



Artificial Intelligence for Big Data Analytics: A Review of Trends and Challenges

Vidya Devi Oad^{1*}

¹Indiana Wesleyan University

¹vidyaoad9@gmail.com



Corresponding Author

Vidya Devi Oad

vidyaoad9@gmail.com

Article History:

Submitted: 11-02-2026

Accepted: 15-03-2026

Published: 20-03-2026

Keywords

Artificial Intelligence, Big Data Analytics, Data Processing, Predictive Analytics, Real-Time Analytics, Cloud Computing.

Global Trends in Science and Technology is licensed under a Creative Commons Attribution-Noncommercial 4.0 International (CC BY-NC 4.0).

ABSTRACT

Artificial Intelligence (AI) has played a major role in transforming the field of Big Data analytics because it allows processing and interpretation of large and complex datasets efficiently. This review examines the basics of Big Data, concepts of AI, and how they could be combined to improve the decision-making process based on the data. It identifies automated machine learning, real-time analytics, edge computing, and generative AI as important trends as well as healthcare, finance, smart cities, e-commerce, and cybersecurity. Other significant issues that are addressed in the study are data quality, scalability, privacy, and ethical concerns. Moreover, it examines key tools and technologies and establishes the way of future research. By and large, intelligent decision-making using AI-based Big Data analytics have the potential to provide potent solutions.

INTRODUCTION

The digital technologies have rapidly developed and increased the amount, nature, and the speed of the data produced worldly in an unprecedented manner. Big Data as it is usually described, is a by-product of various types of sources, including social media sites, sensors, mobile devices, business transactions and scientific research [1]. The conventional data processing methods do not always suffice to work with such huge and multifaceted data, so more sophisticated and smarter methods of data analysis are required. Here, Artificial Intelligence (AI) has become a game changer, which can be used to derive meaningful insights out of Big Data in an efficient manner [2].

Artificial Intelligence is a broader term to include the collection of computational processes enabling machines to mimic the intelligence of humans, in terms of learning, reasoning, and decision-making





processes. To a great extent, machine learning, deep learning, and natural language processing subfields have contributed to the increased efficiency of analyzing large-scale data sets [3]. With AI in combination with the Big Data analytics, organizations can achieve a higher level of analytics, beyond the descriptive analysis, to predictive and prescriptive analytics. Systems with this type of integration are able to discover latent patterns, flag anomalies, predict future trends, and help make decisions that are based on data [4].

The relevance of AI to Big Data analytics is seen in many areas. In the sphere of healthcare, AI-based analytics may help predict a disease and implement a personal treatment course. It finds application in finance, in detection of fraud and risk evaluation. In the same fashion, retail, transportation, and cybersecurity industries also use AI to streamline their operations, enhance customer experiences, and security. The combination of AI and Big Data does not only make this more efficient but also creates new opportunities in innovations and competition [5]. Although it has potential, there are also a number of challenges with the integration of AI and Big Data. Challenges associated with data quality, scalability, privacy and ethical concerns are to be handled seriously to achieve maximum benefits of these technologies. Moreover, the AI models may be too complex and require substantial computational power, which may become an obstacle to its widespread use, especially in settings with limited resources [6].

The main goal of this review paper is to explain the role of Artificial Intelligence in Big Data analytics in general, along with the latest developments and related issues. It is meant to explore the latest trends, outline the practical use, and establish some of the main concerns that should be considered by researchers and practitioners. This review will contribute to the existing body of knowledge by aiming to provide useful information regarding the potential of AI to be utilized efficiently to exploit the potential of Big Data in addition to presenting the future of research in this clearly developing area.

ESSENTIALS OF BIG DATA ANALYTICS

The concept of Big Data analytics can be defined as the ability to analyze voluminous, multifaceted, and heterogeneous data to reveal concealed patterns, correlations, trends, and valuable insights, which can be used in the decision-making process. As the volume of data produced by digital activities is increasing exponentially, the conventional methods of data processing have become inadequate and new methods of data processing, known as advanced analytics, have emerged specifically to process Big Data. The basis of the Big Data analytics is important to its successful exploitation in a number of areas [7].



