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DEVELOPMENT AND ANALYSIS OF ALGORITHMS FOR SOLVING SPECIFIC BUSINESS TASKS USING AI

Abstract: The article discusses the development and analysis of artificial intelligence (AI) algorithms for solving specific business tasks. The stages of algorithm development are explored, from problem definition and data collection to model selection and training. The adaptation of algorithms to various industries, such as finance, healthcare, retail, and manufacturing, is analyzed, taking into account their specific requirements. Examples of successful AI applications for optimizing business processes and improving operational efficiency are provided. The article emphasizes the importance of developing algorithms tailored to the unique challenges of each business.

Key words: artificial intelligence, AI, business tasks, problem-solving algorithms, optimization, machine learning, ML, data analysis, adaptation.

Language: English

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Introduction

Artificial Intelligence (AI) has become an indispensable tool in addressing the multifaceted challenges faced by modern businesses. Its ability to process vast amounts of data, detect complex patterns, and make autonomous decisions has catalyzed significant transformations across a wide range of industries. AI applications span from automating operational processes to providing enhanced predictive capabilities, enabling organizations to improve efficiency, optimize decision-making, and gain competitive advantages. However, the effective implementation of AI requires the development of algorithms specifically adapted to the unique complexities and requirements of individual business sectors.

Certain industries, such as finance, healthcare, and manufacturing, encounter highly specialized problems that cannot be fully addressed through standardized AI solutions. These industries require tailored AI algorithms that take into account specific operational constraints, data structures, and performance goals. For instance, AI applications in financial services may focus on optimizing risk

management or detecting fraud, while in healthcare, the emphasis may be on improving diagnostic accuracy or optimizing treatment strategies. Similarly, in retail, AI is used for demand forecasting and supply chain management, requiring algorithms precisely tuned to the specific dynamics of the industry. The objective of this research is to analyze the development of AI algorithms specifically tailored to solve industry-specific business problems.

Main part. Understanding business problems

Business problems are specific obstacles or inefficiencies within an organization that hinder productivity, increase costs, or delay operations. Identifying and solving these issues is crucial for optimizing overall business performance. Effectively deploying AI in business requires a clear understanding of the specific challenges it seeks to address, which vary across industries. Its impact is most significant in data-rich environments with complex, repetitive tasks and dynamic variables. AI-driven solutions are particularly valuable for problems that involve automation and predictive analytics, where real-time decision-making is essential (table 1).

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Table 1. Types of business problems that benefit from AI solutions [1, 2].

Type of business problem	Industry	AI solutions
Risk management and fraud detection	Finance	AI algorithms analyze large datasets in real time to identify anomalous patterns, facilitating the detection and prevention of fraud while improving risk management.
Customer service optimization	Retail, communications	AI-powered chatbots and virtual assistants provide continuous customer support, enhancing response times and reducing operational costs.
Supply chain and inventory management	Retail, manufacturing	AI enhances demand forecasting and optimizes supply chain management, minimizing waste and improving inventory efficiency.
Predictive maintenance	Manufacturing	Machine learning (ML) models predict equipment failures, enabling preventive maintenance that reduces downtime and increases operational productivity.
Personalized marketing and recommendations	Retail, media	AI facilitates personalized product recommendations and targeted marketing by analyzing customer preferences and behavioral data.
Predictive healthcare diagnostics	Healthcare	AI algorithms analyze patient data to forecast disease outcomes, recommend treatment options, and improve diagnostic accuracy.
Process automation	Finance, insurance	AI automates administrative processes such as document handling and compliance checks, enhancing operational efficiency and accuracy.

From the author's perspective, by developing specialized algorithms for distinct business contexts, organizations can enhance their operational efficiency and create new opportunities for innovation. However, the success of these implementations depends heavily on a thorough understanding of the industry's unique demands, appropriate data infrastructure, and the ability to scale AI systems effectively. In this light, AI emerges as a key enabler of strategic transformation, offering businesses a competitive advantage in an increasingly data-driven economy.

