

## Using big data for optimizing advertising campaigns in social networks

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### **Arjan Krasniqi**

Master of Science in Business Informatics

Institution: "Haxhi Zeka" University

Address: UÇK Street Peje 30000 Republic of Kosovo

E-mail: arjankrasniqi34@gmail.com

### **Berat Maksutaj**

Master of Science in Business Informatics

Institution: "Haxhi Zeka" University

Address: UÇK Street Peje 30000 Republic of Kosovo

E-mail: maksutajberat@gmail.com

### **Erbilin Januzaj**

Master of Science in Business Informatics

Institution: "Haxhi Zeka" University

Address: UÇK Street Peje 30000 Republic of Kosovo

E-mail: januzajerbin@gmail.com

### **ABSTRACT**

In the digital era, advertising on social networks has become a crucial element of marketing strategies. With the increasing number of users on platforms such as Facebook, Twitter, Instagram, and others, companies have unprecedented opportunities to target and engage consumers. This paper aims to examine the role and importance of Big Data usage in optimizing marketing campaigns on social networks. In an era where data is limitless, Big Data has become a valuable resource for businesses looking to understand consumer behavior and improve the efficiency of advertising campaigns. In this paper, we will shed light on the history and development of Big Data, including their volumes and sources. We will explore the potential of Big Data and categorize their sources to better understand how they can be leveraged for social media marketing. Furthermore, we will analyze the benefits and challenges of using Big Data in marketing. Additionally, we will examine cases where the use of Big Data has failed to optimize advertising campaigns on social networks and focus on the influence of Big Data in digital marketing, including personalization and sales promotion. We will also explore the technologies and methodologies used for making marketing decisions using Big Data. This study concludes that Big Data offers exceptional potential for innovation in the field of advertising on social networks, helping companies cope with rapid changes in consumer preferences and market dynamics. The results indicate that the strategic use of Big Data can lead to a deeper understanding of consumer behavior and offer a competitive advantage in a crowded and fast-paced market.

**Keywords:** Big Data, advertising optimization, social networks, digital marketing.

## **1 INTRODUCTION**

### **1.1 CONTEXT AND IMPORTANCE OF THE STUDY**

In the era of information, Big Data has become the cornerstone of digital transformation and has fundamentally changed how businesses reach and communicate with their consumers. With the ever-increasing volume of data flowing from interactions on social networks, businesses have extraordinary opportunities to optimize their advertising strategies to reach their audience most efficiently and effectively.

The importance of studying the use of Big Data in advertising campaigns lies in the ability to understand consumer behavior, improve audience targeting and message personalization, as well as predict and measure the performance of advertising campaigns. This means that businesses can make more informed decisions, reduce unnecessary costs, and increase ROI (return on investment).

This study aims to explore in-depth the role and impact of Big Data in the field of digital advertising, especially in the context of dynamic and ever-changing social networks. It will analyze how big data can be used to create campaigns that not only attract consumers' attention but also build a stronger connection between brands and their users.

Through this analysis, the paper will help uncover best practices, challenges, and opportunities presented by the use of Big Data in the social media advertising sector, offering a clear and detailed perspective on how Big Data can be leveraged to drive innovation and efficiency in digital marketing.

### **1.2 OBJECTIVES AND OBJECTIVES OF THE WORK**

This study aims to investigate and analyze the critical role that Big Data plays in optimizing advertising campaigns on social networks. The specific goals and objectives of this work are as follows:

#### **1.2.1 Main Objective**

To deeply understand how Big Data can be used to increase the efficiency and effectiveness of advertising campaigns on social networks.

#### **1.2.2 Specific Objectives**

##### **1. Analyze the History and Development of Big Data:**

- Conduct a literature review to understand the historical trajectory and evolution of Big Data as a vital source of information in digital marketing.

##### **2. Identify the Role of Big Data in Digital Marketing:**

- Study the impact of Big Data on understanding and modeling consumer behavior in the digital environment.

3. Evaluate the Use of Big Data in Social Networks:

- Analyze specific ways in which Big Data influences the creation and optimization of advertising campaigns on various social platforms.

4. Exploit the Five Vs of Big Data:

- Apply the concepts of Volume, Velocity, Variety, Veracity, and Value to illustrate how each contributes to the analysis and use of data for more effective advertising campaigns.