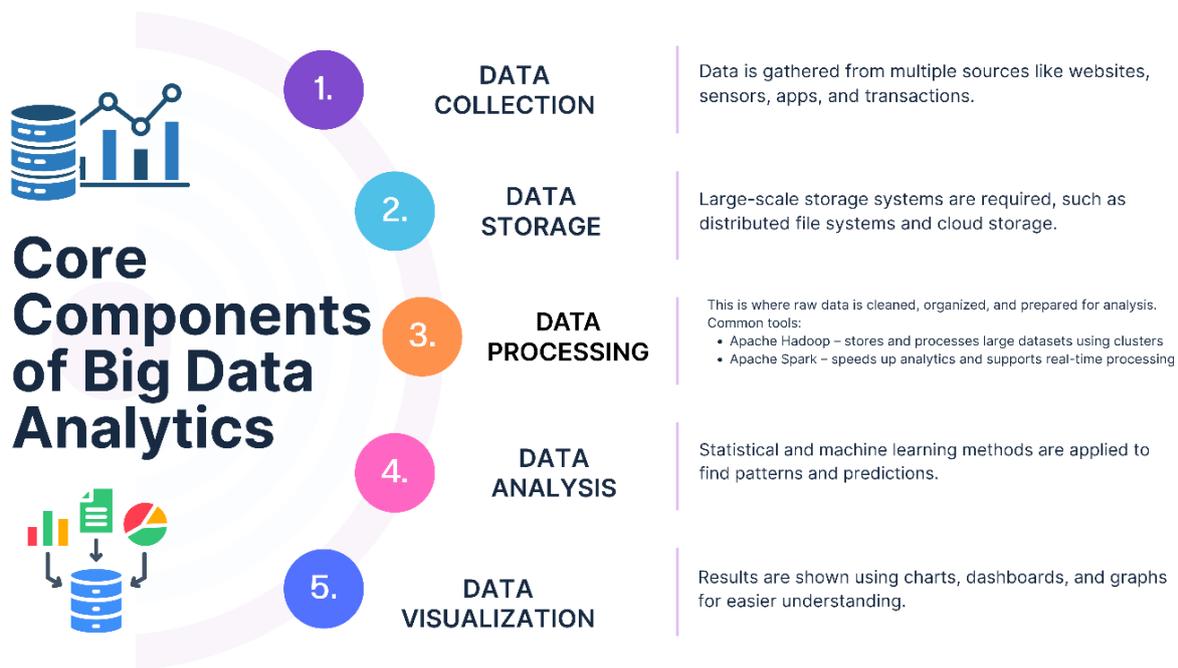


Figure 1. Core components of big data analytics

The defining features of Big Data are one of its most important dimensions which are frequently referred to by the so-called 5 Vs where volume, velocity, variety, veracity, and value are used as a reference. Volume is the huge volume of data that is being produced on a secondly basis through various sources. Velocity refers to the rate at which information is generated and processed, this can be in real time [8]. The variety shows the various kinds of data, such as structured data (databases), semi-structured data (XML files or JSON files), and unstructured data (images, videos, and text). Veracity deals with the quality and reliability of the data, and the quality and reliability of the information is crucial [9]. Lastly, Value (symbolizes the valuable insights that can be made based on the analysis of the data and which eventually result in the business and organizational gains).

The origins of the Big Data are very numerous. These are social media networks where users create enormous contents daily; Internet of Things (IoT) systems, which constantly gather sensor information; enterprise applications like customer relationship management (CRM) and enterprise resource planning (ERP); and online exchanges on e-commerce websites. Also, the scientific research, healthcare systems, and government operations are considered to be the sources of the growth of Big Data. These sources are also very diverse, and this adds even more complexity to the task of data management and analysis [10].

The other essential basic is the difference between traditional and modern data analytics. The traditional analytics are usually based on structured data, which is kept in the relational databases, and the analysis is performed with the help of the statistical tools. Although they work well on smaller



data sets, the techniques are not very scalable to the scale and complexity of the Big Data. Conversely, contemporary Big Data analytics makes use of distributed computing systems, including Hadoop and Spark that allow processing large data volumes on several computers at once [11]. Such technologies enable processing of data faster and more effectively dealing with different types of data.

In addition, Big Data analytics involves various forms of analytical methods, such as descriptive, diagnostic, predictive and prescriptive analytics. Descriptive analytics is dedicated to summing up historical data, whereas diagnostic analytics tries to comprehend why some things have happened. Predictive analytics involves the application of statistical models and machine learning methods to predict future trends, whereas prescriptive analytics is a set of recommendations on the best decisions to make [12]. The basics of the Big Data analytics are based on the concepts of the main features of the data analytics, its source, and methods of analysis. These principles form the basis of the modernization of the technology like Artificial Intelligence and, eventually, allow more sophisticated and intelligent data analysis [13].

AI TECHNIQUES FOR INTELLIGENT DATA PROCESSING

Artificial Intelligence (AI) can be defined as the simulation of human intelligence in machines that have been coded to think, to learn and to make decisions. It is a general branch of computer science that tries to come up with systems that can successfully execute the tasks that might need human intelligence skills to be executed, including problem-solving, experience-based learning, reasoning, and understanding of natural language [14]. In the last ten years, AI has developed at a significant pace becoming one of the most critical technologies that have facilitated innovation in many sectors, especially within the data-driven technologies [15].

AI TECHNIQUES IN DATA PROCESSING

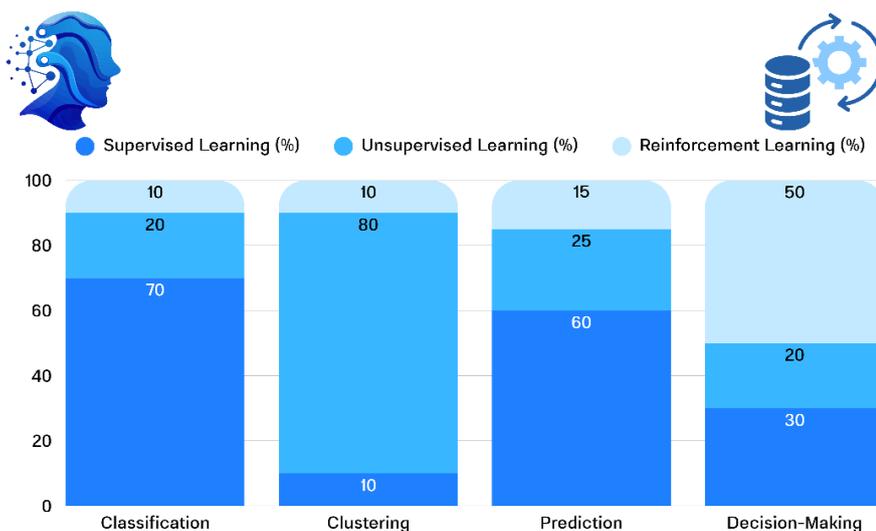


Figure 2. AI techniques in data processing





In its most basic form, AI will receive large volumes of data, find patterns, and make decisions or predictions regarding those data. The modern AI systems are able to learn and become better with time unlike the traditional systems of rule that had to be programmed to handle all possible situations. This flexibility is one of the reasons why AI is especially useful in complex and uncertain scenarios like those of Big Data analytics [16]. There are a number of significant subfields of AI, which bring about the general possibilities of AI. Machine Learning (ML) is one of the most noticeable ones and is concerned with creating algorithms that enable computers to learn based on the data and refine their performance with time passing. There are three broad classifications of ML techniques, including unsupervised learning, supervised learning and reinforcement learning [17]. Such methods allow systems to execute activities like classification, clustering and prediction.

Deep Learning is another important sub field which is a branch of machine learning based on the human brain architecture as an Artificial neural network. Deep learning models have been specifically effective on large and complicated data, so they are greatly applicable in image recognition, speech processing, and natural language understanding [18]. They can automatically retrieve features of raw data, which makes them highly important in eliminating the manual preprocessing of data. The other critical part of AI is Natural Language Processing (NLP) which is concerned with the interface between computers and human language. NLP allows human language to be read, comprehended and created meaningfully by a machine. This can be applied in areas like chatbots, sentiment analysis and automatic translation systems [19].

