

ANALYSIS OF THE ROLE OF MACHINE LEARNING ALGORITHMS IN THE CONTEXT OF BUSINESS STRATEGIES

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ABSTRACT

In recent years, Artificial Intelligence (AI) and machine learning (ML) algorithms have become integral to many sectors, most notably in business. The use of these technologies in business and consumer decision-making opens up new perspectives, changing the conventions of data analysis and market behaviour prediction.

The aim of the paper is to analyse the role of machine learning algorithms in the context of business strategies and customer interactions. In the enterprise field, machine learning techniques enable the analysis of large data sets to detect patterns and market trends, leading to more reasoned business decisions. In addition, it is possible to use these techniques to automate business processes and tailor offers and services to customers' needs. In the context of consumers, machine learning techniques are used for product recommendations, personalisation of the shopping experience and customer service. These activities have a significant impact on improving the customer experience and increasing brand loyalty.

In this paper, the author aims to present the relevance of machine learning algorithms in today's business and consumer world, with a particular focus on their impact on business strategies and customer interactions. The paper will provide an analysis of these issues, emphasising practical applications and implications for the future. In addition, the topics will be discussed in a foreign context.

Key words: machine learning, business strategies, artificial intelligence, customers.

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1. Introduction

In recent years, artificial intelligence (AI) and machine learning (ML) algorithms have gained crucial importance in various sectors of the economy. Artificial intelligence, as defined on the European Parliament website, is the ability of machines to exhibit human skills such as reasoning, learning, planning and creativity. Artificial intelligence enables technical systems to perceive their environment, deal with what they perceive and solve problems, working towards a specific goal. The computer receives data prepared or collected with its sensors, processes it and reacts. AI systems are able to adapt their behaviour to some extent, analysing the effects of previous actions and acting autonomously. Their role in business is difficult to overestimate, as they enable the analysis of huge amounts of data, the automation of processes and the personalisation of offers and services. In Poland, as in many other countries, AI and ML competencies are being dynamically developed, leading to the integration of these technologies into various business strategies. However, it should be borne in mind that with regard to AI, doubts are being raised about data security and the protection of intellectual property rights. Not only legal but also ethical issues are taken into account (Fischer, Pązik, Świerczyński, 2023).

AI and ML are finding applications in many areas of business, from improving customer service to advanced data analysis (Galek, 2023). Netflix, Tesla or Google are some of the examples where such technology finds its place. In terms of business strategy, Netflix uses AI algorithms to recommend content by analysing users' preferences and providing them with personalised suggestions for films and series. This increases their customer loyalty. Tesla, an innovator in electric cars, uses AI to create autonomous vehicles that enhance safety and comfort through advanced ambient recognition systems. The closest thing almost every Google Chrome browser user is familiar with is the voice assistant, which recognises speech and executes users' commands, from searching for information to managing daily tasks. At Google, it is this solution that is being made effective through the use of artificial intelligence (Kruk, Ławińska, Oleszczuk, 2024).

Thus, in order to understand the content contained in this article, it is still necessary to provide a definition of machine learning. It is defined in the scientific literature as one of the basic techniques of AI, which involves developing algorithms and models capable of learning from data. Learning systems can identify patterns and relationships in data and then use this knowledge to make decisions and predict future outcomes (Bovsheva, My Luong, 2024). Furthermore, machine learning is a technology whereby machines, rather than being programmed to perform a task directly, are trained to use an extensive data set to recognise patterns, make predictions or optimise specific goals. There are three main types of machine learning: supervised

learning, unsupervised learning and reinforcement learning, each of which is applicable in different business contexts.

Analysing the role of machine learning algorithms in business strategies and customer interactions, with a focus on the situation in Poland and abroad, is such an important topic, as the world is moving at a dizzying pace with technological progress. Presenting specific examples of companies that are effectively using AI and ML in their operations and discussing the prospects for further development of these technologies in the context of transforming industries and increasing competitiveness within the scope of this article does not completely exhaust the topic and can serve as a basis for further discussion. This article is a kind of case study intended to introduce the reader to a given topic and inspire him to delve deeper into the topic. Moreover, the literature used in this article is not always provided in the text, because most of it may refer to it and it is not possible to cite a specific fragment to a given source. Based on the literature, this article aims to provide a comprehensive overview of current and future applications of artificial intelligence in business and its impact on management and marketing.