5. Explain the Advantages and Challenges:

- Determine the competitive advantages that the use of Big Data brings, as well as identify the challenges that companies face when integrating this data into their advertising strategies.

6. Define Methods and Technologies:

- Explore current technologies and methodologies used to process and analyze Big Data, to improve marketing decisions and personalize the consumer experience.

**1.2.3 Expected Outcome:**

- Provide a practical guide for marketers and business professionals on how to integrate Big Data into their advertising strategies to achieve higher customer engagement and greater ROI.

This study will contribute to existing literature by offering a detailed and updated perspective on the use of Big Data in the context of digital marketing, as well as proposing recommendations for best practices in the social media advertising industry.

## **2 LITERATURE REVIEW**

Big data is the term that describes a collection of data so large and complex that it cannot be processed with existing database management tools or traditional data processing applications. Procedures and processes for capturing, curating, storing, searching, sharing, transferring, analyzing and visualizing are different for big data [1].

Big data represents one of the most profound and widespread developments in the digital world. Examples of Big Data come from Internet of Things (IoT) devices, as well as smart cars, but also the use of social networks, industries, and so on. Data sources are numerous and constantly growing, and, therefore, what characterizes big data is not only the volume, but also the complexity caused by the heterogeneity of the information that can be obtained [2].

The term "big data" defines large sets of data that are characterized by a wide, complex, and heterogeneous structure, causing challenges in their storage, analysis and, visualization for further use in processes or to derive concrete results [3].

Big Data refers to the massive volume of structured and unstructured data (images, social media posts, videos, ...) that are distributed daily in businesses. To illustrate their scale, consider this: every day,

people search Google 8.5 billion times [4], send 500 million tweets [5], and watch up to 1 billion hours of YouTube videos [6].

Big data is a term that describes large volumes of hard-to-manage data—both structured and unstructured—flowing into businesses every day. But it's not just the type or amount of data that's important, it's what organizations do with the data that matters. Big data can be analyzed to draw insights that improve decisions and provide certainty to make strategic business moves [7].

It can be said that big data is another technological revolution after the development of the Internet, cloud computing, and the Internet of Things, which are attractive for social media marketing [8].

The term "Big data" is broad and includes large amounts of data, social media analytics, next-generation data management capabilities, real-time data, and much more. It also stands for advanced trends in technology that open doors to a new approach to understanding the latest trends and making intelligent decisions [9].

The term "Big Data" was coined to describe the rapid and massive growth of data, which reaches the size of zettabytes. This data can be processed through computers to discover patterns, trends, and connections, especially those related to human behavior and interactions [10].

## 2.1 HISTORY AND DEVELOPMENT OF BIG DATA

In 2003, humanity had created 5 exabytes ( $10^{18}$  bytes) of data. Today, a similar amount of information is produced in just two days. By 2012, the digital universe of data expanded to 2.72 zettabytes ( $10^{21}$  bytes). It is predicted that this amount of data will double every two years, reaching a total of about 8 zettabytes by 2015 [11]. According to IBM, every day we create 2.5 exabytes of data, and interestingly, 90% of this data was generated in the last two years [12]. A personal computer typically has a capacity of about 500 gigabytes ( $10^9$  bytes). It would take about 20 billion personal computers to store the current amount of data in the world. The process of deciphering the human genome, which once took about 10 years, can now be completed in less than a week.

Multimedia data continues to occupy a significant portion of Internet traffic, and this traffic is expected to increase by 70% by 2013. Google itself reports that it has more than one million servers in use around the world. There are approximately 6 billion mobile subscriptions globally, and 10 billion text messages are sent every day. By 2020, it is expected that 50 billion devices will be connected to the network and the Internet [13]. Introduction The Internet has experienced continuous growth and development, past and present, creating digital footprints that can be collected and processed to determine various individual schemas, useful for distinguishing the behaviors of different individuals and those of the group. This is indeed a time when a large amount of information has an extraordinary speed for distribution in networks: data equipped with these characteristics have been called "big data" [14].

History of Big Data Big data is taken to describe data that is so large, fast, or complex that it is difficult or impossible to process through traditional methods. The act of accessing and storing large amounts of information for analysis has been around for a long time. However, the concept of Big Data gained momentum in the early 2000s, when industry analyst Doug Laney summarized today's definition of Big Data as the three Vs we'll cover in the following chapters.

