



# WEB APPLICATION FOR READING ENCOURAGEMENT THROUGH GAMIFICATION

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## Abstract:

The aim of this paper is to present the basic characteristics of the big data concept, as well as its importance in the field of business analytics. The increase in data volume has led to a situation in which traditional systems for data collection, storage, processing, and visualization are no longer able to keep up with the amount of data, its variety, and velocity. This rapid data generation has resulted in new methodologies and techniques for storage of data, retrieval, management, and processing, which are collectively recognized as a scientific discipline known as big data. Its application is widespread, ranging from marketing and sales to medicine and transportation. The paper examines the main components of the systems that employ big data, including technologies like Apache Spark and Hadoop. Special attention is given to the application of machine learning methods and data analysis to support better business decision-making. It is concluded that the use of such technologies provides organizations with a competitive advantage through a better understanding of data and more efficient decision-making.

## Keywords:

Big data, Business Analytics, Machine Learning, Apache Spark, Apache Hadoop.

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## INTRODUCTION

The true value of analytics lies in the fact that, without it, data remains merely a large collection of information without clear meaning or purpose. Data has become the most valuable resource today, as it enables organizations to predict trends, understand user behaviour, and reduce risk [1], [2]. Instead of guessing, decisions are based on accurate measurements, which directly increases efficiency and profit. Big Data generally refers to datasets that are overly large in volume and that contain data complex in ways that traditional data processing software is unable to keep up.



In the past, companies operated in an environment where data was scarce, slow to collect, and expensive to store [3]. The drawback of relying solely on experience is that intuition is not always reliable, as it is based on subjective judgment and past situations that may not be applicable in every context. Therefore, it is necessary to support decision-making with concrete data and evidence. Decisions were made based on past data (e.g., a sales report from three months ago), rather than on what is happening now [4]. The drawback of a reactive approach lies in relying on outdated data and reports that do not reflect the current state of the market. Such information can lead to inadequate decision-making, as it is not aligned with present conditions and ongoing changes. Analyses were conducted on small samples, which often led to incorrect conclusions about the entire market. The drawback of a limited sample lies in the fact that the analysis is based on a small amount of data that does not represent the entire market. This can result in an incomplete or inaccurate picture of the actual situation and lead to incorrect conclusions.

These problems have largely been overcome with the introduction of big data. Making decisions is no longer based solely on intuition, but on data that provides reliable and concrete insights. The availability of real-time data helps organizations respond promptly to changes and make informed decisions in line with current market conditions. Additionally, analyses are no longer based on limited samples but on complete datasets, resulting in a more accurate and realistic view of the business environment.

The type of data that is used, along with the required tools, makes the main difference between big data and traditional analytics. Traditional approaches store data in well-organized systems that make it easy to read that data, which are usually relational databases. Traditional statistical methods are applied like structured query language (SQL).

On the other hand, unstructured data along semi-structured and even fully structured data are present in big data. Hence, the complexity of data processing and analysis is increased, calling for more advanced methods. Big data analytics uses techniques like machine learning and data mining to pull useful information from large and complex datasets. The management of such formats is usually performed with a system like Hadoop [5]. The four main aspects of data analysis are provided in further text. The first is represented by the descriptive analytics, which focus on summarizing the past data, as well as describing its basic attributes.

The second aspect is described by the diagnostics, which identify root patterns and trends. The third one is used for predictive analytics, applying historical data, machine learning models, and trend forecasting. Lastly, going beyond predictions, prescriptive analytics are applied for optimization of future actions. In addition, advanced analytical tools and machine learning methods help uncover hidden patterns and predict future trends, which improves the quality of decisions and reduces the chance of mistakes.

## 2. BIG DATA ANALYTICS

It is first necessary to define the difference between data and information. One perspective argues that data are structured facts in a form suitable for processing by humans and computers, but without inherent meaning. For example, the data “50” by itself has no specific meaning, but if it represents the total number of students enrolled in a master’s program at a particular faculty, then this data becomes information.

Another, more widespread perspective suggests that data becomes information only at the moment when it is relevant to us. For instance, the statement “The expected temperature in Belgrade on July 23 is 35°C” becomes information only when it is of importance to us, for example, if we are planning a trip to Belgrade on that date or if we are conducting a study comparing temperatures in that city over a certain period.

The term itself has been around since the early 1990s. The concept of big data appeared due to the fast growth of information technologies and the digitalization of modern society. The spread of the internet, social networks, and mobile devices led to a rapid elevation in data generated.

Internet of Things (IoT) technologies development has also added to the growing volume and variety of data. Traditional data management systems could not handle such large and complex datasets efficiently, which led to the development of new technologies known as big data. In a narrower sense, big data denotes the size of the sample. In a broader sense, it includes both the size of the sample and its dimensionality.