2. Applications and Benefits of Machine Learning in Business

Machine learning, as an integral part of artificial intelligence resources, offers a wide range of applications that accelerate the development of many companies. This is possible thanks to the reduction of operational costs by skillfully identifying processes that require better optimization. After such data analysis, companies can change their strategy regarding warehouse logistics to avoid accumulating excessive stock, which is also a significant cost. They can implement pricing changes to attract more potential customers or improve communication with suppliers by enhancing the supply chain. Machine learning is an excellent tool for processing data analysis from various sources. Analyzing not only text but also graphics, sound, or video is very time-consuming and labor-intensive for humans, while for machines, it takes only a few seconds if the command is well-defined. These actions are valuable for understanding the company's customers and studying their satisfaction, as well as monitoring any positive or negative comments about the company on the Internet. Process automation frequently appears in the literature on the subject. Indeed, it is one of the greatest benefits of using machine learning. By contributing to process automation, a company can increase its operational, production, and logistical efficiency. In terms of production, this can include monitoring quality and predictive maintenance of machines. Such solutions can certainly be applied in manufacturing plants, for example, in the automotive industry. Logistics may be associated with courier companies, which is a valid thought, as an example being InPost, which could or already does use machine learning to manage the

products they have in warehouses and, above all, to reduce costs related to transportation by optimizing delivery routes.

Machine learning also finds its solutions in market analysis and customer segmentation. Understanding the target group that a company has the greatest influence on is essential for better tailoring its products or services. Market analysis and then identifying trends, and understanding consumer needs, can guarantee increased revenues for the company in the near future. Algorithms that detect these patterns and market trends are used by large companies like Amazon and Netflix, but this application can also be seen in the financial sector, where banks and financial institutions increasingly use machine learning to analyze transactions, detect fraud, and more. In Figure 1, various areas where the financial sector began to implement or consider such solutions in 2020 can be seen. By 2024, in the post-COVID-19 era, technological advancement has surely progressed, so these data have likely changed.

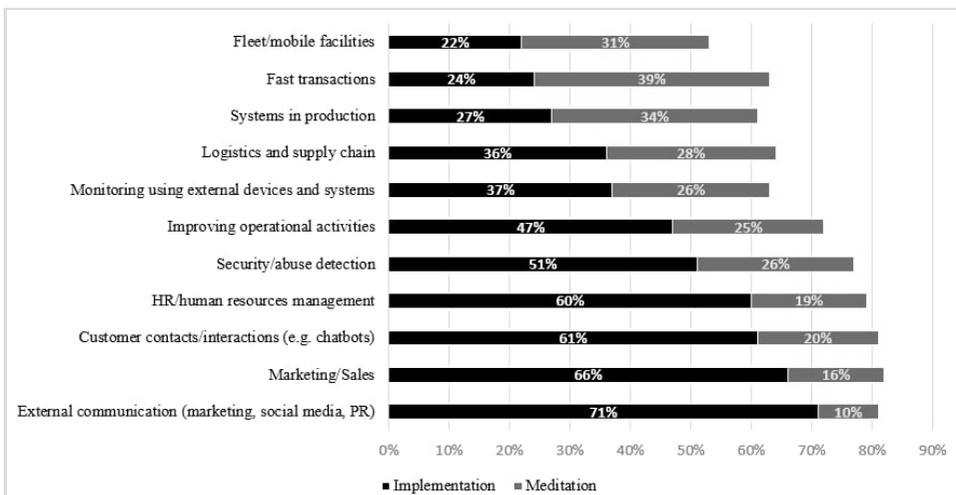


Figure 1. In what areas did the financial sector use artificial intelligence in 2020?

Source: *Sztuczna inteligencja w bankowości*. Wydawcy: Związek Banków Polskich, Centrum Prawa Bankowego i Informacji, aleBank.pl.

However, the e-commerce sector is not lagging behind. Data analysis and pattern detection are certainly noticeable on popular shopping sites like Allegro. Such companies analyze purchase data and try to predict trends among website users to display offers that are similar or simply of interest to them. Product recommendations and personalization of shopping experiences are a type of customer segmentation. It involves using algorithms that meticulously analyze, for example, users' purchase history and the ads for other products that are displayed to them, creating a profile based on their behavior, preferences, and even demographic data (A. Przegalińska, D. Jemielniak, 2023).

Machine learning also helps optimize organizational processes and customer service. Companies increasingly allow the use of chat on their websites, where the system is programmed to identify recurring issues and help solve them for site users. Moreover, when calling an institution or a small business, the person hears a voice programmed to inform the client about, for example, which department they are talking to before the conversation begins. Such solutions are used in the Google browser, where the system can perform the requested task via voice command or at least guide the user to the solution. Smaller companies compared to Google, like the telecommunications companies Play or Orange, have chatbots set to work 24/7, allowing customers to get answers to important questions. If the system does not know the answer, the user is directed to a consultant or contact via email.

