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Opportunities for Using Machine Learning and Artificial Intelligence in Business Analytics

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Abstract

In today's fast-paced business landscape, data is no longer just a byproduct; it's the driving force behind informed decision-making. With the rise of business analytics, organizations can harness the power of data to gain insights that lead to improved strategies, enhanced operations, and, ultimately, a stronger bottom line. The topic relevance is confirmed by the business need for modern data analysis methods. Technological progress and large data volumes that need processing require the machine learning use which can improve the business processes productivity. Machine learning, a subset of artificial intelligence, has emerged as a powerful tool in the field of business analytics. He involves the use of algorithms that allow computers to learn from and make predictions or decisions based on data. Machine learning and analytics help automate processes, reduce costs and improve the quality of every decision made. The article purpose is to seek to establish opportunities, trends and limitations in the machine learning use and artificial intelligence in business analytics context.

Keywords: Artificial intelligence, machine learning, deep learning, business analytics, bigdata

1. Introduction

At the present stage, the "Bigdata" phenomenon accompanies the science and technology development. Big data makes it possible to make various data sources publicly available and it is with this process that the digital transformation began. Humanity lives in an information society within the knowledge economy framework, the information is one of the most valuable resources and a kind of problem due to its huge volumes (Cheng et al., 2023). The topic relevance is confirmed by the modern business interest in modern data analysis methods. Technologies are developing at a rapid pace, data volumes are increasing which requires their rapid processing and analysis. These processes are important for making quality decisions and business processes efficiency.

The article purpose is to identify opportunities, trends and limitations in machine learning use and artificial intelligence in business analytics.

2. Materials and Methods

The article analyzes, synthesizes and summarizes data from scientific research covering the using artificial intelligence topic and machine learning technologies for business analytics.

3. Results and Discussion

Modern data sources business intelligence is distributed in several directions. We are talking about databases, web data, mobile data (Bharadiya, 2023). The rapid information technology development, data storage capabilities, solutions related to improving hardware characteristics to create conditions for storing and data volumes processing in all domains which can be structured or unsystematic.

Today every corporation is the information repository with huge databases. The world is experiencing a process during which data becomes more accessible, the more important it is to understand in what volumes it circulates and can be used. The infrastructures cloud use allows for global access to data which has a huge impact on the business environment (Zimmermann, 2018).

Artificial intelligence is the next innovation associated with the ongoing digital transformation (Bughin et al., 2019). AI is being actively researched using neural networks. The breakthrough technologies complex is associated with deep learning concept. As a result of this approach, AI has become a democratic technology that

can be integrated into the fields wide variety and industries and is the most revolutionary since the Internet appeared (Schmitt, 2023).

Deep learning as a machine learning type is penetrating science and production revolutionizing technologies, working approaches with data, the efficiency concept and productivity. Text, speech, images, video recordings, audio recordings today can be comprehensively processed and analyzed. AI and DL are currently at the maturity peak by Gartner (Columbus, 2019) being actively invested due to their enormous potential. The expert community is convinced that fundamental progress in the classical sense is giving way to AI, the versatility of which allows it to be used in science, business and public administration (Stadelmann et al., 2018).

Globalization and changes in technological structures, competitive features, high risks and quality standards and productivity, increased consumer expectations require a more flexible approach to business, the intelligent systems use with AI support in order to survive (Warner and Wager, 2019). In the finance field, healthcare, industrial production, retail trade, supply chain, logistics and housing and communal services, advanced analytics and applications based on machine learning (ML) and artificial intelligence (AI) are actively used Dwivedi et al., 2021).

The highly competitive global market today is influenced by various powerful trends, all decisions are made based on ML data (Davenport, 2018; Oboulhas et al., 2023). The decision is made based on business analytics which is an interdisciplinary field. It is integrative, statistics and information systems are used together with machine learning and operations and management are studied. Analytics can be descriptive, predictive or prescriptive (Schmitt, 2023). AI in the business context is often synonymous with machine learning, predictive analytics, and intelligent automation. These technologies enable businesses to process vast amounts of data with unprecedented speed and accuracy. Alghamdi and Al-Baity (2022) introduce the concept of Augmented Analytics (AA), which represents the convergence of BI and AI.

The more complex the predictive model the more opportunities there are to extract data that will justify one or another reasonable management decision. Such models are being actively implemented but it is necessary to understand that valuable information is extracted and interpreted only by specially trained specialists who are able to operate analytical tools. The educational sphere must adapt to new demands coming, in particular, from business, manufacturing, and medicine. At the same time, there is still professionals shortage in the field (Kar et al., 2021). If non-experts are involved in ML algorithms, problems may arise with the quality tuning of ML models (Schmitt, 2023).