### 3 THEORY AND CONCEPTUAL BASES

#### 3.1 THE IMPORTANCE OF BIG DATA

Why is Big Data important? The importance of big data is not just about how much data you have. The value is in how you use it. By taking data from any source and analyzing it, you can find answers that:

1. Rationalize resource management,
2. Improve operational efficiency,
3. Optimize product development,
4. Increase opportunities for income and business growth,
5. Allow smart decisions to be made.

When you combine big data with high-performance analytics, you can perform business-related tasks such as:

- Determining the root causes of failures, problems, and defects in near-real time.
- Detection of anomalies faster and more accurately than the human eye.
- Improve patient outcomes by quickly converting medical image data into information.
- Recalculation of the entire risk portfolio in minutes.
- Improving the ability of deep learning models to accurately classify and react to changing variables.
- Detecting fraudulent behavior before it affects your organization [7].

#### 3.2 THE POTENTIAL OF BIG DATA

The McKinsey Global Institute has identified the potential of Big Data in five key areas [31]:

1. **Healthcare:** In this sector, Big Data can contribute to the advancement of clinical decision-making systems and provide personalized analyses for each patient based on their health profile. This leads to more personalized medicine, performance-based pricing of healthcare personnel, advanced analysis of disease patterns, and overall, improved public health.
2. **Public sector:** The use of Big Data can help create more transparency through linked data. This can be used to discover the needs of citizens, improve the performance of public services, provide

personalized actions for different services and products, help decision-making through automatic systems that reduce risks, and bring innovation to the creation of products and services.

3. **Retail:** Analyzing consumer behavior in stores can help optimize distribution and logistics and develop online marketplaces.
4. **Manufacturing:** Big data can impact improved demand forecasting, effective supply chain planning, supporting sales processes, and advancing manufacturing operations, including applications that are based on online research.
5. **Personal location data:** This data can be used to create more intelligent journeys, for advertising that targets consumers based on their geographic location, for more efficient responses to emergencies, for urban planning, and to develop models of business cloud.

Through these applications, big data can bring fundamental transformations and help develop new strategies in a wide range of sectors.

### 3.3 VOLUMES OF BIG DATA

The history of Big Data is taken to describe data that is so large, fast, or so complex that it is difficult or impossible to process through traditional methods. The act of accessing and storing large amounts of information for analysis has been around for a long time. But the concept of Big Data gained momentum in the early 2000s when industry analyst Doug Laney summarized today's definition of Big Data as the three Vs [7] :

Using the 3Vs model is a common way to describe the main characteristics of "big data". "Big data" refers to the large amount of information that is influenced by three main factors: High Volume, Velocity, and Variety [15]. These 3Vs can be further explained as follows:

**Volume** - refers to the tremendous amount of data, but also to the fact that more than 90% of the world's data has been created in recent years. Issues related to this feature concern the efficient acquisition, storage, and control of information of all kinds that, in contrast, must be organized, verified, and analyzed [16].

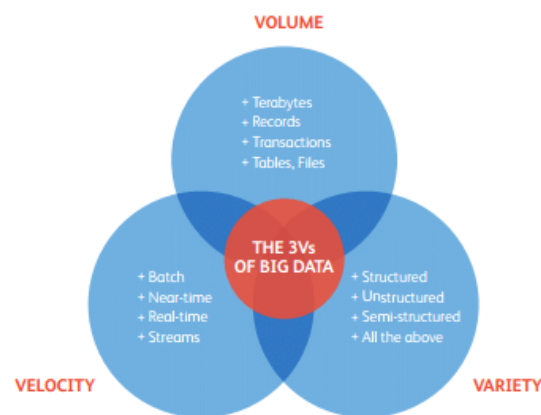
Organizations collect data from a variety of sources, including transactions, smart devices (IoT), industrial devices, video, images, audio, social media, and more. In the past, storing all this data would have been very expensive, but cheaper storage through data lakes, Hadoop, and the cloud has eased the burden [7]. Data is widely available, typically in quantities ranging from terabytes to petabytes [17].

**Velocity** - understood as the uninterrupted speed with which data is propagated in networks, and the speed required for real-time data analysis. This is a key feature of Big Data and marks a difference between them and a simple set of Big Data [16].

