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A Conceptual Framework using Big Data Analytics for EffectiveEmail Marketing

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Abstract

Email marketing is the practice of sending commercial emails to a targeted audience. Email marketing currently routinely produces a significant ROI (return on investment) in the marketing sector. However, a significant research question in email marketing is how to gather subscriber data and deliver emails just to interested customers.
Faced with the explosion in the volume of information, companies are becoming increasingly aware of the structural challenges of Big Data. Collecting and processing large amounts of heterogeneous data in real time is indeed invaluable. In the era of Big Data, the analysis and exploitation of data, by email marketing specialists, is now essential to remain competitive.
In this paper, we review the impact of Big Data on email marketing activities and we identify the techniques, frameworks and data types that were adopted. Therefore, our contribution to this work is the proposed conceptual framework for email marketing campaign practice based on big data analytics.

Keywords: Email Marketing; Big data analytics; Decision making; Predictive analytics

1. Introduction

In the last decade, the Internet has seen a 33% growth in the number of users worldwide. This has led to greater acceptance by consumers, either as a tool to facilitate the search for information or as a means to end the purchase of products and services. This technological environment has generated a significant change in consumer behavior, habits and trends, thus leading to an increase in e-commerce [2].

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There is now a vast amount of information thanks to the trend of digitization in many facets of life. A growing number of individuals are using the global Internet as a result of information technology advancements. Every day, terabytes of brand-new information, including in the field of economics, emerge. Data processing and analysis tools. are required in this situation. One of the information technology fields with the highest growth potential is big data. Statistics show that the overall amount of data doubles every 1.2 years [1].

Email marketing is an essential channel in marketing strategies not only as a tool to increase visibility and brand awareness but also as an excellent promotional and sales tool [15]. Even with the advent of social media and networking platforms, email marketing is still the most preferred channel to generate leads, inform and influence customers.

Big Data is seen as a technology to redefine business intelligence, a field that relies on data analysis for insight and better decision making. The concept of Big Data is not specific to commerce or marketing, but the development of e-commerce and digital marketing has played an important role in bringing the issue of Big Data to the fore. These are indeed sectors that by nature generate huge volumes of data to process. In 2013, a player like Critéo, a specialist in retargeting on the Internet, analyzed 230 terabytes of data daily and generated more than a billion advertising impressions per day.

This paper is organized as follows: Sections I and II, we introduce a brief review of big data and its role in the email marketing area to make efficient decisions. In section III, we explain the role of big data analytics Frameworks. In Section IV, we present a conceptual framework to integrate big data analytics in email marketing campaigns. Finally, section V concludes the work and highlights the future directions of research.

2. Background

2.1. Big Data: Definition and features

The term Big Data was used for the first time in 2000 during an econometrics conference and then used in companies following a report by MC Kinsey in 2011 [5]. The huge datasets are primarily referred to as "big data" in light of the exponential growth in global data. Big data often contain vast amounts of unstructured data that require greater real-time analysis as compared to standard datasets. Big data also creates new obstacles, such as how to efficiently organize and handle large information, as well as the new potential for uncovering new values. It also enables us to better grasp the hidden values [4].

Apache Hadoop described big data as datasets which could not be gathered, handled, and processed by normal computers within an acceptable scope. In other words, this term is used to capture, store, manage, analyze and process a huge amount of data that traditional database management systems, such as relational database systems (SGBDR) cannot manage

Big Data represents large amounts of data, but the notion of volume is not the only one to consider [6]. The characteristics of Big Data have been identified in 3Vs, volume, variety and velocity.

- Volume is the main attribute of big data and corresponds to the size of the data from TB to YB.
- Velocity refers to the speed of data arrival and the speed of data modification. High velocity data requires distributed processing techniques with both real-time and non-real-time capabilities.
- Variety indicates that the data is not of the same type. With the evolution of technology, big data comes from many different sources with different types of data: structured, semi-structured and unstructured.

