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Artificial Intelligence for Modern Business

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Abstract: Over the course of human history, we have experienced various transformations that have altered how we conduct business in the real world. In the age of Industry 4.0, Artificial Intelligence (AI) has emerged as a crucial asset, enabling businesses to attain market competitiveness. This article aims to provide a comprehensive understanding of AI and its impact on different types of businesses. Although AI is revolutionary in many aspects, it necessitates several considerations before an organization can adopt this capability. Therefore, the article comprehensively analyzes how AI influences modern businesses by examining their real-world operations.

Keywords: Artificial Intelligence, Machine Learning, Computer Vision

I. INTRODUCTION

Artificial Intelligence (AI) has been a buzzword in recent times, and we are currently in the early stages of an AI revolution that will significantly change how businesses operate in the future. It is widely believed that we are currently in the midst of the Fourth Industrial Revolution, also known as Industry 4.0. This term describes integrating critical technological components and operations, including advanced technologies such as robotics and AI, in business and technology sectors (Xing et al., 2023).

Artificial Intelligence is explained as the ability of an artificially created entity to solve a complex problem with the help of intelligence (Anant et al., 2022). AI is often associated with a computer's ability to simulate and perform complex tasks (Fabio, 2022). Since ancient times, several scholars used mathematical and statistical concepts to solve day-to-day problems. As the complexity of the problems increased, there was a scarcity of efficient programming languages, skilled resources, computing power, etc, to address them.

II. GROWTH OF AI IN RECENT TIMES

The concept of 'artificial neurons' was introduced in the year 1943, paving the way to a new era of studies referred to as 'Artificial Neural Network.' However, in the year 1956 Dartmouth Conference, the term 'Artificial Intelligence' (AI) was formally introduced within the research community. Since then, AI research has been one of the most popular research themes (Siderska, 2020). AI has grown tremendously, touching many businesses. To understand this accelerated growth of AI, we can look deeply at the critical drivers of growth.

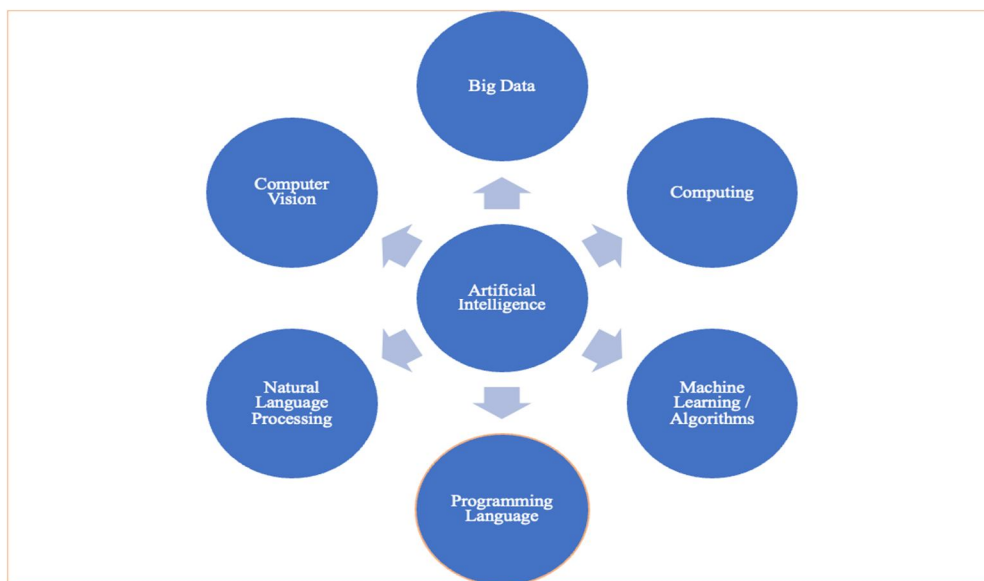


Figure 1: Drivers of AI Growth

A. Big Data (BD)

The world has seen a significant rise in data generation due to the increasing use of smart devices and the Internet of Things (IoT) appliances. BD refers to a vast and intricate data collection that cannot be quickly processed, managed, or synthesized through conventional data processing techniques (Holmes, 2017).

BD is often characterized by three core elements: Volume, Velocity, and Variety.

- Volume refers to the volume of data generated and collected from various sources, including computers and intelligent systems (Bello-Orgaz et al., 2016).
- Velocity refers to the speed at which the data is created, modified, and processed (Bello-Orgaz et al., 2016)
- Variety refers to the range of types and formats of data, ranging from organized data, such as tabular data, to something like videos or social media data (Bello-Orgaz et al., 2016)

BD provides a set of complex tools that enable the capture of large amounts of data with varying characteristics. This data serves as critical contextual information for AI algorithms to understand how to make accurate predictions. With BD, intricate trends and hidden patterns within the data can be identified, which ultimately helps AI to make reliable predictions about the future (Tsai et al., 2015).