As far as data processing is concerned, AI is a disruptive concept because it makes data analysis more efficient and more accurate. It is able to automate routine processes, identify deviations and concealed insights which would otherwise be lost in conventional analysis means. There is also the possibility of unstructured data, in the form of text, images, and videos, that can be processed by AI-driven systems and is an important part of Big Data [20]. The Artificial Intelligence is a potent instrument that supplements and improves the Big Data analytics. It has a way of learning through data, adapting to new data, and bending the program to do intricate tasks and, thus, should be considered an essential part of contemporary data-driven systems [21].

AI DRIVEN APPROACHES IN BIG DATA SYSTEMS

The convergence of Artificial Intelligence (AI) and Big Data analytics is one of the major advances in the field of processing, analyzing, and getting valuable insights out of massive and complicated datasets. And, as Big Data presents the raw material in the form of large amounts of structured and unstructured data, AI presents the intelligence needed to make sense of that data in the most efficient way [22]. When united, they constitute a great force that improves the decision-making, automation,





and predictive capabilities in different spheres.

AI complements the Big Data analytics as it allows the systems to move beyond the conventional statistical analysis and pursue more dynamic and innovative methods. The ability of AI to automatically learn through pattern of data and can be improved with time is one of its most important assets. The algorithms provided in machine learning, in particular, are capable of processing a large amount of data to pinpoint trends and correlations and to detect anomalies that would be hard or impossible to notice through traditional methods. This is enabled to create greater insights and make better predictions which can in turn enhance the efficiency of the operations and strategic planning of the organizations [23].

Big Data analytics rely on a number of AI methods. The classification, clustering and regression analysis are tasks commonly done using machine learning algorithms. Multi-layered neural network based deep learning models are especially useful in analyzing unstructured data e.g. images, videos and text. Textual information in the form of social media, customer reviews, and documents is analyzed using methods of natural language processing, which makes it possible to perform sentiment analysis and topic modeling [24]. Also, reinforcement learning can be used in the dynamic environments where systems are taught to act best out of trial and error.

The architecture of AI-driven Big Data systems has many layers, which collaborate to process and analyze data. On the lower level, the data is gathered through the sensors, databases, and online sources. This information is subsequently stored in distributed storage systems such as lakes of data or cloud-based systems. Frameworks like Hadoop or Spark are used in the processing layer to process large-scale data processing operations [25]. Over this, the AI models are used to process the data and provide insights. Lastly, the findings are displayed on the visualization tools and dashboards in a format that can be understood by decision-makers [26].

Automation is another significant attribute of integration. AI helps to automate the preprocessing of data, extracting features, and choosing the model and minimize human intervention. This not only accelerates the process of analysis, but reduces the chances of human error as well. Additionally, AI systems can be constantly updated on new information, which means that they can adapt to new circumstances and enhance their operations as time progresses [27]. The use of AI in analytics of Big Data processes converts raw information to useful intelligence. This synthesis of sophisticated computational methods and scalable data processing systems contributes to the efficiency, accuracy, and overall value of the systems of data analytics, making it a pillar of the modern technological innovation [28].





ADVANCEMENTS IN AI FOR BIG DATA ANALYTICS

The Artificial Intelligence (AI) branch of Big Data analytics is one of the most rapidly developing today due to the impact of the technological breakthrough and the growing need of data-driven solutions that are smart. Various emerging trends are influencing the use of AI in relation to the Big Data to increase its capabilities and increase its use in industries. Such trends do not only enhance efficiency but also allow making decisions more sophisticated and real-time. Among the most prominent ones is the emergence of Automated Machine Learning (AutoML) [29]. AutoML makes the construction and deployment of machine learning models easier automatically performing data preprocessing, feature selection, model selection as well as hyperparameter tuning. This minimizes the heavy technical skills required and enables organizations to exploit AI at easy [30]. Consequently, it has been possible to build precise predictive models more quickly and at reduced cost, which has made AI-based analytics more affordable.

GLOBAL AI IN BIG DATA ANALYTICS MARKET GROWTH (2020–2030)

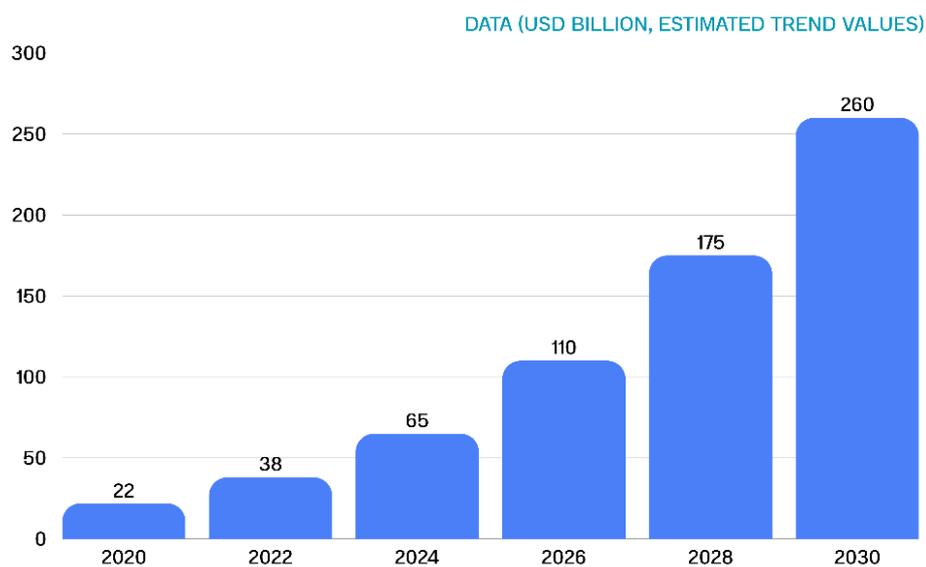


Figure 3. Global AI in Big Data Analytics Market Growth (2020–2030)

The other trend is real-time analytics. As the rate of data generation continues to accelerate, there is an increased requirement to process and analyze data as it is generated. AI-based real-time analytics systems have the ability to track streams of data and deliver real-time insights. This is especially useful in fraud detection, financial trading and industry monitoring applications, where the decisions made must be timely [31]. This trend is assisted with the help of technologies, such as stream processing and in-memory computing that help to process the data quickly. AI along with edge computing also takes shape. Rather than having centralized cloud systems, edge computing processes





data at the end point where the data originated, e.g. IoT devices or local servers [32]. At the edge, the integration of AI makes it possible to analyze the data faster, minimize the latency, and enhance the privacy. This is of particular use in such applications as autonomous vehicles, smart cities, and healthcare monitoring systems, in which fast reactions are essential.