Development process of AI algorithms

The creation of AI algorithms to address business challenges is a multi-stage endeavor that demands a comprehensive understanding of both AI technologies and the specific needs of the industry. The effectiveness of an AI solution is largely determined by the degree to which its algorithm is tailored to the unique characteristics of the problem it aims to address [3].

The first stage of AI algorithm development is the precise **definition of the business problem**. This step involves translating a real-world issue into a problem that can be addressed by AI. It requires collaboration between technical experts and business stakeholders to ensure that the objectives are clear and measurable.

The next critical phase is **data collection**. AI models depend on vast amounts of data to learn and make accurate predictions or classifications. The quality, quantity, and relevance of the data directly influence the performance of the algorithm. In business applications, data is often sourced from

customer transactions, operational processes, or external systems such as financial markets or supply chains. This data must be cleaned, pre-processed, and sometimes augmented to ensure that it is suitable for training AI models.

Choosing the right AI model is crucial in development, based on the business issue and available data. Supervised models, like decision trees and deep learning, are suited for tasks with labeled data, such as fraud detection. Unsupervised models, including clustering, handle unlabeled data to reveal patterns like customer segmentation. Reinforcement learning, valuable in robotics, uses trial and error for optimization problems like dynamic pricing. After model selection, **training begins**, adjusting parameters to minimize error and enhance accuracy.

The development of algorithms is not a one-time process but rather an iterative cycle, requiring continuous monitoring and adjustment to maintain optimal performance over time. Once **deployed**, the algorithm's performance is **monitored** continuously, and adjustments are made as needed. This is especially important in dynamic business environments where conditions, customer behaviors, or external factors may change over time. Regular updates to the model, including retraining with new data, are necessary to maintain optimal performance.

Application of AI in various industries

The incorporation of AI into various industries is facilitating significant advancements by offering solutions specifically designed to address sector-specific challenges. In the **financial sector**, the use of AI has transformed key operations such as trading, fraud detection, and customer management [4].

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Goldman Sachs, a leading global investment banking and financial services firm, has been at the forefront of integrating AI into its algorithmic trading systems. The company has implemented advanced ML models capable of analyzing large volumes of market data in real time. These technologies enable the firm's trading systems to execute rapid, data-driven decisions by predicting market trends and optimizing the timing of trades. By leveraging AI, Goldman Sachs significantly enhances both the speed and precision of its trading operations, allowing it to

navigate the complexities of financial markets with greater efficiency than traditional methods. This AI-driven approach positions the firm to respond more dynamically to market fluctuations and capitalize on trading opportunities. According to Goldman Sachs' estimates, AI has the potential to automate many work tasks and accelerate global economic growth. Research suggests that AI could automate approximately 25% of labor tasks in developed economies and 10-20% of work in emerging economies (fig. 1).

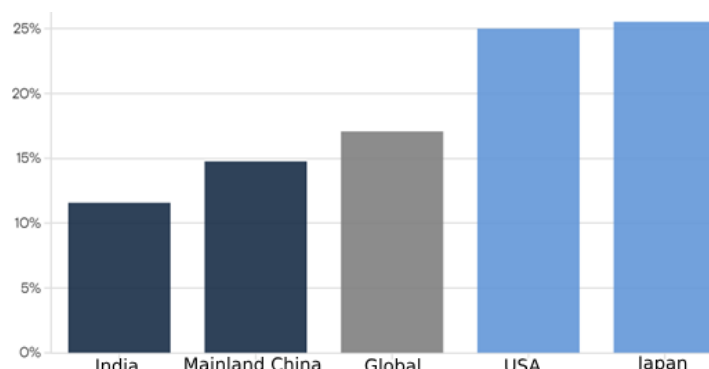


Figure 1. Share of full-time equivalent employment exposed to automation by AI [5].

According to estimates by economists at Goldman Sachs Research, AI could boost productivity growth in the USA by 1.5 percentage points annually, provided it is widely adopted over a 10-year period [5].

The implementation of AI-driven, tailored solutions at Goldman Sachs has contributed to the enhancement of the firm's financial performance. In 2023, total revenue reached \$46,25 billion, compared to \$59,34 billion in 2019 [6]. This progress reflects the firm's ability to integrate advanced technologies to optimize business processes. Goldman Sachs' strong

client-focused strategy has led to substantial growth in its customer base, positioning the company among the top three service providers globally across key sectors.