To effectively utilize big data, it is crucial to employ certain advanced technologies and techniques such as Data Mining, Data Analytics, Machine Learning, and Distributed Computing. Collecting, storing, and processing large amounts of data is necessary to make informed decisions using AI. Therefore, it is necessary to have scalable and efficient algorithms and a robust computational infrastructure that can handle such a challenge (Tsai et al., 2015; Kolajo et al., 2019).

B. Machine Learning / Algorithms

Machine Learning is a scientific field that teaches computers to learn from data and identify patterns. This ability enables computers to make predictions and decisions without explicit programming, automatically learning from real-world data. Machine learning involves developing models and algorithms to analyze and interpret large datasets. The identified patterns are used to make predictions or decisions (Abramson et al., 1963; Das et al., 2020).

Here are some applications of ML in the real world:

- Diagnosing and predicting of diseases (Deo, 2015)
- Determine product recommendations to customers (Kamble, 2022)
- Filtering spam emails from a user's inbox (Stefaneas (2023)

C. Computing / Hardware

AI relies heavily on computing/hardware to process large volumes of data and demands heavy computing and storage capabilities (Li, 2023). The recent advancements in this field, including Distributed Computing and Cloud Computing, have helped us overcome this challenge effectively (Silva and Victor, 2023). AI heavily relies on computational learning, thus requiring high-performance computing to extract information from large data sets (Zhou, 2021)

D. Programming Language

Programming languages like Python and R, are crucial for AI development activities. These programming languages come with extensive libraries and frameworks, simplifying the creation of algorithmic models. For example, one of the most important libraries in Python is Scikit-learn (Riese et al., 2019). Python is a language of choice due to its simplicity and versatility (Pilnenskiy & Smetannikov, 2020). However, almost all high-level programming languages provide support for ML frameworks. Therefore, programming languages play a critical role in enabling the application of AI across different business use cases.

E. Natural Language Processing (NLP)

NLP plays a significant role in enabling machines to understand and process human languages. NLP employs various computing techniques to analyze, interpret, and generate human language content (Hirschberg & Manning, 2015). This enables AI systems to interact with users through natural language interfaces in more intuitive, personal, and user-friendly manners (Almuhana & Abbas, 2022). NLP has numerous applications, and information retrieval is one of the most crucial ones. This involves analyzing vast amounts of data and extracting the relevant information as text. Such analysis is instrumental in search engines, document classification, and recommendation systems use cases (Larson, 2009).

Text data, such as social media posts or customer reviews, can be analyzed to determine the sentiments or emotions expressed by the customers. This is called Sentiment Analysis. NLP techniques are used to analyze the language and context of the text to identify whether the sentiment is positive, negative, or neutral. This information is valuable for businesses as it helps them understand customer opinions, make informed decisions, and improve their products or services (Zhu, 2022).

F. Computer Vision (CV)

CV is a crucial aspect of artificial intelligence (AI) that allows machines to interpret and comprehend visual data from images and videos. Object detection and classification are particularly noteworthy among the many applications of CV. This technology has a wide range of uses across multiple business sectors, including:

- CV algorithms can analyze medical images like X-rays and MRIs to improve the accuracy and efficiency of diagnosis, disease detection, and treatment planning (Tizhoosh & Pantanowitz, 2018).
- CV enables robots to autonomously navigate, manipulate objects, interact with humans, and build or assemble systems (Sophokleous et al., 2021).

III. THE ROLE OF AI IN MODERN BUSINESS

AI has become essential in modern business, offering valuable capabilities and competitive advantages (Harayama et al., 2021). Looking at the core business benefits is a pivotal way to evaluate and understand AI's role.