Another important trend is the implementation of AI platforms on clouds. Cloud computing offers scalable storage and impressive tools that can be used to implement the Big Data analytics and AI models. Services provided by large technology vendors allow companies to hold large volumes of information, train complicated models, and implement AI applications without having to allocate significant resources on-premise. This is because cloud-based AI solutions are flexible and scalable which is very appealing to any business regardless of its size [33].

Besides, Generative AI is becoming a disruptive trend in Big Data analytics. Generative models have the ability to produce new content text, images, or synthetic data using previous datasets. Within the framework of Big Data, it is possible to apply simulative AI to generate situations, complement datasets, and optimize data-driven insights [34]. This comes in handy especially in cases where there is limited or sensitive real data. The latest tendencies in AI used in the Big Data analytics revolve around automation, speed, scalability, and innovation. The recent advances are rendering AI more reachable and effective, which helps organizations to utilize the potential of Big Data in full and keep up with the increasing complexity of the contemporary data landscape [35].

REAL WORLD APPLICATIONS OF AI ANALYTICS

Big Data analytics with Artificial Intelligence (AI) has resulted in radical modifications in a variety of industries by facilitating intelligent decision-making processes, robotization, and predictive findings. Combinations of these technologies enable organizations to efficiently process massive data and derive useful information that will improve performance, minimize costs, and improve user experience. The uses of AI in Big Data analytics are diverse and are still increasing due to the advancement in technology [36].

Healthcare is one of the most important fields of application. Big Data analytics based on AI is applied in this area to enhance patient care, disease diagnosis and treatment planning. Through machine learning using giant volumes of electronic health care data, medical images, and wearables, AI can be used to detect diseases like cancer, diabetes, and heart-related conditions at their early stages [37]. Predictive analytics are also useful in the prediction of disease outbreaks and personalized treatment plans, resulting in more precise and timely medical care interventions.

AI is important in the finance sector to detect frauds, manage risks, and algorithmic trade. Financial institutions process vast amounts of transactional information on a real time basis to identify





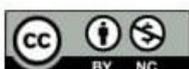
suspicious behaviour that could be fraudulent. Credit risk is also evaluated with the help of machine learning models, which can also assess loan applications better [38]. Also, AI-based investment systems can compute fast trading ventures, relying on market and historical data to enhance profitability and minimize human error. Another significant field of usage is the idea of smart cities. Urban infrastructure, traffic management, energy consumption, and public safety are developed with the help of AI and Big Data. As an example, sensor and camera traffic data can be analyzed to optimize traffic flow and ensure a lower amount of congestion. AI is applied to smart energy grids to manage the demand and supply of electricity. Predictive analytics is also used in public safety systems to detect the possible security threat and better respond in case of emergence [39].

AI-based Big Data analytics in e-commerce and marketing sector assists the business to know how the customers behave and what they like. It is based on browsing history, purchase patterns, and social media activity that companies can make personal recommendations as well as targeted advertisements. This enhances customer satisfaction and boosts the sales conversion rates. The AI-based chatbots also improve the customer service as they respond to queries instantly [40].

Another important field of AI and Big Data analytics application is cybersecurity. The artificial intelligence (AI) systems keep track of the network traffic and user activities to identify anomalies and possible cyber threats. Machine learning systems have the capability to detect malware, phishing campaigns, and unauthorized access better than a traditional security system [41]. This assists organizations in the enhancement of their defense systems and prompt response towards security incidents. AI in Big Data analytics has a wide range of applications that are effective. In healthcare and finance, e-commerce, and cybersecurity, AI is used to turn raw data into actionable information and is helping organizations increase efficiency, innovativeness, and decision-making in all industries [42].

DIFFICULTIES IN AI IN TERMS OF BIG DATA ANALYTICS

Although Artificial Intelligence (AI) provides numerous benefits in the big data analytics, the technology also has a number of challenges that restrict its potentials and its common utilization. The difficulties are due to the complexity, scale, and sensitivity of the information, technical and ethical problems related to AI systems. These challenges must be understood to come up with more effective, safe, and dependable AI-based analytics solutions [43]. Data quality and preprocessing have been found to be one of the key challenges. Big Data is frequently multi-sourced, comprising of social media, sensors and transactional systems leading to incomplete, inconsistent, noisy or unstructured data. The quality of data is extremely important because poor quality can considerably minimize the precision of AI models and provide unreliable results [44]. Hence, analysis would be time consuming





and resource consuming since it needs a lot of data cleaning, transformation and preprocessing prior to analysis.

Scalability and computational complexity is another problem of concern. Deep learning algorithms and other artificial intelligence models need a lot of computational power and high processing ability to process extensive datasets. With the growing volume of data that is rapidly increasing exponentially, the conventional computing systems are finding it difficult to cope up. Despite the fact that distributed computing systems and cloud computing platforms can be used to resolve this problem, it is still challenging to manage and optimize large-scale AI systems [45]. Another significant barrier to the AI-based big data analytics is privacy and security issues. Because Big Data may include sensitive personal and financial or organizational data, chances of data leaks and unauthorized access are high. It is a challenging task to achieve privacy of data and also be able to perform meaningful analysis. Encryption, anonymization and federated learning are developed techniques, although the issue of privacy protection is a persistent one, particularly with stringent regulatory demands [46].

Another significant problem is the ethical concerns and bias in artificial intelligence models. The learning process of AI systems is based on the past data, which can be biased based on gender, race, location, or socioeconomic status. Unless managed, such biases may result in a discriminatory or unjust decision-making processes. To establish trust and prevent disastrous outcomes, AI models require confidentiality, responsibility, and transparency [47]. Skilled workers in the sphere of AI and Big Data analytics are not available. The design, implementation, and support of high-level AI systems demand a skill in the field of data science, machine learning, coding, and knowledge expertise.

