Big Data and Precision Marketing New Era Strategy to Improve Marketing Effectiveness

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Abstract: This article explores the application of big data technology in precision marketing and analyzes its advantages and potential risks. On the one hand, big data analysis gives companies the ability to gain more accurate insights into consumer behavior, thereby formulating more targeted and personalized marketing strategies. Through the use of the Internet and mobile devices, consumer data is increasingly accessible, which has promoted the transformation from traditional marketing to precision marketing. On the other hand, big data marketing also faces challenges such as data privacy protection and the "information cocoon" effect. Although technologies such as data anonymization and encryption can reduce the risk of privacy leakage, companies need to increase the transparency of data use and give users more control over their data. The article points out that the "information cocoon" effect is a potential negative impact of the algorithm recommendation mechanism, which may lead to a narrow user perspective and social division. Platforms and companies should strive to improve the transparency of algorithm recommendations and encourage users to actively obtain diversified information to alleviate this problem.

Keywords: Big Data, Marketing, Privacy Security, Information Cocoon.

1. Introduction

In recent years, the most advanced and welcomed technology—big data combined with artificial intelligence (AI)—is becoming increasingly important and is the norm in today's digital and real world. Compared with traditional marketing, precision marketing can more accurately locate the target audience and formulate more targeted strategies, thereby improving advertising effectiveness and conversion rates. Because data collection and analysis are more accessible than ever, businesses large and small are likely to take advantage of this technology, achieving impressive results, and it is called the Data-driven Decision-Making Model, which is gaining popularity across various business activities. As big data relies on vast pools of metadata, it encompasses records of people's daily activities, such as borrowing records, purchases, and internet visit histories. The intersection of big data and AI Aims to find true value in the information collected and perform deep analyses to understand customer behaviors, thereby providing useful real-time information for marketing decision-makers to create, optimize, alter, and edit plans to cater to market demands. Well-known analytical tools, like Microsoft Azure Synapse, assist firms in predicting or identifying trends that positively influence decision-making around product development, marketing, accounting, inventory, delivery, and more. Additionally, the data will be automatically organized into reports, charts, graphs,

and dashboard visualizations for users and readers. Business processes can be well automated once analyzed data and AI solutions are implemented. For example, in the manufacturing industry, inventory tracking and recording, equipment maintenance history, reminders, and safety reviews can be fully supported with AI. Any business can use AI to review and search through documents and handle customer service requests, particularly in the marketing sector.

Big data technology is changing the way companies make decisions and interact with customers with unprecedented depth and breadth, and its influence far exceeds traditional business analysis methods. As Davenport and Harris stated companies can gain competitive advantages by analyzing data, and the development of big data technology makes this easier than ever before [1]. According to Chen, Chiang, and Storey, who discussed leveraging big data analytics to elevate decision-making levels and competitive advantages, businesses can strategically utilize data to enhance their operations [2].

This enables companies to break away from the limitations of relying on experience and sampling surveys in the past and turn to data-driven decision-making. For example, by analyzing website browsing data, social media interaction data, transaction history data, etc., companies can more accurately predict market trends, optimize product design, formulate precise marketing strategies, and even predict future trends, make product recommendations and service optimization in advance, and improve user experience and loyalty.

Marr provides a framework named SMART to help companies formulate effective big data strategies [3]. Furthermore, Marr's subsequent work in 2016, "Big Data in Practice: How 45 Successful Companies Used Big Data Analytics to Deliver Extraordinary Results," demonstrates through case studies how companies across different industries have successfully applied big data analytics in areas such as marketing, customer relationship management, and operational optimization.

More importantly, big data technology enables companies to identify customer needs with unprecedented accuracy. By integrating user data from multiple channels, companies can build a complete user portrait, including basic information, interest preferences, consumption habits, social relationships, etc. Based on user portraits and behavior analysis, companies can achieve personalized marketing and precision services. For example, e-commerce platforms can recommend products that users may be interested in based on user browsing history, purchase records, favorites, and other information; music platforms can recommend songs that users may like based on user listening records, favorite lists, and liked songs.

Wedel and Kannan discussed how marketing analytics can enhance the effectiveness of marketing activities in data-rich environments [4]. TikTok, for instance, is a well-known mobile social media application with one of the best AI technologies in the world. It can accurately recommend users' favorite channel programs and video content. TikTok also allows users to create their own original videos using easy-to-use tools and upload them to TikTok, sharing them precisely with other users with similar interests. This is the reason why the platform has reached 1.04 billion monthly active users worldwide as of May 2024 [5]. Many corporations realize this platform's potential and are willing to create their own official accounts for broadcasting and advertising their products, leading to impressive sales figures.