The most promising AI applications involve the development of new products and services. DeepMind, owned by Alphabet, created the AI system AlphaGo, which defeated the world champion in the game Go, demonstrating the potential of AI in creating innovative solutions. Similarly, OpenAI developed the GPT-4 system, which generates texts based on given information, finding applications in many fields from education to business. In the healthcare sector, AI is used to analyze medical images, predict diseases, and personalize treatment plans. Machine learning systems can analyze X-rays, CT scans, and other medical images, detecting anomalies with greater precision than humans. AI also helps in the development of new drugs by predicting which chemical compounds might be effective in treating specific diseases, speeding up the drug discovery process. In the automotive industry, the development of autonomous vehicles is one of the most well-known applications of AI. Self-driving cars use advanced algorithms to analyze the environment, make real-time decisions, and ensure passenger safety. This technology has the potential to revolutionize transportation by reducing road accidents and air pollution. Retail also benefits from AI through data analysis, customer experience personalization, and inventory management optimization. Machine learning algorithms can predict product demand, allowing companies to better manage resources and minimize losses. Personalization of shopping experiences, through product recommendations and promotions tailored to customer preferences, increases customer loyalty and sales. AI is also used in finance to analyze risk, detect fraud, and automate banking processes. Banks and financial institutions use machine learning algorithms to analyze transaction data, detect suspicious activity, and prevent financial crimes. Automation of processes such as loan application processing and creditworthiness analysis allows for faster and more efficient management of banking operations. New AI platforms and ecosystems, like IBM Watson and Microsoft Azure AI, offer advanced tools for data analysis, trend prediction, and process optimization. These ecosystems enable companies to accelerate digital transformation, providing a wide range of services that support business growth.

IBM Watson is an advanced artificial intelligence system that allows companies to process and analyze large datasets. Watson is used in many industries, from healthcare to finance, helping companies make better decisions based on accurate data analysis. An example is Watson's use in the healthcare sector to analyze medical images and support disease diagnosis, contributing to improved healthcare quality. Microsoft Azure AI is a comprehensive cloud platform offering tools for machine learning, data analysis, and natural language processing. Companies use Azure AI to build, train, and deploy AI models that help automate processes and personalize customer offerings. For example, in the e-commerce industry, Azure AI can be used to analyze customer shopping behavior and recommend products, increasing sales and customer loyalty. These AI platforms also offer tools for predicting market trends, which is crucial for companies wanting to stay competitive. Analyzing large datasets allows for the identification of patterns and trends that can influence strategic business decisions. This enables businesses to better prepare for market changes and adjust their strategies to maximize profits. Optimizing business processes is another key area where AI platforms like IBM Watson and Microsoft Azure AI play a vital role. Automation of routine tasks, such as customer service or inventory management, allows companies to increase efficiency and reduce operational costs. For example, chatbots and virtual assistants built using AI tools can quickly and effectively respond to customer inquiries, improving service quality and increasing customer satisfaction. Another advantage of using AI platforms is their ability to integrate with existing systems and processes within the company. Thanks to flexibility and scalability, AI solutions can be easily tailored to the specific needs of an enterprise, regardless of its size or industry. This allows companies to gradually introduce innovations and modernize processes without having to completely overhaul existing structures. Artificial intelligence (AI) and machine learning (ML) are becoming increasingly integral parts of business strategies across various industries, moving beyond the realm of science fiction and becoming the foundation of modern enterprises. AI and ML not only automate simple tasks but also enable companies to analyze markets, segment customers, and optimize marketing and sales activities, making them invaluable tools in contemporary business.

Practical applications of AI and ML in business strategy include the analysis of large datasets, which allows for better understanding of the market and customer needs. With advanced algorithms, companies can identify market trends and forecast future changes, enabling more precise strategic planning. An example is the use of AI to analyze consumer behavior, allowing for the creation of more personalized marketing campaigns and better matching of offers to individual customer needs. In the context of customer segmentation, AI and ML enable companies to more accurately profile their customers based on various variables, such as purchasing behavior, preferences, and demographic data. This allows businesses to more effectively target their marketing efforts,

leading to increased campaign effectiveness and higher returns on investment. Customer segmentation using AI also allows for the creation of more tailored and effective loyalty strategies, contributing to increased customer satisfaction and loyalty.

