



The Application of Big Data Analysis in the Hierarchical Management of Automobile Customers

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ABSTRACT

In recent years, automobiles are becoming one of the mainstream people's travel modes. The automobile industry has benefited from big data analytics to improve their sales and marketing efficiency. With the increasing popularity of network applications, the Internet is changing the business models of traditional industries. Traditional industries are undergoing online and digital transformation. This paper summarizes the importance of bigdata analysis and its application in hierarchical management of automobile customers. In general, automotive big data can be roughly divided into identity data, transaction data, and behavior data. Automobile manufactures can find out more valuable information of these research data in the automobile industry with the help of big data analysis and data mining. In addition, the classification of customers has also been discussed. It could be one of the potential solutions is customer analytics which use the lowest cost value to maintain the stickiness of customers and minimize the loss of customers.

Keywords: Automotive industry, Automobile sale, Big data, Big data analysis, Customer analytic.

1. INTRODUCTION

In recent years, automobiles are not limited to a specific group of customer segment. According to the data from Statista.com, more than 66.7 million cars have been sold in 2021 (Figure 1) which is 7% up from 63.8 million in 2020 [1].

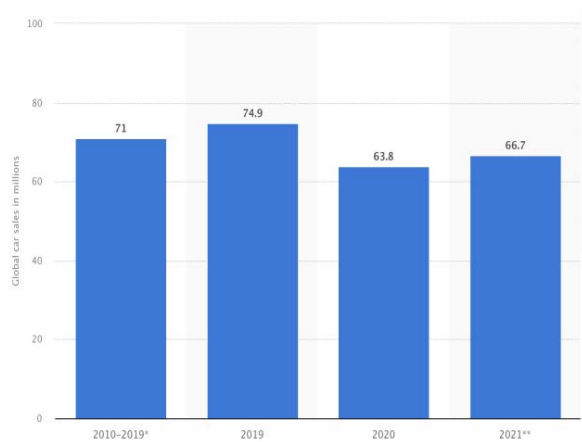


Figure 1 Number of cars sold worldwide between 2010 and 2021

This number is expected to reach 99 million by 2025. China's automobile market is still strong. In 2020, 25.31

million cars were sold [2]. The year-on-year decrease is 1.9% . Among them, 20.17 million of the passenger vehicles were sold with a year-on-year decrease of 6.0% (Table 1). The automotive industry is one of the industries that could reap the benefits from Big Data. Many digital technologies, such as artificial intelligence, big data, and autopilot have participated in the automobile manufacturing process in the last decade [3]. The modern automobile industry's digital transformation will not only affect automobile manufacturing, but also how the automobile can be sold.

Table 1. Chinese New vehicle sales by type in 2020

Units (10,000)	Units (10,000)	Share (%)	Y-o-Y (%)
Sedan/Hatchback	927.5	36.6	-9.9
MPV	105.4	4.2	-23.8
SUV	946.1	37.4	0.7
Mini Van	38.8	1.5	-2.9
Passenger Cars Total	2,017.8	79.7	-6.0
Commercial Vehicles Total	513.3	20.3	18.7
Grand Total	2,531.1	100.0	-1.9

In the current automobile sale, there are many sources of data information about customer such as the official

website of the auto manufacturer, customer information kept by dealers, media, and questionnaires. These data are usually cleaned and integrated. After that, the data are sent to car dealers (sales staff of dealers). Under normal circumstances, Original Equipment Manufacturers (OEMs) that produce automobiles can only get customer information from sales staff. However, there is no unified customer grading standard system as the basis for sales staff of different dealers of the same type of model. As a result, it is very difficult for these OEMs to obtain scientific conclusions based on incomplete data analysis.