But the number of people seeking such experts is so high that the supply is insufficient to meet it, which leads to talent shortage slowing down the adoption and innovation processes [48]. Although AI can dramatically improve the quality of analytics of Big Data, it is prone to diverse challenges pertaining to the quality of data, its scalability, privacy, ethics, and the skills of the workforce. These issues can be highly relevant in ensuring that AI-powered Big Data systems are efficient, reliable, and responsible to work in the field [50].

TOOLS AND TECHNOLOGIES

Successful adoption of Artificial Intelligence (AI) to the field of Big Data analytics is dependent on a vast amount of tools and technologies that are intended to gather, store, process, and analyze big volumes of data. These tools are the foundation of the contemporary data-driven systems and allow organizations to convert raw information into valuable insights in a cost-effective way. In the course





of the years, developments concerning both the framework of Big Data and the platforms of AI have allowed to process an even more sophisticated analytical task faster and more precisely. Apache Hadoop is one of the most popular platforms of Big Data [51].

Hadoop is an open source platform which enables the storage of huge data as well as processing of this data in clusters of computers over a network. It is based on the Hadoop Distributed File System (HDFS) to store data and Map Reduce programming model to process data concurrently [52]. Hadoop is very scalable and fault-tolerant and it is applicable in handling large datasets in different industries. Nonetheless, since it is a batch processing method, it can be accompanied by more contemporary real-time analytics tools.

Apache Spark is another valuable structure that has become popular because of its ability to process data as fast as possible and in memory. Compared to Hadoop Map Reduce, Spark works with data much faster because it stores intermediate data in memory instead of in disk. Spark is also compatible with many workloads such as batch processing, streaming data, machine learning and graph processing [53]. Its MLlib library also offers machine learning algorithms, hence it is an effective tool to use in AI-based analytics of big data. Was created by Google and it offers a versatile platform to deploy AI models on various platforms, such as mobile and cloud software. Made by Meta, PyTorch is famous due to its dynamic computation graph and simplicity, which makes it popular with the researcher and developer community to run the experiment quickly [54].

Alongside them, data storage and management tools (e.g., NoSQL databases, e.g., MongoDB, Cassandra) are important in working with unstructured and semi-structured data. These databases can be configured to act out horizontally and offer high-availability and thus best suited to Big Data applications where the traditional relational databases might not be adequate. The cloud computing systems like Amazon Web Services (AWS), Microsoft Azure, and Google Cloud Platform (GCP) are also central in AI and integration of Big Data [55]. These environments offer services of scalable infrastructure, data storage services, and AI services that enable companies to create and implement analytics systems without spending a lot of resources on purchasing hardware. They also provide data visualization tools, real-time analytics tools, and machine learning model deployment tools [56].

The instruments and technologies of the AI-based Big Data analytics are varied and constantly changing. The use of frameworks such as Hadoop and Spark and AI libraries, including TensorFlow and PyTorch, and cloud computing platforms all make it possible to perform data processing and intelligent analysis. Modern analytics systems are based on these technologies and cannot be complete without unlocking the potential of Big Data [57].





FUTURE PROJECTIONS AND AREAS OF RESEARCH

The sphere of Artificial Intelligence (AI) within the Big Data analytics is changing steadily, and the research efforts are currently aimed at covering the existing setbacks and exploring the opportunities of more efficient, intelligent, and ethical systems based on data. Due to the ever-growing rate of data generation, the future trends will focus on automation, transparency, scalability, and responsible AI practices [58]. There are a number of promising avenues of research that are influencing the future of this field.

Among the most significant directions of the future, there exists Explainable Artificial Intelligence (XAI). The black boxes of AI models and, in particular, the deep learning system, seem to become more complex as the models grow. Such lack of transparency is problematic in such serious areas as healthcare, finance, and law enforcement, where it is important to know how such decisions are reached. XAI is working on models and techniques that can make AI decisions less ambiguous and human intelligible [59]. This will enhance trust, responsibility, and increased applications of AI systems to sensitive applications.

Federated Learning is another major field of study that can solve privacy issues in Big Data analytics. Rather than storing the data in one place, federated learning provides the possibility to train the AI models on multiple decentralized devices or servers but retains the data locally. The model updates are shared as opposed to the raw data. The privacy and security are improved and yet, machine learning on a large scale are allowed. It is mostly applicable in the medical sector, mobile apps and financial systems where the sensitivity of data is very high [60].

Another research direction is the case of AI governance and ethical frameworks. Due to the growing role of AI systems in making decisions, it is essential to have certain fairness, transparency, and accountability. Future studies revolve around the creation of policies, standards, and technical solutions that minimize bias and discourage discrimination and responsible use of AI. This involves coming up with algorithms that are unbiased and audits in order to recognize and rectify biased results [61]. Sustainable AI and energy efficient computing is another potential opportunity emerging. Large AI models are expensive to train in terms of computational power and energy usage, and are environmentally unfriendly. To make AI greener, researchers are investigating methods of optimization of algorithms, decreasing the complexity of models and creating devices that use less energy. This encompasses model compression, pruning and low-power computing architectures [62]. Also, new AI analytics and edge intelligence should significantly contribute to the development in the future. As the number of Internet of Things (IoT) devices is growing, demand rises in AI systems capable of processing and analyzing data at the network edges with the lowest amount of latency.





This will boost applications like autonomous cars, smart cities and automation in industry [63]. The future of AI in Big Data analytics is aimed at ensuring that the systems are more transparent, secure, efficient, and sustainable. Future generation of intelligent data-driven technologies will heavily depend on research on explainable AI, federated learning, ethical governance and edge computing, and allow more responsible and effective application of Big Data across industries [64].

CONCLUSION

Artificial Intelligence (AI) has become a revolutionary technology of the Big Data analytics, changing the nature of processing, analysis, and interpretation of large and multifaceted datasets. The combination of AI and Big Data will help organizations overcome the old data analysis methods and adopt more intelligent, automated, and predictive ones. As noted in this review, AI together with Big Data is not merely improving the power of analytics but also changing the way decisions are made in various sectors.