As Internet coverage increases, data flows into businesses at an unprecedented speed and must be handled promptly. RFID tags, sensors, and smart meters push the need to cope with these data flows in the short term (Sas, n.d.). Big data is characterized by real-time availability and a very fast growth rate [17].

**Variety** - Data comes in all kinds of formats - from structured, numeric data in traditional databases to unstructured text documents, email, video, audio, data stock market, and financial transactions. Big data collects and processes text, images, audio, and video. Furthermore, it overcomes data gaps by combining them through data fusion techniques [17].

Figure 1: The “3Vs” of Big Data



Source: (Kızıltan, 2018) [32].

SAS<sup>1</sup> considers two additional dimensions when it comes to big data:

**Variability** - In addition to increasing the speed and variety of data, data flows are unpredictable - they change often and change a lot. It's challenging, but businesses need to know when something is trending on social media, and how to manage daily, seasonal, and event-driven data loads.

**Veracity** - Veracity is related to the quality of the data. Because data comes from many different sources, it is difficult to connect, adapt, clean, and transform data across systems. Businesses need to connect and correlate multiple relationships, hierarchies, and data connections. Otherwise, their data can quickly get out of hand [7].

<sup>1</sup> SAS is an information technology company originating in the United States of America. SAS is an abbreviation that comes from "Statistical Analysis System", and the company specializes in developing and providing software products and services for data analysis, business intelligence, big data analysis (big data), and risk analysis, among others.

### 3.4 SOURCES OF BIG DATA

The volume of data today has significantly exceeded terabytes and petabytes. This large amount of information has made traditional methods of data storage and analysis inadequate, leaving these techniques behind in terms of efficient management of large amounts of information [18,19]. This data originates from various sources: sensors that capture information, posts, and comments on social networks, multimedia content, online transactions, and mobile network usage, just to name a few. Every mouse click, keyboard keystroke, or smartphone screen tap contributes to the collection of massive data - otherwise known as 'big data'. Therefore, in the digital world, consumers, service providers, and various organizations are producing and consuming large amounts of information [9].

Big Data sources can be broadly classified into three main categories:

1. **Data Streams:** This includes data activity that is generated or processed by devices such as computers and mobile phones, such as log files, data from sensors, location tracking systems, and data that is produced from processors, etc.
2. **Social Networks (Social Network):** This category contains information shared and used by people on different platforms, such as Google+, Facebook, YouTube, Twitter, LinkedIn, blogs, WhatsApp, Instagram, Pinterest, and others.
3. **Public Domains:** Includes data that is publicly available on the Internet, such as government portals, Wikipedia, World Bank, SEC/Edgar, Microsoft Azure Marketplace/DataMarket, etc.

Among these, social networks have become one of the main means of addiction and communication in the daily lives of people around the world. They produce a large amount of unclassified data that reflects the everyday emotions of users, which are authentic and produced in real-time. Data flowing from social networks is a natural resource and comes in various forms and types, but unlike any other source, it is constantly growing. This continuous growth makes data extraction, processing, and analysis challenging, as it is variable and unclassified. Furthermore, data that is not cleaned cannot be used effectively [9].

#### 3.4.1 Social Media as a Source of Big Data

Social media produces a significant amount of data, including likes, shares, comments, and more, which reflect consumer behavior and the effectiveness of marketing initiatives. However, the management of these Big Data presents challenges due to the size and rapid pace of their production, making it difficult to use traditional database management systems.

To cope with this data flow, advanced analysis is needed that is enabled by dedicated software and technologies such as Hadoop and NoSQL databases, which enable fast and efficient processing of large volumes of information [9]



### 3.5 CATEGORIZATION OF BIG DATA SOURCES

Big data originates from a wide range of sources and can typically be categorized into three types:

1. Structured;
2. Semi-structured and
3. Unstructured.

Structured data is organized into specific databases, making it easy to catalog and analyze. On the other hand, unstructured data is less organized and, as a result, more difficult to analyze. Meanwhile, semi-structured data does not fit completely within the boundaries of fixed fields but contains labels that help identify different segments of information [18, 12]

## 4 THE ROLE OF BIG DATA IN THE UNDERSTANDING OF CONSUMER BEHAVIOR AND THE OPTIMIZATION OF ADVERTISING CAMPAIGNS

### 4.1 THE BENEFITS OF BIG DATA IN MARKETING

The benefits of embracing Big Data in marketing are many, giving companies a competitive edge in the changing market landscape. Here are some key advantages:

1. **A single view of the customer:** Big data empowers marketers to consolidate customer data from disparate sources such as CRM and customer databases, logs of online interactions, data sets of their purchases, etc. This means you create a 360-degree overview of individual preferences [20], purchase history, and engagement patterns. And when you know the customer that well, you can tailor your marketing efforts to hit the right notes.
2. **Better Targeted Marketing:** Big data analysis helps organizations better understand consumer behaviors and preferences. By analyzing purchasing trends, reactions to previous marketing campaigns, and social media usage, companies can create personalized campaigns that better resonate with their audience. This means that marketing messages are more attractive and targeted to individuals who are more likely to respond, making marketing more efficient and costs lower.
3. **Identifying New Sales and Market Opportunities:** Using massive data analysis, companies can discover new opportunities in markets that may not be evident at a cursory glance. This may include discovering new consumer trends, developing new products, entering new geographic markets, or building new strategic partnerships. By being able to identify and exploit these opportunities, companies can expand their portfolio and grow efficiently.
4. **Development of new products:** Big data provides a wealth of information about the needs and pain points of customers, and helps in the development of innovative products and services that satisfy exactly the demands of the market [21].

The production, processing, and application of Big Data offer media marketing new opportunities, including precision marketing models and others. And in the future, it is necessary to build advanced and accurate social media marketing platforms with big data. So in the future, social media marketing in the context of Big Data should further develop the ability to collect and complete data, improve the applicability of data, and ensure the prerequisites of media marketing [8].

#### 4.2 BIG DATA CHALLENGES IN MARKETING

Although a considerable number of people consider massive data as an opportunity, both now and for the future, some others see it as a challenge due to the difficulties in managing it [3]. Using Big Data analytics to achieve marketing success also presents several challenges:

1. **Data integration:** Consolidating data from different sources into a consistent and usable format can be complex and time-consuming. Each data source resides in a different location and needs extensive cleaning before it can be used.
2. **Data governance:** Ensuring data security, privacy, and regulatory compliance is very important in the era of Big Data. However, this also places a heavy burden on marketing teams.
3. **Data quality and accuracy:** The reliability of the records depends heavily on the quality and accuracy of the data collected. Without testing the data pipelines that generate marketing messages, there is a risk of spending the marketing budget on insufficient communication strategies.
4. **Lack of qualified personnel:** Demand for data-savvy marketers often outstrips supply, making it difficult to find qualified personnel to handle big data. Alternatively, marketing teams rely on the IT or data department for their work. This often creates friction and delays in marketing activities.
5. **Real-time analysis and action:** Timely data analysis is important to take advantage of emerging opportunities, which requires strong capacities for real-time data collection and analysis [21].

#### 4.2.1 Migration from traditional data to Big Data:

When legacy analytics systems are replaced, organizations may face problems such as the inability to manage large volumes of data, insufficient support for the analytical models that are needed, slow data loading, as well as requirements for a state-of-the-art analytics platform that the IT department may not be able to complement.

When implementing big data analytics, some of the potential challenges include incompetent or irresponsible personnel, high costs, lack of ongoing support from the business, difficulties in designing and implementing analytical systems, and the lack of software - updated for databases [21].

Based on the survey conducted by the Intel IT Center for Big Data Analytics, the challenges facing Big Data management are numerous. They include the exponential growth of data volume, the need for appropriate data infrastructures, governance and regulatory policies affecting data management, their integration, the need to process data at high speed, managing the diversity of data, the implementation of various legislations related to data, as well as the challenge of their effective visualization.

In addition, the Intel IT Center identifies various barriers related to big data, including security concerns, high capital, and operational costs, network bottlenecks due to increased data traffic, shortage of data professionals specialized in data science, difficulties in managing data velocity, challenges in making copies of data, inefficiencies in data compression, high latency in networks and limited power of computer processors [22].