In short, big data technology has brought innovative changes to companies, helping them shift from a "product-centric" to a "customer-centric" approach and achieve precision marketing and refined operations. It is undeniable that big data technology has brought unprecedented opportunities to enterprises, opening the door to more efficient operations, more accurate marketing and deeper insights. However, technological progress is often accompanied by new challenges, and the potential drawbacks of big data technology should not be ignored.

2.   Risk of Privacy Leakage

The problem of privacy leakage is particularly prominent, like a lingering haze, shrouding the future development of big data technology. How to ensure data security and maintain user privacy has become a major issue that enterprises and society need to solve urgently. Entering the era of big data, massive amounts of personal information are continuously collected, stored, and analyzed by enterprises, becoming an important resource for gaining insight into the market and optimizing products and services. However, this massive amount of data is like opening a "Pandora's Box." Once security measures are not in place or if the data is used maliciously, it will lead to large-scale privacy leaks, causing immeasurable losses to users and potentially triggering a crisis of social trust.

Acquisti et al. pointed out that technological advancements have made the collection, storage, and analysis of personal information much easier, while simultaneously presenting new privacy challenges [6]. They argue that understanding the psychological aspects of privacy is essential for businesses and policymakers, enabling them to leverage the opportunities presented by big data while protecting individual privacy and fostering trust.

In recent years, a series of major data breaches have shaken the global landscape, with incidents involving Facebook, Marriott Hotels, and Equifax standing out as some of the most alarming. In 2018, the unauthorized collection of data by Cambridge Analytica from millions of Facebook users highlighted the significant data security vulnerabilities present even at tech giants and underscored the dire consequences of data misuse for political purposes. Cambridge Analytica leveraged this data for targeted political advertising, influencing public opinion and potentially altering the outcomes of elections, thus raising serious questions about the ethics and governance of data usage in the digital age.

Also in 2018, Marriott International suffered a massive data breach that compromised the sensitive information of more than 500 million guests. This incident not only resulted in substantial financial penalties for the company but also caused irreparable reputational damage. Perhaps more critically, the breach exposed users to a range of security risks, including identity theft and fraudulent activities. Customers who had trusted the hotel chain with their personal data found themselves vulnerable to malicious attacks, highlighting the importance of robust data protection measures in the hospitality industry.

Another significant breach occurred in 2017 when the credit reporting agency Equifax experienced a cybersecurity incident that led to the unauthorized access of sensitive information belonging to over 147 million users. This breach is considered one of the most serious in history due to the nature of the data involved—personal information that could be used for identity theft and financial fraud. The impact on affected individuals was profound, leading to extensive financial losses and a loss of trust in the institution responsible for safeguarding their personal details.

These events underscore the critical need for stringent data protection policies and the implementation of advanced security measures across all sectors. They serve as stark reminders of the far-reaching implications of data breaches, which extend beyond financial penalties and reputational harm to include the real-world dangers faced by individuals whose personal information has been compromised. Companies must prioritize data security to prevent such breaches and ensure the trust and safety of their customers. These incidents sounded the alarm for privacy protection and highlighted the urgency of strengthening data security and safeguarding user rights. Pariser addresses the phenomenon of the "filter bubble," where personalized recommendation algorithms limit users' perspectives, leading them to encounter only information consistent with their existing views [7]. He warns that this can lead to societal division, political polarization, and issues of information manipulation, posing a threat to democratic societies.

The harm of privacy leakage is like a domino effect, bringing immeasurable losses to individuals, enterprises, and society. For individuals, privacy leakage may lead to property loss, identity theft, reputational damage, and even threats to personal safety; for enterprises, privacy leakage incidents can severely damage the company's reputation, leading to user loss, termination of partnerships, and ultimately affecting the company's development; for society, large-scale privacy leakage may cause a crisis of social trust, disrupt social order, and even endanger national security.

Tene and Polonetsky proposed the principles such as "data minimization" and "user control" to protect personal privacy [8]. They suggest that collecting and using only necessary data and allowing users to access, modify, and delete their data can help strike a balance between utilizing the power of big data analytics and ensuring privacy protection.

3.   Difficulties and Challenges Faced by SMEs in Participating in Big Data

Ably unitizing big data for precisely making decisions is quite difficult for small and traditional enterprises. They may not have skilled program engineers as those technology companies who are the experts in data collection, analysis, and application. Therefore, they need to rely on sophisticated digital platforms, to help them to collect and analyze large quantities of data, making them understand consumer patterns like a master expert. Marr stated that in order to overcome these obstacles, SMEs must seek appropriate partners and technical assistance [3].

In the era of big data, massive amounts of data contain unlimited business opportunities, bringing unprecedented opportunities for enterprise development. However, for small and micro enterprises that are relatively short of funds, technology and talents, big data technology is like a "siege", with both opportunities and challenges.