Based on the discussion of fundamentals, it is evident that Big Data is defined by the high volume, high velocity, extreme variety, uncertain truth, and high value. The characteristics ensure that data management and analysis is very difficult using traditional approaches. Artificial Intelligence can help solve these issues by introducing new advanced algorithms and learning models that can efficiently process structured, semi-structured and unstructured data. Machine learning, deep learning and natural language processing have all become critical assets in deriving meaningful insights on a large amount of data.

Integration of AI into the Big Data analytics have played a major role in improving efficiency in the data processing, predictive accuracy, and automation. The systems that are developed on AIs can identify latent patterns, find anomalies, and produce real-time insights that can be used to make informed decisions. Distributed computing, cloud systems, and smart algorithms have enabled the creation of an architectural system capable of supporting the scale of analytics functions to address the need of the contemporary data landscape. Consequently, these innovations have brought immense benefits to industries like healthcare, finance, retail, smart cities and cybersecurity.

Automated machine learning, real-time analytics, edge computing, cloud-based AI systems, and generative AI are all current trends suggesting that the discipline is moving very quickly towards being more automated, fast and more accessible. These advancements are rendering AI-based Big Data analytics more feasible to large and small organizations. Nevertheless, these developments still have various obstacles. Problems to be resolved include poor data quality, scalability issues, privacy issues, ethical bias, and lack of professional expertise still prevent the potential of AI in Big Data settings.





The systems and software that facilitate this integration, such as frameworks such as Hadoop and Spark, AI libraries such as TensorFlow and PyTorch and cloud systems such as AWS, Azure, and Google Cloud are essential to support scalable and effective analytics solutions. The technologies offer the infrastructure required to process large datasets and implement intelligent models with ease. In the future, explainable AI, federated learning, ethical governance, sustainable AI, and edge intelligence are identified as the possible directions of research to further contribute to the capabilities and reliability of the AI-driven Big Data systems. These innovations will enhance technical performance, as well as take care of the transparency, privacy, and environmental issues.

The potential of AI-based Big Data analytics is very strong with an impressive number of prospects. There are still issues to overcome, but with ongoing innovation to algorithms, infrastructure, and ethical models, AI will help achieve the full potential of Big Data, making it smarter, faster, and more responsible to have information to act on in all areas of society.

REFERENCES

- [1]. Karthick AV, Gopalsamy S. Artificial intelligence: Trends and challenges. In 2022 Seventh International Conference on Parallel, Distributed and Grid Computing (PDGC) 2022 Nov 25 (pp. 7-12). IEEE.
- [2]. Goyal D, Goyal R, Rekha G, Malik S, Tyagi AK. Emerging trends and challenges in data science and big data analytics. In 2020 International conference on emerging trends in information technology and engineering (ic-ETITE) 2020 Feb 24 (pp. 1-8). IEEE.
- [3]. Luan H, Geczy P, Lai H, Gobert J, Yang SJ, Ogata H, Baltus J, Guerra R, Li P, Tsai CC. Challenges and future directions of big data and artificial intelligence in education. *Frontiers in psychology*. 2020 Oct 19;11:580820.
- [4]. Ojokoh BA, Samuel OW, Omisore OM, Sarumi OA, Idowu PA, Chimusa ER, Darwish A, Adekoya AF, Katsriku FA. Big data, analytics and artificial intelligence for sustainability. *Scientific African*. 2020 Sep 1;9:e00551.
- [5]. Krishna CV, Rohit HR. A review of Artificial Intelligence methods for data science and data analytics: Applications and Research Challenges. In 2018 2nd International Conference on I-SMAC (IoT in Social, Mobile, Analytics and Cloud)(I-SMAC) I-SMAC (IoT in Social, Mobile, Analytics and Cloud)(I-SMAC), 2018 2nd International Conference on 2018 Aug 30 (pp. 591-594). IEEE.
- [6]. Yanamala AK, Suryadevara S. Advances in data protection and artificial intelligence: Trends and challenges. *International Journal of Advanced Engineering Technologies and Innovations*. 2023 Nov 10;1(01):294-319.





- [7]. Bacha A, Sehar H, Naseem S, Khan MI. Federated learning for threat intelligence sharing: A privacy-preserving collaborative defense model. *Spectrum of Engineering Sciences*. 2024 Dec 31:656-64.
- [8]. Rahmani AM, Azhir E, Ali S, Mohammadi M, Ahmed OH, Ghafour MY, Ahmed SH, Hosseinzadeh M. Artificial intelligence approaches and mechanisms for big data analytics: a systematic study. *PeerJ Computer Science*. 2021 Apr 14;7:e488.
- [9]. Gurjar K, Jangra A, Baber H, Islam M, Sheikh SA. An analytical review on the impact of artificial intelligence on the business industry: Applications, trends, and challenges. *IEEE Engineering Management Review*. 2024 Feb 29;52(2):84-102.
- [10]. Dai D, Boroomand S. A review of artificial intelligence to enhance the security of big data systems: state-of-art, methodologies, applications, and challenges. *Archives of Computational Methods in Engineering*. 2022 Mar;29(2):1291-309.
- [11]. Raza H, Erdenetsogt T, Singh A, Farooq M, Kabeer MM, Aslam MS. A Comprehensive Review on Data Science Frameworks for Big Data Analytics. *PERFECT: Journal of Smart Algorithms*. 2026 Jan 6;3(1):1-0.
- [12]. Ding H, Tian J, Yu W, Wilson DI, Young BR, Cui X, Xin X, Wang Z, Li W. The application of artificial intelligence and big data in the food industry. *Foods*. 2023 Dec 18;12(24):4511.
- [13]. Naeem M, Jamal T, Diaz-Martinez J, Butt SA, Montesano N, Tariq MI, De-la-Hoz-Franco E, De-La-Hoz-Valdiris E. Trends and future perspective challenges in big data. In *Advances in intelligent data analysis and applications: Proceeding of the sixth euro-China conference on intelligent data analysis and applications, 15–18 October 2019, Arad, Romania* 2021 Nov 26 (pp. 309-325). Singapore: Springer Singapore.
- [14]. Oliveira RC, Silva RD. Artificial intelligence in agriculture: benefits, challenges, and trends. *Applied Sciences*. 2023 Jun 22;13(13):7405.
- [15]. Singh A. Advancing Healthcare through AI-Driven Data Analytics: Integrating Machine Learning and Cybersecurity in Modern Computer Science. *Global Journal of STEM and Society*. 2026 Feb 6;1(1):107-26.
- [16]. Abas ZA, Rahman AF, Pramudya G, Wee SY, Kasmin F, Yusof N, Yunus NM, Abidin ZZ. Analytics: A review of current trends, future application and challenges. *Compusoft*. 2020;9(1):3560-5.
- [17]. Iqbal R, Doctor F, More B, Mahmud S, Yousuf U. Big Data analytics and Computational Intelligence for Cyber-Physical Systems: Recent trends and state of the art applications. *Future Generation Computer Systems*. 2020 Apr 1;105:766-78.