#### 4.3 CASES WHERE THE USE OF BIG DATA HAS FAILED TO OPTIMIZE SOCIAL MEDIA ADVERTISING CAMPAIGNS?

There are several cases where the use of Big Data has failed to optimize social media advertising campaigns. Some of these cases are:

1. **Lack of accurate data:** If the data used for the analysis of advertising campaigns is not accurate, then there may be a failure in the optimization of the campaigns.
2. **Lack of technical knowledge:** To use Big Data most effectively, employees must have technical knowledge and the ability to adapt to new technologies.
3. **Lack of proper strategy:** To use Big Data most effectively, it is necessary to have a clear and defined strategy for your campaign.
4. **Lack of reliable sources:** Another reason why Big Data can fail to optimize campaigns is the lack of reliable and valid sources.
5. **Lack of ability to adapt to changes:** To use Big Data most effectively, employees must have the ability to adapt to changes and adapt to new technologies.

#### 4.4 THE INFLUENCE OF BIG DATA ON DIGITAL MARKETING

With Big Data, businesses can get the information they need to understand their target audience, big data has become an indisputable part of any digital marketing strategy.

Big data can help organize data, market segmentation, and create customer personas based on characteristics such as behavior, purchasing patterns, hobbies, geographic location, etc. Also, they help improve the user experience.

As a result, they eliminate all doubts and are thus an effective marketing method.

Big Data helps digital marketing in the following ways:

1. Information on Customers
2. Data translation has become a critical component of implementing marketing strategies in today's digital age.
3. Big data helps extract real-time consumer insights. Therefore, marketers can understand the tastes and preferences of their target audience.

When businesses communicate with consumers through social media, they can understand what consumers expect from them. Therefore, you can structure your digital marketing campaign to stand out from your competitors.

##### 4.4.1 Personalization

In today's competitive business landscape, businesses cannot avoid personalization. Big data can help businesses personalize their digital marketing campaigns. With insights into consumer behaviors, businesses can understand tastes and preferences, so they can structure their digital marketing campaigns in a targeted and personalized way.

Digital marketing is all about delivering the right message at the right time. Targeted emails and ads can help personalize digital marketing campaigns.

With targeted emails, businesses can create a stronger connection with their customers. Email marketing can help marketers create more personalized and efficient campaigns by delivering the right message. business

Businesses can target these emails through browsing history, behaviors, purchase history, etc.

Big data can help businesses create more efficient targeted advertising. Marketers may use third-party sources to display advertisements to users. As a result, businesses can increase brand awareness, revenue, and brand loyalty.

#### 4.4.2 Boost Sales

With big data, businesses can predict the demand for a product or service. Information about user behavior can help businesses answer many types of questions, such as what types of products consumers buy, how often they buy or request a product or service, and what payment methods they prefer to use.

Not every visitor to your website will make a purchase. Therefore, if businesses have answers to these questions, they can create a seamless user experience and identify and target user pain points [23].

#### 4.5 COMPANIES THAT TRUST BIG DATA FOR THE OPTIMIZATION OF ADVERTISING CAMPAIGNS IN SOCIAL NETWORKS

The use of big data by companies to optimize advertising campaigns in social networks is a common and efficient strategy. Here are some examples of different companies using big data in this way:

- a. **Amazon:** Amazon uses big data to improve the customer experience in two main ways: with dynamic pricing and product recommendations. Their prices change up to 2.5 million times a day based on various patterns such as buying behavior, competitor prices, and whether the product is mainstream or not. This strategy contributes to 35% of Amazon's annual sales [24].
- b. **Netflix:** As the largest online platform for streaming movies and series, Netflix uses big data to create personalized experiences for its users. They collect data such as how long subscribers watch a program, whether they watch it continuously or not, and whether they pause and resume later. This data is used to create personalized accounts for each customer and to create original movies and series that respond to their preferences [24].
- c. **Apple:** Uses big data to learn how people use apps in real life and change future designs in line with customer preferences. Apple also uses big data to track the health and improve the lifestyle of its users [25].
- d. **Google:** Uses big data to understand what its users want based on various parameters such as search history, locations, trends, and many more. Google uses this data to optimize search results and provide more personalized experiences [25].
- e. **eBay:** eBay uses technologies such as Apache Spark, Storm, and Kafka to analyze and act on incoming data in real-time (streamed data). This allows the company's data analysts to search for information tags that are associated with the data (metadata) and make the data consumable for as many people as possible with the right level of security and permissions. [26].
- f. **Facebook:** uses big data to create short videos containing memories from users' old photos and uses image recognition technology to assess details in photos or videos [25].