As data usage dimensions were scaled, more and more significant features were eventually included such as value, veracity, and validity

2.2. Big Data Analytics

With the evolution of technology and the increase in the multitudes of data that flow in and out of organizations every day, the specialists not only want to collect the data, they also want to understand the meaning and importance

of that data and use it to help them make decisions. So, it has become necessary to find faster and more efficient ways to analyze that data. As a result, this requires new tools and methods specialized in big data analysis, the necessary architectural frameworks are needed to store and manage this data. Thus, the rise of big data affects everything from the data itself and its collection through its processing to the final derived decisions.

Data analytics is known as applying algorithms to analyze data sets to extract valuable and undiscovered patterns, correlations, and information [7]. Data analytics are also used to identify significant links between the variables included in huge data sets and to extract previously undetected, valid, valuable, and hidden patterns and information from such data sets. Due to decision makers' increasing interest in learning from historical data to achieve competitive advantage, analytics have a substantial influence on research and technology [8].

In order to incorporate big data analytics tools and processes into the decision-making process, the authors [9] suggested the Big Data, Analytics, and Decisions framework. The framework associates the various big data management, analysis, and processing tools, as well as visualization and assessment tools, with the various stages of the decision-making process. Big data storage and architecture, data and analytics processing, and lastly big data analyses that may be used for knowledge discovery and well-informed decision making are the three primary areas where big data analytics have changed.

2.3. Big Data: Predictive Analytics

Predictive analysis is the analysis of the historical and present data that is already accessible to predict future behaviors, preferences, and demands.

It seeks to foresee trends, especially in the marketing industry. In order to create automated systems, effective marketing campaigns customer profiles and target specific markets. Marketers can use predictive analysis to collect information from data that users leave when they interact online and use it to forecast purchase patterns and user behavior models [12].

There are three types of predictive models' marketers should know about:

- Classification algorithms
- Clustering algorithms (segments)
- Regression algorithms
- Propensity models

2.4. Decision Making

From a decision-maker's point of view, the importance of big data lies in its ability to provide valuable information and knowledge on which to build decisions.

Managerial decision making has been an important and extensive research topic over the years.

Big Data is becoming an increasingly important asset for decision makers. Large volumes of highly detailed data from various sources such as marketing campaigns, CRM and social media platforms, offer the possibility to provide significant benefits to organizations. This is only possible if the data is properly analyzed to reveal valuable insights, allowing decision makers to capitalize on the opportunities resulting from the wealth of historical and real-time data generated by e.g. customer behavior.

2.5. Big Data Driven Approach

Data-driven marketing is the process by which marketers use Big data to create and implement actionable strategies across marketing to better understand the customer, meet their needs, and maximize return on investment (ROI) for an organization. There are gaps in the peer-reviewed literature linking data-driven marketing strategies with organizational change, change management, and value or economic gains. While there is emerging research on the evolution of marketing as well as business model innovations, there is still much to be studied from the

perspective of marketing, strategic use of BD, and financial outcomes. However, there are a few studies in the literature containing research surrounding better decision making and big data driven marketing strategies [11].

The process of setting up an email marketing campaign is an example in this area. The collection of massive real data which contains historical data of customer actions such as opening an email or clicking on an email and based on this data, it is possible to study the profiles of future recipients.

The following trends are some of the major ones in big data driven marketing [12]:

- Predictive Marketing
- marketing of visualization
- personalized marketing

3. Big Data and Email Marketing

Email marketing is a marketing channel that allows companies to communicate with their customers, prospects and subscribers via email marketing campaigns.

As mentioned in the previous section in the field of email marketing, marketers use models based on the massive data collected to optimize the performance of their marketing campaigns and improve the customer experience either through personalization, churn prediction or prediction of marketing campaign performance metrics such as open rate, click through rate or conversion rate. The diagram in figure 1 illustrates this:

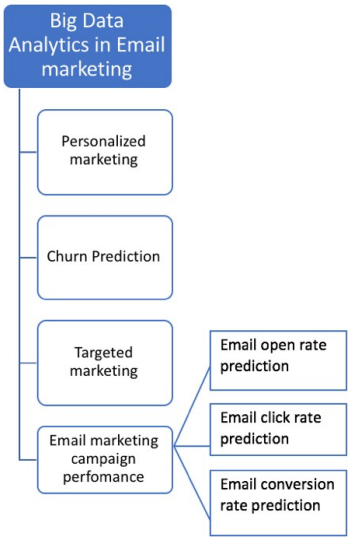

Fig. 1. Application of Big data analytics in Email marketing

3.1. Big Data major data source

- Location data: location data and customized messages for a specific audience frequently go hand in hand. Advertisers may give what a client wants to see when they want it based on what street they reside on by utilizing unique location data.

