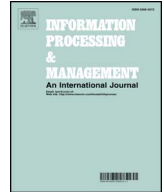




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A survey towards an integration of big data analytics to big insights for value-creation

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ABSTRACT

Big Data Analytics (BDA) is increasingly becoming a trending practice that generates an enormous amount of data and provides a new opportunity that is helpful in relevant decision-making. The developments in Big Data Analytics provide a new paradigm and solutions for big data sources, storage, and advanced analytics. The BDA provide a nuanced view of big data development, and insights on how it can truly create value for firm and customer. This article presents a comprehensive, well-informed examination, and realistic analysis of deploying big data analytics successfully in companies. It provides an overview of the architecture of BDA including six components, namely: (i) data generation, (ii) data acquisition, (iii) data storage, (iv) advanced data analytics, (v) data visualization, and (vi) decision-making for value-creation. In this paper, seven V's characteristics of BDA namely Volume, Velocity, Variety, Valence, Veracity, Variability, and Value are explored. The various big data analytics tools, techniques and technologies have been described. Furthermore, it presents a methodical analysis for the usage of Big Data Analytics in various applications such as agriculture, healthcare, cyber security, and smart city. This paper also highlights the previous research, challenges, current status, and future directions of big data analytics for various application platforms. This overview highlights three issues, namely (i) concepts, characteristics and processing paradigms of Big Data Analytics; (ii) the state-of-the-art framework for decision-making in BDA for companies to insight value-creation; and (iii) the current challenges of Big Data Analytics as well as possible future directions.

1. Introduction and motivation

The notion of Big Data Analytics (BDA) is driven by underpinning new waves of innovation, analytic services with intelligence and stirring advances in technology over the last few decades. The emergence applications of BDA have prompted the attention of many academic researchers, industry practitioners, and government organizations. It is a technology-driven ecosystem, where better decision-making will help many organizations to extract knowledge from data in an interpretable and appropriate form.

Strawn (2012), described Big Data as “fourth paradigm of science”, whereas (Hagstrom, 2012) defined it as “new paradigm of knowledge assets”, or “the next frontier for innovation, competition, and productivity” (Manyika et al., 2011). Gantz and Reinsel, (2011) defined Big Data as “a new generation of technologies and architectures, designed to economically extract value from very large volumes of a wide variety of data, by enabling the high-velocity capture, discovery, and analysis”. It was described an integrated approach to organize, process, analyze the six characteristics (namely volume, variety, velocity, veracity, valence, and value). BDA is used to generate action for delivering the insights, value, measuring performance, and establishing competitive advantages (Wamba,

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Akter, Edwards, Chopin, & Gnanzou, 2015). The paper by (De Mauro, Greco, & Grimaldi, 2016) defined that “Big Data is the information asset characterized by such a high volume, velocity, and variety to require specific technology and analytical methods for its transformation into value” .

The BDA, as a scientific topic of investigation, provides some significant and insightful readings that are discovered by various researchers. However, it is still needed to carryout the systematic review of innovative analytical methods, techniques, and tools for making insightful decisions in various domains. Indeed, it became a key component of decision-making processes in business (Hagel, 2015).

The big data and advanced data analytics techniques can be used for the development of analytical and computational models (Iqbal, Doctor, More, Mahmud, & Yousuf, 2017). There are still several research interest how to develop the infrastructure, apply various data mining and machine learning algorithms in different domains. The BDA is concerned with modern statistical and machine learning techniques to analyze huge amount of data (Suthaharan, 2014). The researchers suggested that Big Data Analytics and deep learning have the potential to provide new generation applications based on modeling and simulation (Chen & Lin, 2014; Tolk, 2015).

The traditional tools are not able to address the issues of scalability, adaptability, and usability, whereas such issues are critical to its success as they influence how big data is developed, managed and analyzed. The BDA is categorized by the requirement of advanced data acquisition, data storage, data management, data analysis, and visualization. To turn BDA into big insights for value-creation, there are great challenges in terms of data, process, analytical modeling and management for different applications. It should not be considered as synonymous with data collected through the internet as data can be originated from sources such as commercial transactions taking place in supermarkets, bank etc. Big Data can also be originated from sensors (satellite and GPS tracking data from mobile phones) and administrative data (education records, medical records, and tax records) (Eagle, Pentland, & Lazer, 2009).

The BDA helps in acquiring a deep understanding and useful insights of various sectors such as: agriculture, healthcare, cyber-physical system, smart cities and social media analytics etc. The enormous amount of information is needed to analyze it in an iterative way and time sensitive manner (Jukic, Sharma, Nestorov, & Jukic, 2015). By the use of advanced BDA tools such as NoSQL, BigQuery, Map Reduce, Hadoop, Flume, Mahout, Spark, WibiData, and Skytree, it provided an insight in desirable form to enhance the ability and decision-making process in various sectors such as business intelligence analytics (Chen, Chiang, & Storey, 2012), healthcare analytics (Archenaa & Anita, 2015), smart agriculture or farming analytics (Majumdar, Naraseyappa, & Ankalaki, 2017; Wolfert, Ge, Verdouw, & Bogaardt, 2017), social media analytics (Vatrapu, Mukkamala, Hussain, & Flesch, 2016), smart cities (Khan, Anjum, Soomro, & Tahir, 2015), intelligent transport management (Fiosina, Fiosins, & Müller, 2013), financial and accounting (Sledgianowski, Gomaa, & Tan, 2017), financial risk management (Cerchiello & Giudici, 2016), energy management (Tu, He, Shuai, & Jiang, 2017), and future predictions (Waller & Fawcett, 2013).

The BDA is data-driven decision framework. This article is directed to comprehensively study the BDA to solve the challenges, gain insight, and to make informed decisions by using various data analytics approaches. This paper summarizes an extensive and systematic methodological review on various tools and technologies of BDA and also reports the research gaps for further investigation. In more detail, our review article addressed following research questions:

- RQ1: What are the most important seven characteristics of Big Data Analytics?
- RQ2: How to design BDA-DM framework?
- RQ3: What are the main tools, techniques, and technologies of Big Data Analytics?
- RQ4: What are the main application areas of Big Data Analytics?
- RQ5: What is the relation between value-creation and Big Data Analytics?
- RQ6: Which are the specific aspects of the data management, data transformation and utilization drive value for companies?
- RQ7: Can the value of data be monetized, tracked and considered for financial accounting?
- RQ8: What are the different challenges of each component of the BDA framework?

This article attempts to answer the above research questions (RQs). RQs will guide, centre our research work and clearly focus on specific topics to indicate our distinctive perception. However, this work leads to a new advancement for the conceptual framework of BDA.

The contributions of this research article are as follows:

- Categorize the current approaches and general requirements for various components of BDA architecture by demonstrating the open state-of-the-art frameworks and challenges.
- Summarize various existing tools, methods, and technologies in advanced BDA.
- Provide the summary of the key technology for value-creation applications, financial companies of BDA.
- Present the, future research directions relating BDA in new emerging technologies.

This paper is structured into eight sections. The [Section 2](#) describes the relevant research methodology and summarizes the review studies. The [Section 3](#) presents an ecosystem of Big Data Analytics and Decision-Making Framework (BDA-DMF). The [Section 4](#) presents a big data management phase of the framework. The [Section 5](#) presents Big Data Analytics techniques, technologies, tools, and its applications phase. In this section, we present a concise statement of different steps of data analytics framework. A brief review of different areas of application such as Agriculture, Healthcare, Cyber security and Smart City is also presented. The [Section 6](#)

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