With the rapid development of information technology, big data not only has a profound impact on the computer Internet industry, but also has a wide and far-reaching impact on other work fields. Big data technology has greatly changed people's way of life and work, resulting in the explosive growth of information volume, bringing new opportunities and challenges to enterprise management, improving the operation efficiency of enterprise processing, inspiring managers to open up new management ideas, and opening up new management thinking and forming a new work mode through learning and mastering big data. So far, there is no clear definition of big data. We can roughly understand big data technology as a record of comprehensively querying information and building a central database. In the central database, we can take advantage of the resource advantages of the Internet to accelerate the acquisition of information data. Enterprises can identify the future development direction and improve their core competitiveness through accurate use and replacement of data. At present, China's information technology is making continuous progress, and the amount of data information generated in enterprise operation is also increasing. The use of big data technology can significantly improve work efficiency.

As data analysis capabilities improve, predictive analysis based on big data is a powerful tool that can dramatically improve forecasting efficiency as well as operations performance [4]. The challenge is whether the automobile OEMs can use this large amount of experience data. In other words, big data brings difficulties to evaluation and decisions making. A good big data analysis strategy can integrate these massive information—whether it's a “machine-readable” dataset, or unstructured data such as video, or text [5]. As a result, automobile OEMs can find out which models, accessories or services are of interest to a particular group of customer segment. Meanwhile, it can also provide personalized and tailored products to increase sales. With the popularity of the Internet and social media, automobile OEMs can access to a steady stream of customer data, and the analysis is becoming more and more accurate. In addition, supply chain data can indicate the weakness during the manufacturing and sale process

so that solutions can be taken before serious problems arise.

There is few research in this field regarding the big data analysis in the hierarchical management of automobile customers. The aim of this paper is to study the state of knowledge and perspectives of big data analysis in the hierarchical management of automobile customers. The objectives of this study are to: 1) discuss the big data source of automotive industry; 2) discuss the current knowledge and perspectives of the application of big data in customer analytics of automobiles sale.

2. THE VALUE OF ENTERPRISE BIG DATA

With the increasing popularity of network applications, the Internet is changing the business models of traditional industries. Traditional industries are undergoing online and digital transformation. Enterprises have accumulated a large amount of data during this process. The world's data doubles every 18 months especially for the rapidly developing market [6]. How to efficiently use these massive data is becoming an urgent question which need to be solved for each enterprise. The rapid development of big data technology provides an effective method for enterprises to data processing and data mining. Regarding this explosive growth of data, Deloitte believes that the focus of enterprise big data application is not to acquire more data, but to conduct in-depth analysis and problem-solving through big data analysis around business goals and specific business problems. Enterprises should start from the business strategy and IT strategy to build the top-level framework design of big data applications.

Big data analysis is not simple data statistics and summarization. The results are not only for the causality questions, but more related ones with uncertainty. The analysis of massive data from multiple sources can discover potential business drivers and patterns, thereby assisting business decision-making and driving business change and innovation. Nowadays, the business of modern enterprises become more digital, and the communication among enterprises, customers, and suppliers are becoming more diversified and agile, which could provide a broad stage for big data analysis [7]. At present, many enterprises have applied big data technologies to solve business problems, but at the same time, there are still many problems need to be solved in the application of big data in these enterprises. For example, low quality data brings difficulty to the data analysis. Furthermore, the data prediction accuracy also needs to be improved. Although big data prediction capabilities have made great progress in today's intelligent world, the accuracy of prediction is relatively insufficient, which puts forward higher requirements for the application of big data technology.