- Historical data: historical data examines data that was gathered in the past. Then, predictive models may use this data to find patterns and build mathematical models that represent trends. Additionally, they may generate prediction ratings for everything the data applies to, including clients and other subjects. In addition, it has both structure and spontaneity

- Real-time data: we base a lot of our decisions on current information. This data collection may contain location, forecasted information, and ad context. Real-time data may be a key factor in figuring out how to reach the appropriate audience at the right moment.

4. Role of Big Data Analytics Frameworks

Different types of knowledge are used while thinking about big data. Different sorts of frameworks are required to undertake various types of research. various workloads in the area of big data processing. We also observe a combination of these scattered workloads to serve a corporate objective:

• For instance, batch-oriented processing is used in Map Reduce-dependent frameworks like Hadoop for repeating activities like large-scale data mining or aggregation.
• Online transaction processing (OLTP) using Apache HBase is used for user-facing e-commerce transactions.
• Interactive ad-hoc query using Apache Drill, with Storm serving as a model system for handling stream sources such as social network feeds or sensor data [3].

5. A conceptual framework for using big data in email marketing

The three types of email marketing concerns include monitoring, administration, and forecasting. We created a conceptual framework for efficient email marketing utilizing Big Data analytics, as shown in Figure 2. The subsequent sections go into data gathering, data analysis, and problem-solving techniques.

• Data Collection

The first and most important phase in Big Data applications is data collection, which tries to gather both structured and unstructured data from a range of sources, including Geolocation data, click, open, convert, purchase, unsubscribe, opening hours, and other information sources. Filtering, harmonizing, and eliminating extraneous data are some of the fundamental modules that are implemented at this step. In order to describe how the data is displayed and evaluated, metadata is also created for each dataset.

• Data Analysis

It was necessary to arrange the gathered data by removing the essential details for additional analysis. In this step, data is cleaned, interpreted, integrated, mined, analyzed, and warehoused in order to retrieve the important information. To enhance data understanding, a variety of analysis techniques may be used, including predictive analysis, data visualization and machine learning.

In general, data visualization analysis can be used to learn more about the links that have been found in large datasets and to provide researchers with more intuitive visual cognition and effective decision-making support. Additionally, visualization is mostly achieved using Email marketing software connected to Big Data, while processing and analysis appear to be primarily accomplished through distributed system architecture like Hadoop and batch processing technologies like MapReduce. Decision-makers employed those tools.

• Problem Solving

Finally, actionable perceptions are created from the acquired data. Here, the data gathered from various sources is used to enhance email marketing activity monitoring, administration, and forecasting. Big Data is being used to enhance real-time prediction insights for future campaign outcomes.