JPMorgan Chase, a leading global financial services firm, leverages advanced AI technologies to enhance its fraud detection capabilities across the vast volume of transactions it processes daily [7]. By employing sophisticated ML algorithms, the company is able to analyze transaction data in real time, identifying patterns and anomalies that may indicate fraudulent activity. PMorgan Chase holds the top position in the 2023 AI Index for global banks (fig. 2).

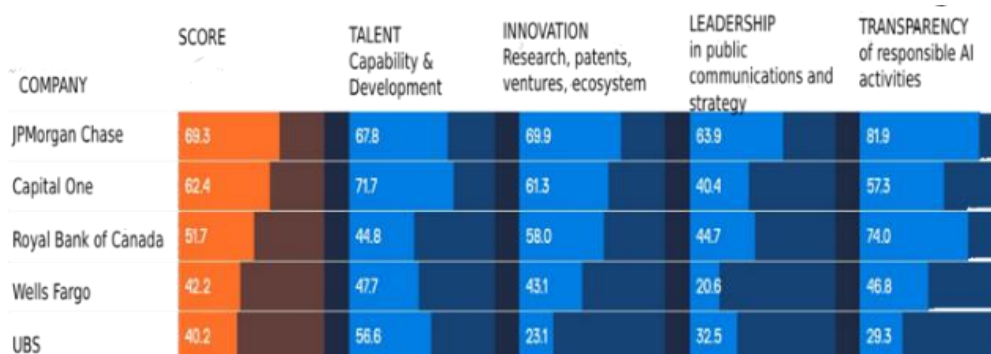


Figure 2. AI Index for global banks [8]

This index encompasses 50 of the largest banks across North America, Europe, and Asia. Each institution is evaluated based on more than 100 individual metrics, derived from millions of publicly available data points. The assessment focuses on four key components: talent, innovation, leadership, and

transparency. These criteria provide a comprehensive view of how effectively banks are integrating AI into their operations and leadership strategies [9].

In the **manufacturing sector**, AI has emerged as a pivotal tool in enhancing processes, particularly in the areas of predictive maintenance and process

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optimization. AI technologies are now integral to improving operational efficiency, allowing companies to anticipate equipment failures and optimize production workflows.

Caterpillar, a prominent American manufacturer of construction and mining equipment, has implemented AI-driven solutions to address key operational challenges, particularly through predictive maintenance and autonomous machinery. By

leveraging real-time sensor data, the company anticipates equipment failures and schedules proactive maintenance [10]. Additionally, Caterpillar's fleet of AI-powered autonomous mining trucks optimizes hauling operations, reducing downtime and costs. These AI innovations have significantly enhanced operational efficiency, and as a result, have contributed to improved financial performance for the company (fig. 3).

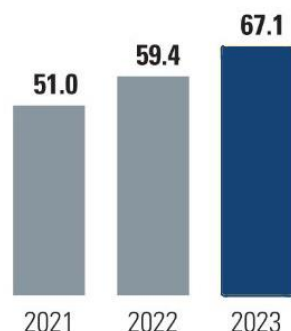


Figure 3. Caterpillar's revenue, billion dollars [11].

This increased efficiency not only streamlines operations but also enhances sustainability by reducing fuel consumption and emissions. Caterpillar's AI-driven systems also support better decision-making by providing real-time data analytics, enabling more precise control over machinery and production processes. As AI continues to evolve, Caterpillar remains committed to integrating these technologies to further boost performance, expand their capabilities, and maintain their competitive edge in the global market.

In the **healthcare sector**, AI is becoming increasingly essential for improving diagnostic

precision and optimizing treatment strategies. American healthcare companies have adopted AI to enhance patient outcomes and streamline healthcare services. A notable example is **IBM Watson Health**, which has developed AI-driven diagnostic tools to assist in identifying complex medical conditions. By processing large datasets, including medical literature, patient records, and clinical trials, Watson's AI offers physicians valuable insights, leading to more informed decision-making, particularly in cases where traditional diagnostic methods are insufficient (table 2).