Building a big data platform and purchasing related software and services require high costs, which is undoubtedly a huge burden for small and micro enterprises with limited funds. McKinsey's research, in 2011, shows that the initial investment of enterprises in big data project construction requires an average of hundreds of thousands of dollars, and the subsequent maintenance and operation costs are also high [9]. The high-cost threshold excludes many small and micro enterprises from enjoying the dividends brought by big data. At the same time, the application of big data technology requires professional technical talents, including data scientists, data analysts, data engineers, etc. However, small and micro enterprises often lack the financial strength and platform resources to attract and retain such talents, making it difficult for technology applications to be implemented. Even if they invest money to build a platform, it is difficult to find suitable talents to operate and maintain it, which may eventually lead to the embarrassing situation of "having a platform but no application". Data security is a key link in big data applications. However, small and micro enterprises often have insufficient investment in data security, weak security awareness, and insufficient technical protection capabilities, making it difficult for them to cope with increasingly complex data security threats. Once a data leak occurs, small and micro enterprises will face serious consequences such as huge fines, and reputational damage, and may even lead to corporate bankruptcy.

4.   Information Cocoon

Benefits of Personalized Recommendations Personalized recommendations are instrumental in helping decision-makers harness data analysis and engage with consumers in a customized manner. The primary goal of precision marketing is to increase customer loyalty, achieve steady growth in conversion rates, and secure competitive advantages in the marketing industry. Without a doubt, companies strive to understand their customers' needs and preferences, resulting in more effective marketing efforts for both customer retention and acquisition. Recommendation systems can accurately push relevant information based on user's interests and preferences, improving the

efficiency of information acquisition and helping users find what they need faster. For example, e-commerce platforms recommend products based on users' browsing and purchase history, and news platforms recommend content based on users' reading habits. Such systems can enhance user experience and save time and effort. Moreover, businesses and internet platforms are motivated to promote goods and advertisements that align with consumers' preexisting consumption patterns to increase traffic and profit. Over the long term, however, this strategy may exacerbate the information cocoon effect, despite offering short-term benefits [10].

Problems The deep analysis of user data and algorithmic recommendation processes are integral to the practice of big data precision marketing. The term "information cocoon" describes a situation where people are confined within a narrow circle of information due to algorithmic suggestions, often receiving largely homogeneous content. Algorithm suggestion methods create a comprehensive user profile by examining the individual's social connections, consumption patterns, and browsing history. Using this profile, tailored content is delivered to the user based on what is likely to interest them. However, algorithms often overly rely on past user behavior and underappreciate the importance of diverse information, resulting in users receiving more monotonous material [7]. Moreover, the information cocoon effect brings a series of issues. Firstly, long-term exposure to a single type of information leads to a narrowed perspective, and a lack of understanding of different viewpoints, and is detrimental to rational thinking and judgment. Secondly, the information cocoon exacerbates social differentiation. Due to the absence of shared topics and mutual understanding between different groups, it is easy to foster feelings of alienation and opposition, which is detrimental to social harmony and stability. Finally, the information cocoon provides fertile ground for information manipulation. Some platforms might use algorithm recommendation systems to selectively push information, influencing user cognition and even manipulating user behavior.

Suggestions To address the challenges posed by the information cocoon, platforms and enterprises should improve the algorithm recommendation system to avoid overly reinforcing users' existing preferences and instead encourage access to diverse information. Simultaneously, users themselves should enhance their ability to discern information, take the initiative to step out of their information cocoons, actively participate in public discussions, and jointly create a more open and inclusive cyberspace. Tene and Polonetsky emphasize the importance of "data minimization" and "user control" in the context of big data, advocating that users should have the ability to access, modify, and delete their data as part of the solution to maintain privacy and autonomy in the digital age [8].

5. Conclusion

This paper discusses the application of big data in precision marketing, highlighting both its benefits and potential drawbacks. The positive effect indicates that big data analytics enables companies to understand consumer behavior more effectively, leading to the development of highly targeted and personalized marketing strategies. The transition from traditional marketing to precision marketing is driven by the increasing availability of consumer data through the Internet and mobile device usage. Also, various studies are cited to support the fact that big data analysis allows for accurate market segmentation, identification of potential markets, and ultimately, increased marketing ROI. However, it should consider the challenges associated with big data in marketing, particularly concerning privacy protection and the emergence of "information cocoons". While technologies like data anonymization and encryption are presented as solutions to mitigate privacy risks, the results emphasize the need for transparency and user control over data usage. The "information cocoon" effect is discussed as a potential consequence of algorithmic recommendations, which can limit users' exposure to diverse viewpoints and potentially lead to social fragmentation. Therefore, the platforms and businesses should strive for algorithmic transparency and encourage users to seek diverse information to mitigate this issue.

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