- [18]. Ashiwaju BI, Orikpete OF, Uzougbo CG. The intersection of artificial intelligence and big data in drug discovery: a review of current trends and future implications. *Matrix Science Pharma*. 2023 Apr 1;7(2):36-42.
- [19]. Kersting K, Meyer U. From big data to big artificial intelligence? Algorithmic challenges and opportunities of big data. *KI-Künstliche Intelligenz*. 2018 Feb;32(1):3-8.
- [20]. Gandomi AH, Chen F, Abualigah L. Big data analytics using artificial intelligence. *Electronics*. 2023 Feb 15;12(4):957.
- [21]. Jamarani A, Haddadi S, Sarvizadeh R, Haghi Kashani M, Akbari M, Moradi S. Big data and predictive analytics: A systematic review of applications. *Artificial intelligence review*. 2024 Jun 17;57(7):176.
- [22]. Duan Y, Edwards JS, Dwivedi YK. Artificial intelligence for decision making in the era of Big Data—evolution, challenges and research agenda. *International journal of information management*. 2019 Oct 1;48:63-71.
- [23]. Mohamed A, Najafabadi MK, Wah YB, Zaman EA, Maskat R. The state of the art and taxonomy of big data analytics: view from new big data framework. *Artificial intelligence review*. 2020 Feb;53(2):989-1037.
- [24]. Ikegwu AC, Nweke HF, Anikwe CV, Alo UR, Okonkwo OR. Big data analytics for data-driven industry: a review of data sources, tools, challenges, solutions, and research directions. *Cluster Computing*. 2022 Oct;25(5):3343-87.
- [25]. Bose S, Dey SK, Bhattacharjee S. Big data, data analytics and artificial intelligence in accounting: An overview. *Handbook of big data research methods*. 2023 Jun 20:32-51.
- [26]. Dawn N, Ghosh T, Ghosh S, Saha A, Mukherjee P, Sarkar S, Guha S, Sanyal T. Implementation of Artificial Intelligence, Machine Learning, and Internet of Things (IoT) in revolutionizing Agriculture: A review on recent trends and challenges. *Int. J. Exp. Res. Rev*. 2023 Apr;30:190-218.
- [27]. Deliu D, Olariu A. The role of artificial intelligence and Big Data analytics in shaping the future of professions in Industry 6.0: Perspectives from an emerging market. *Electronics*. 2024 Dec 18;13(24):4983.
- [28]. Paramesha M, Rane N, Rane J. Big data analytics, artificial intelligence, machine learning, internet of things, and blockchain for enhanced business intelligence. *Artificial Intelligence, Machine Learning, Internet of Things, and Blockchain for Enhanced Business Intelligence (June 6, 2024)*. 2024 Jun 6.





- [29]. Balabanov OS. Big Data Analytics: principles, trends and tasks (a survey). *Problems in programming*. 2019 Jun 16(2):47-68.
- [30]. Tseng ML, Tran TP, Ha HM, Bui TD, Lim MK. Sustainable industrial and operation engineering trends and challenges Toward Industry 4.0: A data driven analysis. *Journal of Industrial and Production Engineering*. 2021 Nov 17;38(8):581-98.
- [31]. Benke K, Benke G. Artificial intelligence and big data in public health. *International journal of environmental research and public health*. 2018 Dec;15(12):2796.
- [32]. Mycka J, Mańdziuk J. Artificial intelligence in music: recent trends and challenges. *Neural Computing and Applications*. 2025 Jan;37(2):801-39.
- [33]. Sun L, Shang Z, Xia Y, Bhowmick S, Nagarajaiah S. Review of bridge structural health monitoring aided by big data and artificial intelligence: From condition assessment to damage detection. *Journal of Structural Engineering*. 2020 May 1;146(5):04020073.
- [34]. Zhao E, Sun S, Wang S. New developments in wind energy forecasting with artificial intelligence and big data: A scientometric insight. *Data Science and Management*. 2022 Jun 1;5(2):84-95.
- [35]. Lengnick-Hall ML, Neely AR, Stone CB. Human resource management in the digital age: Big data, HR analytics and artificial intelligence. In *Management and technological challenges in the digital age 2018* Jan 3 (pp. 1-30). CRC Press.
- [36]. Majumder RQ. *Machine Learning for Predictive Analytics: Trends and Future Directions*. Available at SSRN 5267273. 2025 Feb 13.
- [37]. Torre-Bastida AI, Del Ser J, Laña I, Ilardia M, Bilbao MN, Campos-Cordobés S. Big Data for transportation and mobility: recent advances, trends and challenges. *IET Intelligent Transport Systems*. 2018 Oct;12(8):742-55.
- [38]. CHANTAL U, CLEMENCE N, GEDEON N, EPIPHANIE U. Artificial intelligence for big data in modern marketing: a review about trends, applications, and challenges. *INTERNATIONAL JOURNAL*. 2025;14(2):165-83.
- [39]. Badshah A, Daud A, Alharbey R, Banjar A, Bukhari A, Alshemaimri B. Big data applications: overview, challenges and future. *Artificial Intelligence Review*. 2024 Sep 16;57(11):290.
- [40]. Meng Q, Peng Q, Li Z, Hu X. Big data technology in construction safety management: application status, trend and challenge. *Buildings*. 2022 Apr 22;12(5):533.
- [41]. Ochuba NA, Amoo OO, Okafor ES, Akinrinola O, Usman FO. Strategies for leveraging big data and analytics for business development: a comprehensive review across sectors. *Computer Science & IT Research Journal*. 2024 Mar;5(3):562-75.





