-cost data supply and data returns for organizations. The rules and substance of the data, or the relevant information in the data, can only be retrieved and the actual worth of the data is exposed by recognizing and filtering out a significant quantity of repetitious information, classification, and aggregating data with a specific "gold content," etc. From the standpoint of social development, the tendency of "fragmentation" of product audiences is growing more and more significant because of the continuous development of the Internet and new media and the rise in consumer personalized requirements. Companies are being forced by the "fragmentation" tendency to investigate further niche markets, niche media, and consumer behavior. Additionally, big data helps individuals make greater assessments and forecasts about "large trends".

The problem is that, before the advent of Big Data, the information one had to understand human behavior frequently came from trailing statistics and passive survey forms. With the usage of big data technologies, it is feasible to more objectively comprehend human behavior thanks to a multitude of sensors, including mobile applications, cameras, shared photos, and videos. Big data technology links human behavior. Through big data, information on human behavior is gathered, subjected to analysis, and then analyzed to better understand how people behave. Big data may be argued to play a significant role in understanding human behavior features, gathering, and analyzing data on human behavior, and providing the fundamental building blocks for a data value to be used commercially. The effectiveness of data processing has increased with the development of big data technology platforms. Its efficiency has increased geometrically, and it is now possible to process data in a matter of minutes instead of days or even weeks. Big data's effective computational power allows people to work faster. One may assume that Big Data technology will propel human civilization into a new stage given that efficiency enhancement is a well-known indicator of human society's advancement.

Human beings are resistant to being swayed by the tidal wave of big data development, but they do benefit from the convenience it brings. It is rational to consider the harm big data may cause people, and to develop preventative measures. Thus, big data development will lead to a stable world for people.

7. Conclusion

In summary, this paper demonstrates the implementations of bigdata analysis in consumer behavior and compare the differences between the former style. The times are developing, technology is advancing, and the traditional way of consumption is no longer able to adapt to the needs of consumers, so it is an inevitable development to be replaced by a new way of consumption headed by the big data age. A fresh opportunity exists with big data, and the changes brought by big data will certainly trigger changes in consumer behavior. Through the prediction and analysis of consumer behavior by big data, we are also familiar with the future business model, and big data must be the future business development trend. But there are two sides to everything. Companies also need to protect the quality of their products when they vigorously develop big data businesses. The way to better create more value by analyzing the impact of big data on consumer behavior, effectively use big data business to effectively communicate with consumers, and take appropriate business models to enhance their competitiveness, will be the new problem of enterprise development. Overall, these results offer a guideline for consumer behavior analysis in bigdata ear.

References

- [1] Hoyer W D, MacInnis D J, Pieters R. Consumer behavior. Cengage Learning, 2012.
- [2] Hoyer W D, Stokburger-Sauer N E. The role of aesthetic taste in consumer behavior. *Journal of the Academy of Marketing Science*, 2012, 40(1): 167-180.
- [3] Kähr A, Nyffenegger B, Krohmer H, et al. When hostile consumers wreak havoc on your brand: The phenomenon of consumer brand sabotage. *Journal of marketing*, 2016, 80(3): 25-41.
- [4] Fullerton R A. The birth of consumer behavior: motivation research in the 1940s and 1950s. *Journal of Historical Research in Marketing*, 2013.
- [5] Grable J E, Lyons A C. An Introduction to Big Data. *Journal of financial service professionals*, 2018, 72(5).
- [6] Coursaris C K, Van Osch W, Balogh B A. A social media marketing typology: Classifying brand Facebook page messages for strategic consumer engagement. *ECIS 2013 Completed Research*. 2013, 46.
- [7] Davenport T H, Barth P, Bean R. How'big data'is different. *MIT Sloan Management Review*, 2012.
- [8] Erevelles S, Fukawa N, Swayne L. Big Data consumer analytics and the transformation of marketing. *Journal of business research*, 2016, 69(2): 897-904.
- [9] Xu Z, Shi Y. Exploring big data analysis: fundamental scientific problems. *Annals of Data Science*, 2015, 2(4): 363-372.
- [10] Gajjar N B. Factors affecting consumer behavior. *International Journal of Research in Humanities and Social Sciences*, 2013, 1(2): 10-15.
- [11] Richard M O, Chebat J C. Modeling online consumer behavior: Preeminence of emotions and moderating influences of need for cognition and optimal stimulation level. *Journal of Business Research*, 2016, 69(2): 541-553.
- [12] Tian, Xiaojun. "Beer and Nappies." *Big Data, Big World*, 14 Dec. 2014, Retrieved from: <https://bigdatabigworld.wordpress.com/2014/11/25/beer-and-nappies/>.
- [13] Benson S G, Dundis S P. Understanding and motivating health care employees: integrating Maslow's hierarchy of needs, training and technology. *Journal of nursing management*, 2003, 11(5): 315-320.