The big data analytics can be grouped into five V’s: volume - storage of large volumes of data is complicated, as well as its processing, analysis, and other operations, variety - data originating from different sources can be structured, unstructured, quasi-structured, and semi-structured, velocity - the speed required to carry out these activities and the time needed to obtain final



results, veracity - general accuracy of the data and its reliability, and value - big data analytics aims to extract actionable insights that offer tangible value.

This involves turning vast data sets into meaningful information that can inform strategic decisions, uncover new opportunities, and drive innovation. Advanced analytics, machine learning, and AI are key to unlocking the value contained within big data, transforming raw data into strategic assets. Data often comes from various, numerous, and unstructured sources. Some of these sources include: internal sources, social networks, web data, commercial or transactional data, sensor data, and data from tracking devices: global positioning system (GPS).

### 3. BUSINESS IMPLICATIONS OF BIG DATA

The term analytics refers to a classical cognitive process that begins with data collection and analysis in order to determine facts, includes discovering patterns (relationships) that exist among variables represented by the data, and ends with the formation of a theory.

Finding rules and models that are: valid and applicable to new data coming from the same source, useful and easy to implement in solving problems, unexpected and not obvious to systems, and understandable so that people can understand the rules and how the models function. What represents the true value of data collected by organizations is the resulting analytics. Without them, it would merely be a large collection of data with limited use for business.

The growth of the big data concept created a need for new technologies that could store, process, and analyse large amounts of data efficiently. Traditional database systems were not able to keep up with modern data, which comes in large volumes, is generated quickly, and exists in many different formats. In response to these challenges, a new set of tools and technologies known as big data technologies was developed [6].

Big data technologies include tools and platforms that allow data to be processed across multiple systems, scaled up as needed, and used with different types of data. They cover solutions for storing, processing, and analysing large and varied datasets that traditional databases cannot manage. Key technologies include Apache Hadoop for distributed storage (HDFS), Apache Spark [7] for fast real-time data processing, and NoSQL databases.

Analytics, a distributed file system, and data storage are offered by the Java-based Hadoop framework. It is an open source platform allowing for parallel computation and administration. Large datasets can be processed and distributed over clusters. One of the platform's advantages is that it can support a range from a single server to thousands of servers. The framework uses Hadoop Distributed File System (HDFS) by employing a mechanism of node replication over other nodes of clusters, which allows for high resiliency and reliability. Big data and analytics jobs are spread by Hadoop over nodes in a cluster. Such a system supports both structured and unstructured data.

On the other hand, another open-source platform for large data processing, engineering, and machine learning is Apache Spark. This framework offers real-time analytics and processing of workloads. Native support is provided for languages R, Java, Python, and Scala. It was created in 2009 as a research project of the University of California, Berkeley. The goal of the project was to increase the speed of Hadoop job processing.

NoSQL databases are databases that do not rely on structured tables for storing data. Since they are non-relational, minimal prior planning is only required, resulting in fast setup. Such examples of databases include MongoDB, SimpleDB, DynamoDB, CouchDB, OrientDB, Couchbase, InfiniteGraph, FlockDB, Neo4j, Cassandra, and HBase. Cloud computing technologies further contribute to the development of big data systems by enabling flexible use of resources and scalability according to organizational needs [8].

Big data use allows organizations to process large amounts of data and carry out complex analyses, which improves business analytics and supports decisions based on real data. In the modern business environment, decisions are no longer made based on intuition but rather on data. By using the right algorithms and models, it is possible to predict trends, spot growth opportunities, and identify potential risks before they become a problem. Business analytics focuses on investigating the actual performance of businesses. It employs various methods such as statistical analyses, descriptive models, and predictive models. The tools and techniques of business analytics have found applications in numerous areas to improve customer relationship management, enhance financial and marketing activities, manage human resources, and more. Various use cases and problems can apply big data analytics:



1. **Customer Analytics:** User experience can be enhanced, conversion rates improved, and retention increased through analysis of customer data.
2. **Operational Analytics:** Operational performance improvements and better corporate resource utilization through big data.
3. **Fraud Prevention:** Suspicious activities can be more easily detected as patterns emerge as more data is collected.
4. **Price Optimization:** Price optimization should increase revenue.

The integration of big data powered analytics into business operations not only enhances efficiency but also fosters innovation by revealing insights that were previously hidden. Big data technologies provide significant benefits in the areas described in the following text.

Research practices are revolutionized by big data in healthcare, as clearer insight can be provided into disease prevention, treatment, and diagnosis. Health trends can be identified by health organization, possibly predicting outbreaks, and treatment plan development that will improve overall population health.