Machine learning application and analytics services in business. Machine learning and AI services are used in business analytics in the vast industries majority (Table 1).

Table 1. Directions for use (Moronen, 2022; Sam Goundar et al., 2021)

Direction	Possibilities
Analysis and sales data forecasting	Analytics services can analyze sales data, identify popular products and predict future sales. It allows businesses to make more informed decisions on inventory management, marketing and product line development
Fraud detection	Machine learning services can detect fraudulent transactions in banking, online trading and other areas. Machine learning algorithms analyze transactions, identify anomalies and prevent fraudulent transactions
Decreasing Customer Churn	Customer churn is one of the most complex problems that companies face. In such a situation, giant organisations like Amazon, Netflix, Google, etc., use machine learning-based analytics to avoid customer churn and raise revenue
Customer Acquisition	Administering efficient machine learning algorithms can assist companies in increasing customer acquisition and attaining better results.
Production optimization	Analytics services can analyze production data, identify bottlenecks in production processes and optimize equipment operation. It improves productivity and product quality and reduces production costs
Risks management	Machine learning services can analyze risks in various areas including financial, insurance and medical fields. Machine learning algorithms analyze data and identify risks associated with customers, products and processes.
Social media analysis	Analytics services can analyze social media data including customer reviews, comments and social media posts. It allows the business to gain insight into customer sentiment and respond to feedback, improve its products and services, and increase customer satisfaction

With these services help analytical procedures regarding big data are automated. This is done in order to identify non-obvious patterns in order to subsequently offer the business an adaptive intelligent system that contributes to the effectiveness of management activities.

Machine learning and analytics services based on AI are used by businesses to:

- to improve, balance processes and make activities more efficient;
- to create new products and services based on data obtained during the analysis;
- communication quality and feedback with consumers in order to make them loyal and increase satisfaction;.
- supporting decision-making with automation tools.

Any organization generates, accumulates, processes, receives and transmits large information amounts. Based on this data, management makes informed decisions. The data complexity requires a specialized approach to their analysis. AI can help with the use and evaluation of data (Borges et al., 2020). For business, it is important to use predictive analytics which allows you to make decisions at any stage including during transactions (Makarius et al., 2020). The situation on the market in the chosen niche, new players, management control, interest decrease in the product line is assessed in order to as a result of these factors interpretation to develop a strategy for competitive behavior in the market (Bytniewski et al., 2020).

AI is the ability to analyze preferences, guidelines, and the emotional component associated with a certain product (Jelonek et al., 2019). It is important to establish how the consumer perceives the product (Bytniewski et al., 2020).

AI can be used in the social and cultural sphere where a business offering products and services seeks to intellectualize the communication environment with the client. Netflix evaluates whole individual person characteristics range before making a recommendation. The personalized offer presence significantly increases consumer interest in the product. In this case, AI produces results based on the person's location, his browsing history and queries (Netflix, 2020). Analytics and machine learning can become a competitive advantage for any modern company that strives for success. At the same time, it is obvious that in practice it is necessary to clearly understand what problems should be solved using these technologies and how to simplify their implementation (Perifanis and Kitsios, 2023).

It is necessary to choose the optimal machine learning algorithms. Data analysis methods will be required that are able to cope with specific task. That is, at the initial stage it is necessary to decide on algorithms and methods for the task. The classification of algorithms in this context may look like this (Figure 1)