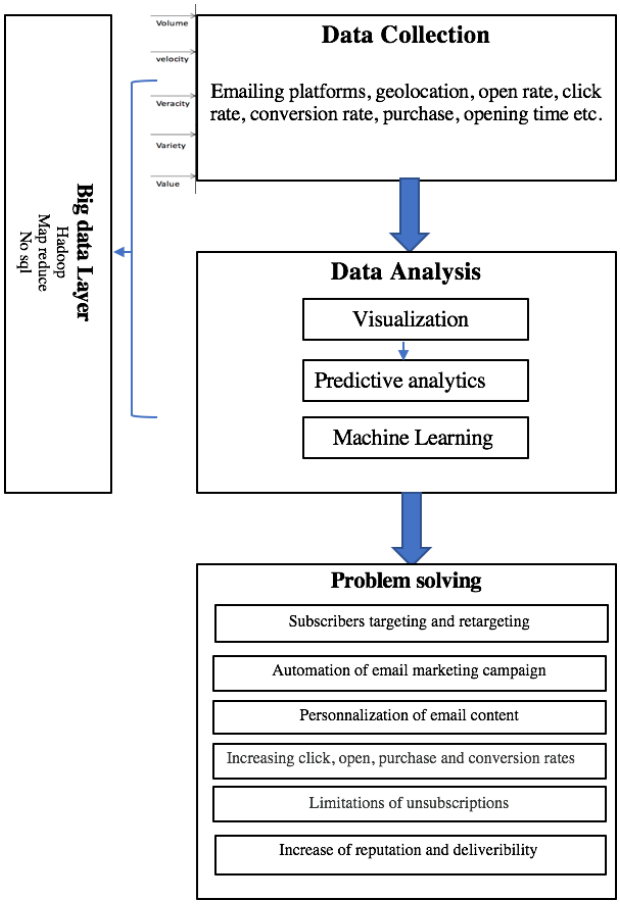

Fig. 2. A conceptual Framework for effective email marketing

6. Conclusion and future Scope

In In this study, we looked at the subject of big data, which was thought to bring prospects and advantages. In the information age that we are presently experiencing, huge volumes of high-speed data are created every day. These data include hidden patterns and fundamental features that should be uncovered and used. Consequently, big data analytics may be used to improve decision-making, specifically in the area of email marketing campaigns

We undertake a literature study in order to examine the most recent cutting-edge research by Big Data in the area of email marketing.

In order to answer our research question of ‘’How to integrate big data analytics into the email marketing process? ’we developed a conceptual framework which guide research in data management and allow them to use big data analytics and the different big data tools to improve the effectiveness of email marketing campaign. We identify actions to be taken, methods, techniques, and applications related to the different perspectives of email marketing. In the future works, we intend to test our proposed framework on reel data.

References

[1] IBM Watson Advertising,‘’How to use predictive analytics in advertising’’(online)
https://www.ibm.com/watson-advertising/thought-leadership/how-to-use-predictive-analytics-in-advertising

[2] J.K. Gerrikagoitia,I.Castander,F.Rebón,A.Alzua-Sorzabal,Newtrends of Intelligent E-Marketing based on Web Mining for e-shops, Procedia - Social and Behavioral Sciences 175 (2015) 75 – 83

[3] Farhad Khoshbakhta, Atena Shiranzaeib, S. M. K. QuadricRole of the Big Data Analytic framework in Business Intelligence and its Impact: Need and Benefits

[4] M. Chen, S. Mao, and Y. Liu, Big data: A survey, I Mob. Networks Appl., vol. 19, no. 2, pp. 171-209, 2014.

[5] “Big Data et Data marketing: opportunités et limites’’ https://creg.ac-versailles.fr/IMG/pdf/big-data-et-data-marketing.pdf

[6] Zikopoulos, P., & Eaton, C. ‘’Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data’’. New York: McGraw-Hill Osborne Media.2011

[7] Adams, M.N.: Perspectives on Data Mining. International Journal of Market Research 52(1), 11–19 (2010)

[8] Song, Z., Kusiak, A.: Optimizing Product Configurations with a Data Mining Approach. International Journal of Production Research 47(7), 1733–1751 (2009)

[9] Elgendy, N.: Big Data Analytics in Support of the Decision-Making Process. MSc Thesis, German University in Cairo, p. 164 (2013) Procedia Computer Science 100 (2016) 1071 – 1084

[10] Economist Intelligence Unit: ‘’The Deciding Factor: Big Data & Decision Making’’. In: Capgemini Reports, pp. 1–24.,2012

[11] Serda Kasaci Yildirim., ‘’big data analysis in digital marketing’’, 2020.”

[12] P. Chintagunta, D. M. Hanssens, J. R. Hauser, Marketing Science and Big Data, MARKETING SCIENCE Vol. 35, No. 3, (May–June 2016), pp. 1– 2 ISSN 0732-2399 (print) I ISSN 1526-548X (online)

[13] Kenza Bayoude, Youssef Ouassit, Soufiane Ardchir and Mohammed Azouazi. “How machine learning potentials are transforming the practice of digital marketing: State of the art”, Periodicals of Engineering and Natural Sciences. Vol.6, No.2, December 2018, pp.373-379 ISSN 2303-4521

[14] M. Dodergny, M. Lasfargues , Livre blanc ,La délivrabilité des campagnes d’e-mail marketing, Experian Marketing Services, (2012)