#### 4.6 TECHNOLOGIES AND METHODOLOGIES FOR USING BIG SOCIAL DATA FOR MARKETING DECISIONS

In the intersection of Big Data and social media, we see the use of Big Data technologies by social networks in the design and development of their information technology infrastructure. The classical paradigms of programming and storage cannot be used to handle the large amount of data coming from social media and social networks.

For this reason, Google has defined and patented the **MapReduce** distributed programming model [27].

- **MapReduce** is based on three elements: the mapper function, the combiner function and, the reducer function. To finish efficiently, the input data is converted into key values, which are grouped and joined together based on their similarities. In the end, they reduce to a small set of output values [27]. The MapReduce paradigm can be implemented in several different programming languages, and Apache Hadoop [28] can be considered one of the most important projects in this field.
- **Hadoop** provides storage capabilities, such as the Hadoop Distributed File System (HDFS), which shares copies of data across many different computers and provides parallel processing capabilities, based on the MapReduce paradigm.
- **Apache Spark1** - To overcome some of Hadoop's shortcomings, one possible solution is to use the Apache Spark1 framework, especially when you are involved in iterative work.
- **Spark** is a framework for parallel computing and allows the use of data across multiple parallel operations. Compared to Hadoop, it offers many times faster performance for some specific applications, thus allowing efficient data processing [30]. However, Spark cannot be used as a standalone system but requires a distribution manager of its class and a third-party distributed storage system, such as HDFS. Distributed data can be easily handled by other systems such as MongoDB 2, HyperDex3, DocumentDB4, etc., which are document-based systems and store data in a similar way to the JSON format.
- **NoSQL** - Similarly, NoSQL databases, which use the key-value model to perform fast queries in a distributed environment, can be successfully used for managing social Big Data. In this context, graph-based databases, which are capable of describing social relationships between users, can play an important role. This category includes Neo4J, Virtuoso, Stardog, and others.
- **NoSQL** databases - NoSQL includes a wide range of different database technologies that have been developed to design modern applications. It describes a database called non-SQL or non-relational that provides a method to accumulate and retrieve data. They are used in real-time web applications and Big Data analytics.

It stores unstructured data provides faster performance, and offers flexibility when dealing with different types of data on a large scale. Examples included are MongoDB, Redis, and Cassandra [29].

If the extraction needs to take at least a few hours, then technologies like Hadoop, Spark, and NoSQL databases are certainly suitable for extracting useful information from big social data. But if you are working with data streams that are produced quickly, change quickly, and require real-time analysis, other technologies such as Apache Storm and Apache Samza may be more suitable.

- **Apache Storm** is a distributed real-time computing system that is very useful for the rapid analysis of large data streams. This system is based on a master-slave structure and includes a complex event processor and a distributed computing framework.
- **Apache Samza** is another framework that handles leak messages as they come in, one at a time. Streams are divided different chunks, which are a regular series of read-only messages.

However, the above technologies should be used together to combine automatic machine learning, natural language processing, network analysis, and statistics to extract interesting insights from big social data, known as social media analysis.

## 5 CONCLUSIONS AND RECOMMENDATIONS

This study has deeply explored the role and impact of Big Data in optimizing social media advertising campaigns. From our research, it is clear that Big Data offers tremendous opportunities for innovation in the field of digital marketing, allowing companies to adapt their advertising campaigns to the changing needs and preferences of consumers.

We have identified several key advantages of Big Data in marketing, including the creation of a comprehensive view of the customer, focused and personalized marketing, and the discovery of new market and sales opportunities. These advantages provide a solid foundation for companies to increase the efficiency and effectiveness of their advertising campaigns.

However, the study also pointed out the challenges associated with the use of Big Data, which include data integration, security and privacy, data quality and accuracy, and the need for qualified personnel. These challenges should be carefully considered by companies that intend to use Big Data in their marketing strategies.

In conclusion, Big Data has the potential to fundamentally change the way companies run and optimize social media advertising campaigns. Based on the findings of this study, we recommend that companies continue to invest in big data technologies and develop clear strategies to manage and use this data most effectively. To be competitive in a rapidly changing digital marketplace, marketplace, companies must adopt a data-driven approach and focus on building a culture that values data analysis and adapting to constant change.

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