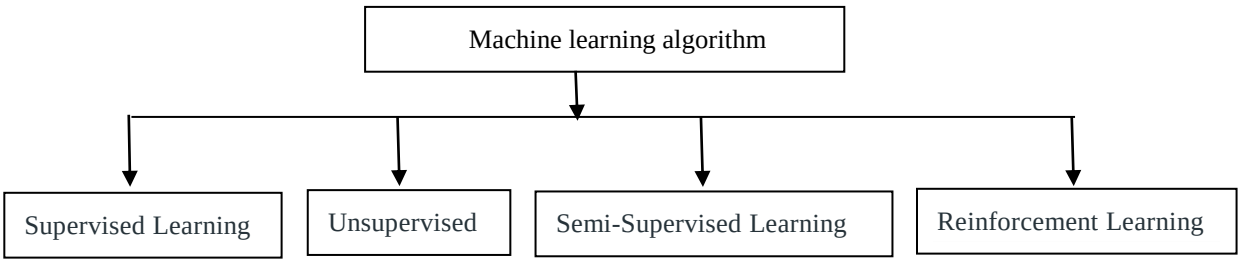

Figure 1. Types of Machine Learning Algorithms

Supervised learning means that a target value is defined in the data. After which, the patterns identification that were previously applied begins, all labeled data is analyzed and recommendations are made (Schmidt et al., 2020). Sometimes learning is Unsupervised then the target value is taken beyond the analysis scope. Training data that has statistical properties is analyzed. With unsupervised learning it could be find hidden patterns that a data set contains. Automatic clustering is used as an application. Anomalies are searched and associations are analyzed. Supervised learning involves working with labeled and unlabeled data. Supervised learning does not rely on past experiences to solve a present problem. It is based on feedback from the external environment. The agent who is a person poses a task to the system. Then the search begins for a better solution, including a combined one (Schmidt et al., 2020).

It is all the more important that high-quality data be provided for analysis. If they are not the result turns out to be unpredictable, approximate and undesirable to use in practice (Lee et al., 2019). There is a clear connection between low-quality information and the ineffectiveness of AI in working on its basis. Such a solution is useless for the company. Low quality in this context is a multidimensional concept. Information may be unreliable, fragmented or have incorrect functions. It is not always possible to assess how objective and accurate the supplied data is. It is necessary to establish cooperation between various specialists in order to identify this problem in a timely manner. These can be employees involved in data processing and subject matter experts

(Baier et al., 2019).

Data must be unbiased, the receiving and transmitting process must be responsible and trusting. Data bias can appear at any stage. For example, at the moment when information is collected and even processed. The assigned semantic meanings may also be incorrect. Bias that may be discovered during the analysis process may occur during sampling, confirmation, etc. The solution to this problem can be regular auditing and quality data management.

Various studies confirm the high data importance itself in their assessment and processing process. Only in this case will AI applications correctly cope with the assigned tasks (Mikalef and Gupta, 2021).

To implement AI company must create the appropriate technology infrastructure. We are talking about algorithms as well as the infrastructure associated with computing power and data sets. The latter are the basis for running AI algorithms. The data set can be enormous. The algorithm is both simple and complex. The computing power required is usually significant. There is a need for high speeds and adaptive scalability. Obviously, not every organization is able to create the specified conditions and has the equipment and software (Schmidt et al., 2020). Especially for such businesses as Google, Amazon and Microsoft it is recommended to use their cloud infrastructure. Google Cloud AI is an example. With these solutions, any business gets access to AI tools (Borges et al., 2020). Thus, companies have two ways to realize the need for quality business intelligence. This is either expensive equipment with on-site software or cloud solutions. As noted earlier, machine learning algorithms can only be effectively used by specialists with the appropriate skills. It is all the more important for the company to improve the staff skills. The results interpretation is also an area that requires training and experience. You need mathematical knowledge, ability to program and handle statistics and experience with machine learning.

It is also worth recalling that all algorithms must be checked for relevance and modernized. The models used need to be updated. Only in this case this technology will really become an argument in a competitive environment and contribute to making informed and prompt decisions. Machine learning and analytics services work with consumer personal data. It means that specialist training must include the legal and ethical issues range. The task itself must be ethical, although, this concept is difficult to formalize and unambiguously evaluate. As already noted, these services operate on the expensive equipment and unique software basis. It is a significant expense for the company. The project economic efficiency should be obvious. Machine learning and analytics is a technology that is effective to varying degrees. Its effectiveness depends on many factors. It is necessary to test algorithms to combat errors, distortions and limitations. Each solution received must also be verified.

3.Conclusion

The objective of this paper was to seek to establish opportunities, trends and limitations in the machine learning use and artificial intelligence in business analytics context. The study showed that AI used with machine learning services helps business analytics become more accurate and reliable. These technologies allow to operate with big data, make forecasts, optimize business processes, and become competitive. They are effective in cases where it is necessary to process large data volumes, to identify trends, behavioral patterns and work on product quality. The study concluded that to ensure the successful implementation it is needed to correctly assess your capabilities, to select algorithms and data analysis methods, to monitor the input information quality, to organize specialists training, to ensure that algorithms remain relevant and resolve ethical and legal issues.

Currently, the sector is experiencing the qualified personnel shortage; it is continued the work on tools that will maintain the data confidentiality and security and it is also allowed to work with any data volume. Consequently, machine learning and AI services are actively developing, solving business analytics issues and are promising for such activity areas as the Internet of Things, cloud computing, the neural networks and artificial intelligence use.

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Authors contributed equally to the study.

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The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

Data sharing statement

No additional data are available.

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