- [42]. Mishra V, Darade H. Harnessing Big Data: An Expert Review of Trends, Challenges, and Future Directions with a Focus on Data Quality. In 2024 Third International Conference on Artificial Intelligence, Computational Electronics and Communication System (AICECS) 2024 Dec 12 (pp. 1-6). IEEE.
- [43]. Borimnejad H, Borimnejad V. Emerging trends challenges and research opportunities in artificial intelligence applications in marketing. *Discover Artificial Intelligence*. 2025 Dec 2.
- [44]. Gates JD, Yulianti Y, Pangilinan GA. Big data analytics for predictive insights in healthcare. *International Transactions on Artificial Intelligence*. 2024 Nov 12;3(1):54-63.
- [45]. Rodríguez-Mazahua L, Rodríguez-Enríquez CA, Sánchez-Cervantes JL, Cervantes J, García-Alcaraz JL, Alor-Hernández G. A general perspective of Big Data: applications, tools, challenges and trends. *The Journal of Supercomputing*. 2016 Aug;72(8):3073-113.
- [46]. Pasham SD. An Overview of Medical Artificial Intelligence Research in Artificial Intelligence-Assisted Medicine. *International Journal of Social Trends*. 2023 Dec 31;1(1):92-111.
- [47]. Singh S, Arya KV, Rodriguez CR, Mulani AO. Emerging Trends in Artificial Intelligence, Data Science and Signal Processing. *Communications in Computer and Information Science (CCIS)*. 2025;2439.
- [48]. Surya L. An exploratory study of AI and Big Data, and its future in the United States. *International Journal of Creative Research Thoughts (IJCRT)*, ISSN. 2015 May 2:2320-882.
- [49]. Saleem I, Abdeljawad I, Nour AI. Artificial intelligence and the future of accounting profession: implications and challenges. In *Artificial Intelligence, Internet of Things, and Society 5.0 2023 Nov 9* (pp. 327-336). Cham: Springer Nature Switzerland.
- [50]. Rane N. Integrating leading-edge artificial intelligence (AI), internet of things (IOT), and big data technologies for smart and sustainable architecture, engineering and construction (AEC) industry: Challenges and future directions. *Engineering and Construction (AEC) Industry: Challenges and Future Directions* (September 24, 2023). 2023 Sep 24.
- [51]. Zhuang YT, Wu F, Chen C, Pan YH. Challenges and opportunities: from big data to knowledge in AI 2.0. *Frontiers of Information Technology & Electronic Engineering*. 2017 Jan;18(1):3-14.
- [52]. Reddy VM, Nalla LN. The Future of E-commerce: How Big Data and AI are Shaping the Industry. *International Journal of Advanced Engineering Technologies and Innovations*. 2023;1(03):264-81.





- [53]. Lv H, Shi S, Gursoy D. A look back and a leap forward: a review and synthesis of big data and artificial intelligence literature in hospitality and tourism. *Journal of Hospitality Marketing & Management*. 2022 Feb 17;31(2):145-75.
- [54]. Sánchez-Sánchez AM, Ruiz-Muñoz D, Sánchez-Sánchez FJ. Trends and Challenges of Sustainable Rural Tourism in the Face of Artificial Intelligence: A Bibliometric Analysis. *Sustainable Development*. 2026 Feb;34(1):676-95.
- [55]. Arslantaş S. Artificial intelligence and big data from digital health applications: publication trends and analysis. *Journal of Health Organization and Management*. 2024 Nov 21.
- [56]. Peres RS, Jia X, Lee J, Sun K, Colombo AW, Barata J. Industrial artificial intelligence in industry 4.0-systematic review, challenges and outlook. *IEEE access*. 2020 Dec 7;8:220121-39.
- [57]. Awan U, Kanwal N, Alawi S, Huiskonon J, Dahanayake A. Artificial intelligence for supply chain success in the era of data analytics. In *The fourth industrial revolution: Implementation of artificial intelligence for growing business success 2021 Feb 13* (pp. 3-21). Cham: Springer International Publishing.
- [58]. Abdelwahab SI, Taha MM, Farasani A, Jerah AA, Abdullah SM, Aljahdali IA, Oraibi B, Alfaifi HA, Alzahrani AH, Oraibi O, Babiker Y. Artificial intelligence in nursing education: A bibliometric analysis of trends, challenges, and future directions. *Teaching and Learning in Nursing*. 2025 Apr 1;20(2):e356-67.
- [59]. Rathore MM, Shah SA, Shukla D, Bentafat E, Bakiras S. The role of ai, machine learning, and big data in digital twinning: A systematic literature review, challenges, and opportunities. *IEEE access*. 2021 Feb 22;9:32030-52.
- [60]. Saha S, Ghimire A, Manik MM, Tiwari A, Imran MA. Exploring benefits, overcoming challenges, and shaping future trends of artificial intelligence application in agricultural industry. *The American Journal of Agriculture and Biomedical Engineering*. 2024;6(07):11-27.
- [61]. Raza A, Shakeel M, Khan MI, Atif F, Parveen R. Identifying the recent trends, voids, and opportunities of sustainable finance via artificial intelligence, big data and analytics. *Multidiscip Rev*. 2025;8(7):2025234-.
- [62]. Şengöz M. Harnessing artificial intelligence and big data for proactive disaster management: Strategies, challenges, and future directions. *Haliç Üniversitesi Fen Bilimleri Dergisi*. 2024 Oct 10;7(2):57-91.





-
- [63]. Tawil AR, Mohamed M, Schmoor X, Vlachos K, Haidar D. Trends and challenges towards effective data-driven decision making in UK Small and Medium-sized Enterprises: Case studies and lessons learnt from the analysis of 85 Small and Medium-sized Enterprises. *Big Data and Cognitive Computing*. 2024 Jul 12;8(7):79.
- [64]. Darvazeh SS, Vanani IR. Big Data Analytics and Its Applications in Supply Chain. New trends in the use of artificial intelligence for the Industry 4.0. 2020 Mar 25:175.