Table 2. Applications of AI in medicine and their impact [12].

Application of AI in medicine	Description	Impact
Disease detection and diagnosis	AI models assist in monitoring patient vitals and diagnosing conditions like sepsis with enhanced accuracy.	Improved early detection of critical conditions, reducing mortality and treatment costs.
Personalized treatment recommendations	AI-powered systems provide real-time, tailored treatment plans to improve precision medicine.	Increased patient satisfaction and better clinical outcomes through more accurate, individualized treatments.
Medical imaging analysis	AI tools analyze imaging data (CT, MRI, X-rays) to detect early signs of diseases like cancer.	Faster, more accurate detection of abnormalities, improving treatment success rates and reducing human error.
Clinical trials optimization	AI accelerates clinical trials by optimizing data management and improving search processes.	Faster drug development cycles, reduced trial costs, and more efficient patient recruitment.
Drug discovery and development	AI helps reduce costs in drug development by identifying new drug combinations and optimizing design processes.	Reduced time-to-market for new drugs, lower research costs, and improved success rates in drug discovery efforts.

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Healthcare professionals are increasingly empowered to make more informed decisions through advanced data analysis enabled by AI, which helps reduce human error and improve patient outcomes. By integrating AI technologies, medical processes become more accurate and efficient, as demonstrated by IBM's predictive model for premature infants, which accurately identifies severe sepsis 75% of the time [12]. These developments underscore the broader potential of AI in enhancing medical diagnosis and treatment, driving better patient care and increasing the overall effectiveness of healthcare systems.

Retail companies in the USA increasingly leverage AI technologies to enhance customer experiences and streamline supply chain operations. ML models are widely used to personalize marketing campaigns and optimize inventory management.

Amazon, a leader in AI-driven personalized marketing, utilizes advanced recommendation systems to analyze customer browsing and purchasing behavior. This AI-based system continuously refines itself to provide highly relevant product suggestions, significantly improving customer engagement and boosting sales. In 2023, Amazon's total revenue increased by 12% year-over-year, growing from \$514 billion to \$575 billion (fig. 4).

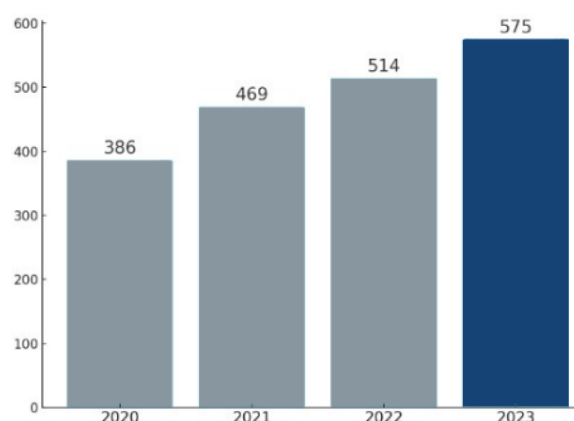


Figure 4. Amazon's revenue, billion dollars [13].

In supply chain management, Amazon uses AI to optimize inventory levels, predict demand, and streamline logistics. By applying ML algorithms to historical sales data and external factors, the company ensures efficient stock management and reduces overstocking or stockouts [14]. This predictive capability enhances overall supply chain performance, reducing costs and improving delivery speed.

Conclusion

The development of AI algorithms tailored to specific business tasks is one of the crucial factors for enhancing operational efficiency, improving decision-making processes, and gaining competitive advantages across various industries. By meeting the unique requirements of sectors such as finance, healthcare, and manufacturing, these algorithms

enable organizations to solve highly specialized problems that standardized AI models may address inefficiently. A key element of success lies in understanding industry constraints, operational goals, and the availability of data for training AI models. The development of an effective algorithm is an iterative process that involves problem definition, data preparation, model selection, and continuous improvement. The impact of AI-driven solutions is particularly significant in areas like predictive maintenance, fraud detection, and personalized marketing, leading to improved business outcomes and innovation. Overall, AI is positioned as a transformative tool, enabling companies to adapt to dynamic market conditions and leverage data analytics to optimize performance.

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