Personalized learning experiences, data-driven teaching methods, and adaptive learning platforms are a part of the revolution by big data in education. Student progress is tracked, which can identify gaps in knowledge. This results in tailored instructions for each student, which increases engagement and academic success.

#### 4. THE FUTURE STATE OF BUSINESS ANALYTICS

Big data technologies are widely recognized as a key factor in modern business and the development of information systems. The rapid growth in the volume of daily data generation has led to the need for better tools and methods for collecting data, processing, and analysis. Numerous studies indicate that the application of these technologies enables organizations to improve the accuracy and speed of data-driven decision-making, thereby contributing to the achievement of a competitive advantage [9].

Big data technologies play an increasingly important role in transforming the educational landscape by allowing the collection, processing, and analysis of vast amounts of data regarding learning patterns, student behaviour, and academic outcomes. The proliferation of digital learning platforms and the integration of information systems in education have led to the generation of massive datasets that can be leveraged to enhance educational quality [10].

A primary driver for implementing big data in education is the ability to optimize the instructional process and tailor education to meet individual student needs. Traditional educational systems often suffer from the one-size-fits-all approach, remaining rigid and failing to adapt to the diverse learning styles, paces, and interests of modern students. By analysing student data, institutions can move away from outdated, standardized templates and develop personalized learning models. This individualized approach fosters a deeper understanding of the curriculum and leads to superior academic achievements and higher student success rates [11].

Furthermore, the application of big data facilitates the early detection of learning difficulties. By analysing historical data, it is possible to identify patterns that signal a risk of academic failure—such as declining activity on learning platforms, poor test scores, or irregular attendance. This proactive approach allows educators to intervene in a timely manner and provide necessary support to at-risk students [12]. Beyond individual student support, big data serves as a powerful tool for strategic decision-making. It provides insights into the optimal allocation of resources, the modernization of curricula, and the improvement of overall teaching quality.

The benefits of big data in education are also reflected in the capacity for continuous progress monitoring, enhanced teacher-student communication, and the introduction of innovative pedagogical methods. These include adaptive learning systems and intelligent tutoring systems, which dynamically adjust content based on the real-time performance and specific requirements of the user [13].

This paper proposes a model that combines big data technologies and machine learning (ML) to improve existing educational systems. The model allows for continuous tracking and analysis of student behaviour and performance in real time. Learning management systems (LMS), online platforms, student databases, and digital learning tools are used as various sources for collecting data. The system records information such as student activity, time spent on specific lessons, test scores, and interactions between students and teachers. This data is stored in one central location and processed using powerful big data tools.

Using the collected data, the system applies ML algorithms to recognize patterns in student behaviour. For example, if a student becomes less engaged, misses deadlines, or starts performing worse academically, the system recognizes this as a potential problem and automatically sends an alert.



An important part of this model is the use of adaptive learning systems. These systems automatically adjust learning materials and teaching methods to better fit each student's needs. As a result, the content is changed based on the student's skill level, learning speed, and engagement, which helps make the learning process more effective.

In addition, real-time data analysis allows teachers and schools to react quickly. Instead of waiting for end-of-semester results, teachers can use visual dashboards to identify students who need help right away. This allows for fast support and adjustments to teaching methods, while school administrators can use this information to improve curricula and how the school is organized.

The model also suggests using big data to recognize each student's strengths and interests early on. By looking at how students perform in different subjects and how much time they spend on certain tasks, ML algorithms can detect whether a student leans toward areas such as STEM, social sciences, or the arts. Pointing students toward programs that match their natural abilities reduces frustration, builds confidence, and helps them make better career choices. However, it is important that these systems stay flexible, making sure they do not limit students to one path, but instead allow their interests to change and grow over time.

Finally, for this model to work well, it is important to focus on data privacy and security [14], as well as to help teachers develop their digital skills. In conclusion, the proposed model has strong potential to improve the quality of education through a personalized, efficient, and data-driven approach to learning.

## 5. CONCLUSION

Big data technologies represent one of the key factors of modern business and the development of information systems. The enormous amount of data generated on a daily basis requires advanced tools and methods for collection, processing, and analysis. By leveraging these technologies, organizations can make faster and more accurate data-driven decisions, gaining a significant competitive advantage. Within business analytics, big data enables a deeper understanding of customer behaviour, optimization of business processes, and prediction of future trends. Tools for processing large datasets and machine learning methods further enhance the ability to analyse and interpret data, improving overall efficiency and performance.

As technology continues to evolve, the ability to analyse and interpret vast datasets will become increasingly crucial for organizations seeking a competitive advantage. Embracing big data analytics not only empowers companies to navigate market complexities but also positions them to innovate and thrive in a constantly changing environment. Therefore, the application of big data technologies will play an increasingly important role in improving business decision-making and achieving competitive advantage.

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