Optimization of marketing and sales activities is another area where AI and ML play a key role. Machine learning algorithms can analyze data from various marketing channels, identifying the most effective strategies and tactics. This enables companies to better manage their marketing budgets by allocating funds to the most beneficial activities. AI also allows for the automation of many aspects of marketing, such as campaign management or personalized customer communication, increasing efficiency and reducing the time needed for these activities. Another important application of AI and ML is supply chain optimization and inventory management. By analyzing demand and supply data, companies can better forecast inventory needs and optimize inventory management, leading to cost reduction and increased operational efficiency. AI can also support supplier relationship management by identifying the most favorable trade conditions and predicting potential disruptions in the supply chain.

In the area of customer service, AI and ML are revolutionizing how companies interact with their customers. Chatbots and virtual assistants, equipped with advanced machine learning algorithms, can quickly and efficiently respond to customer inquiries, solve their problems, and provide information about products and services. These solutions not only improve the quality of customer service but also increase customer satisfaction and build a positive company image. Integrating AI and ML into business strategy also brings benefits in risk management. Machine learning algorithms can analyze data from various sources, identifying potential threats and helping companies make more informed decisions. An example is the use of AI to detect financial fraud, which allows for quick responses to potential threats and minimizes losses.

3. Comparison with Neighboring Countries

Germany stands out as a leader in AI and ML within Europe. The country benefits from substantial government investments and a robust research infrastructure. Notable institutions like the Max Planck Institute and the German Research Center for Artificial Intelligence (DFKI) play crucial roles in advancing AI technology. Major German corporations, such as Siemens and BMW, integrate ML into their production and operational processes. Siemens, for instance, uses ML to improve manufacturing efficiency and predictive maintenance, while BMW employs ML to enhance autonomous driving technologies and optimize supply chain logistics.

The Czech Republic is experiencing rapid growth in its AI sector. Academic institutions like the Czech Technical University in Prague are at the forefront of ML research, contributing significantly to advancements in the field. Prague is emerging as a vibrant hub for AI startups, fostering innovation and entrepreneurial activities. Companies like Avast, a global cybersecurity firm based in the Czech Republic, utilize ML for advanced threat detection and security solutions. ML enables Avast to analyze vast amounts of data in real-time, identifying and mitigating potential cyber threats more effectively.

Despite facing political and economic challenges, Ukraine is making notable strides in AI development. The country's tech ecosystem is growing, with Kyiv becoming a key center for innovation. Startups such as Grammarly have gained international recognition for their use of ML in text analysis and writing enhancement. Grammarly's ML algorithms help users improve their writing by providing grammar corrections, style suggestions, and contextual recommendations. Additionally, Ukraine is home to a burgeoning number of tech companies and research projects that focus on various AI applications, contributing to the global AI landscape despite the nation's ongoing difficulties.

4. Conclusions

Artificial intelligence (AI) and machine learning (ML) are revolutionizing various sectors of the economy by enabling machines to perform human-like tasks such as reasoning, learning, and decision-making. These technologies are crucial in business for analyzing vast amounts of data, automating processes, and personalizing services. In Poland and globally, companies like Netflix, Tesla, and Google effectively utilize AI and ML for enhancing customer experiences, developing autonomous vehicles, and providing advanced digital services. Machine learning, a subset of AI, involves training algorithms to recognize patterns and make predictions, which is essential for optimizing business strategies and operations.

Applications of AI and ML span numerous industries. In business, they help reduce operational costs, improve supply chain logistics, and enhance market analysis and customer segmentation. E-commerce platforms like Allegro use ML to predict consumer trends and personalize shopping experiences. Financial institutions leverage AI for fraud detection and transaction analysis. AI platforms like IBM Watson and Microsoft Azure AI support businesses by providing advanced tools for data analysis, process automation, and strategic decision-making.

At the same time, automation may reduce demand for certain jobs and replace them with technology. The impact on the labor market may result in the

disappearance of some traditional professions, e.g. cashiers or tutors. Due to the development of AI/ML technology, new professions will appear as IT specialists, e.g. data analyst, AI engineer, predictive analyst. It is worth emphasizing that data analysis has already appeared at some universities as a field of study to educate young people towards the challenges of the future.

Countries like Germany, the Czech Republic, and Ukraine are advancing in AI and ML adoption. Germany leads with substantial government investments and robust research infrastructure, while the Czech Republic fosters innovation through academic contributions and a vibrant startup scene. Ukraine, despite challenges, is emerging as a significant player in AI, with notable contributions from tech companies and research initiatives. AI and ML are set to remain integral to business strategies, driving innovation and competitiveness in the global economy.

According to the author, the development of AI and ML has the potential to revolutionize many sectors of the economy by introducing new technologies and data analysis methods. These advances can lead to more efficient processes, resource optimization and the creation of new business opportunities. At the same time, it requires adaptation and development of new skills by both companies and employees to effectively use the potential of AI and ML.

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