3. BIG DATA OF AUTOMOTIVE INDUSTRY

International Business Machines Corporation (IBM) summarizes big data in automobile industry into three “Vs”, i.e., “Volume”, “Variety”, and “Velocity” which constitute the basic characteristics of big data [8]. Some researchers add “Value” to these 3V characteristics of big data into 4V characteristics. Rapid development of the Internet technology, mobile devices, and other intelligent terminals cause the explosive growth of big data. The automobile industry often occupies an important position in the national economy due to its long industrial chain, widespread and strong driving effect. Big data not only includes traditional statistical data, but also includes real-time, continuous transaction data, behavioral data, sensory data. In general, automotive big data can be roughly divided into the following categories (Table 2): 1) identity data of automobile consumers, including name, age, ethnicity, educational background, occupation, home address, phone number, and email; 2) transaction data of automobile consumers, including consumption data for automobiles (automotive finance data, automotive insurance data, automotive repair and maintenance), and other consumption data other than automobiles, such as dining, shopping, leisure and entertainment, health care, business travel and other consumption data; 3) behavior data of automobile consumers, user online interaction behavior, such as travel trajectories, driving behavior, consumption behavior automatically collected by various in-vehicle sensing devices, etc.

Automobile manufactures can find out more valuable information of these research data in the automobile industry with the help of big data analysis and data mining. As a result, automobile manufactures and car dealership can understand many factors such as the market composition of the automobile industry, market segmentation characteristics, consumer demand and competitor status from big data. On the basis of the market demand and competitive intelligence of the automobile industry, they can provide better solutions and suggestions to solve the problem, allowing the unique and personalized market positioning of the enterprise brand, and improve the industry acceptance of the enterprise brand market positioning. It can also establish a mathematical model based on big data to forecast the future market.

Table 2. Types of big data of automobile consumers

Identity data	Transaction data	Behavior data
Name	Automobile finance data	User online interaction behavior
Age	Automobile insurance	Travel trajectories

Ethnicity	Automobile repair and maintenance	Driving behavior
Educational background	Dining	Consumption behavior
Occupation	Shopping	Test driving
Home address	Leisure and entertainment	In-vehicle sensor device operation
Phone number	Health care	-
Email	Business travel	-

4. THE APPLICATION OF BIG DATA IN CUSTOMER ANALYTICS OF AUTOMOBILES SALE

According to industry research data, more than 80% Chinese costumers want to buy automobiles from a car dealership and these Chinese automobile owners plan to change their car when their car is 5.7 years old, and the average cost of car maintenance is 5,000-6,000 Chinese yuan per year [9]. In all car repair and maintenance places, 72% of car owners are still willing to choose a car dealership, and their satisfaction is close to 50%. The biggest pain point of automobile sale comes from their high operating cost. One of the potential solutions is customer analytics which use the lowest cost value to maintain the stickiness of customers and minimize the loss of customers. On the basis of customer big data, customers could be classified as different customer groups based on the multiple dimensions such as vehicle types (SUV, MPV, sedan, new energy, etc.), vehicle age (0-1 year, 1-3 years, 3-5 years, more than 5 years), customer distribution (by administrative area), customer occupation, gender, etc. Based on this classification of customers, it can clearly identify the customer demand, thereby providing value-added services and additional services to gain more customer satisfaction and loyalty. In addition, automobile sale and service are not only service, but also is a part of corporate marketing. Therefore, the customer psychoanalysis is also very important. It can be integrated into the automobile’s sale and after-sales service, which is convenient to provide the same customer with the standard service. It is very important to cultivate customer loyalty. Because not every customer can accept the unchangeable and scripted service model, a freer service experience is the core psychological demand of some customers. Therefore, customer psychoanalysis should be integrated into the automobile’s sale and after-sales service of a car dealership.

5. CONCLUSION

Nowadays, big data is being developed at an exponential rate, and it will undoubtedly revolutionize the automotive industry. It will accelerate the

development of automotive industry and bring a new experience to the customers. At present, big data could provide more channels and ideas for automobile industry and automobile service. Automobile enterprise needs to pay more attention to the use of big data, build a data information network platform, and actively promote the reform and development of the automobile service marketing industry. It should be noted that the actual application of big data analysis of for an automobile enterprise is usually often more complex. It is always highly depending on the customer demands based on the effective analysis (i.e., customer analytics). This effective analysis and application of big data could eventually be an effective approach for enterprises.

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