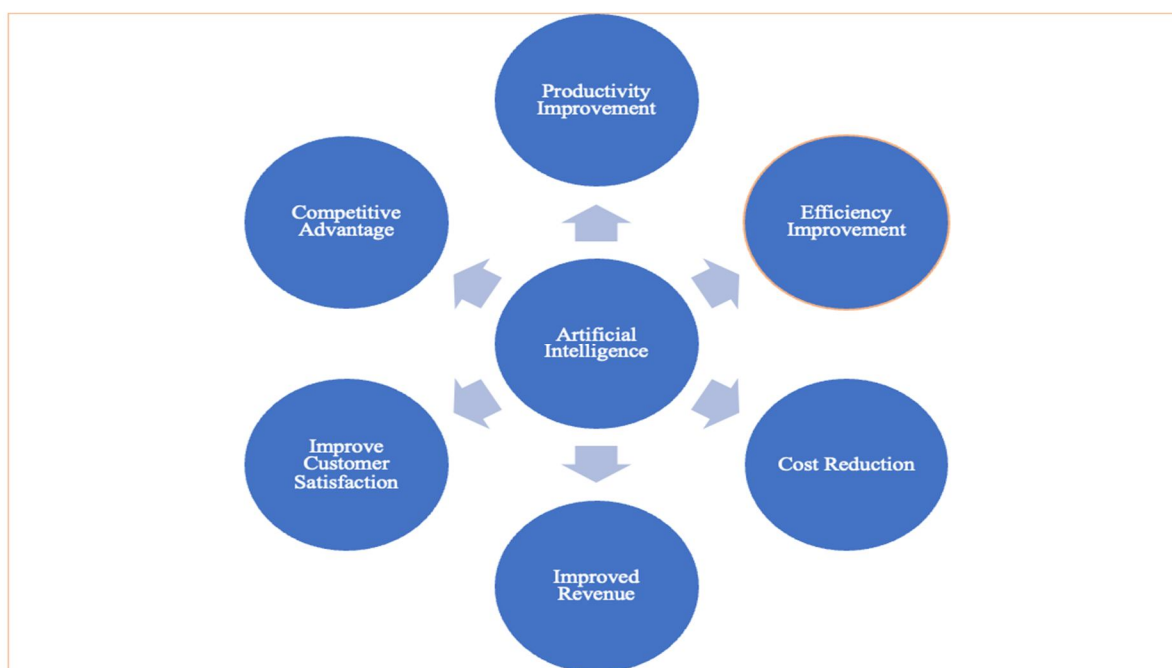


Figure 2: AI Business Benefits

A. Productivity Improvement

AI can enhance productivity by automating routine and mundane tasks, thereby freeing human resources to focus on complex and strategic activities.

- 1) AI is extensively used to automate data entry, processing, customer support, and inventory management tasks. This reduces manual effort and improves operational efficiency (Aghion et al. (2017)).
- 2) AI can enhance productivity by processing large volumes of healthcare data, such as medical records and diagnostic images, assisting in diagnosis, treatment planning, and patient monitoring (Jiang et al., 2017).
- 3) With the evolution of Generative AI, we can see that AI can undoubtedly enhance productivity through personalized customer interactions. Chatbots and virtual assistants driven by AI can handle inquiries, offer support, and provide recommendations. This increases productivity by reducing response times and handling more significant inquiries simultaneously (Sebastian et al., 2023).

- 4) AI can aid data-driven businesses by accurately forecasting demand and inventory needs by analyzing historical data and customer purchase patterns (Tong et al., 2021).

In conclusion, AI has the potential to improve productivity in modern businesses significantly. The key benefits of using AI are streamlining processes, enhancing decision-making, and freeing up human resources to focus on higher-value tasks.

B. Efficiency Improvement

AI can potentially enhance efficiency in modern businesses across various sectors. Some use cases include:

- 1) Supply chain optimization: AI algorithms optimize inventory management and reduce lead times by analyzing data from various sources, such as demand forecasts and logistical data (Mohsen, 2023).
- 2) Resource Efficiency: AI can optimize resource allocation to increase efficiency and achieve sustainable business goals in manufacturing, logistics, and energy while reducing waste (Waltersmann et al., 2021; Yigitcanlar, 2021).
- 3) Fault Detection and Prediction: AI can analyze real-time data to detect manufacturing faults, improve efficiency, and identify quality issues (Waltersmann et al., 2021).

C. Cost Reduction

As demonstrated by the examples mentioned earlier, using AI can significantly enhance a company's efficiency, allowing them to scale their operations in previously unattainable ways. This, in turn, leads to a reduction in costs and serves as a significant advantage of implementing AI technologies.

- 1) Business Model Innovation: AI technologies enable businesses to optimize operations, develop innovative products and services, and reduce costs, leading to increased profitability (Jöhnk et al., 2020).
- 2) Predictive Maintenance: By analyzing sensor data and historical records, AI can predict equipment failures and optimize maintenance schedules (Dubey et al., 2020).

D. Improved Revenue

AI automation optimizes business costs and identifies new opportunities.

- 1) Personalized Marketing: With the assistance of AI, companies can analyze customer data, preferences, and purchasing behavior to personalize marketing campaigns and offerings. By delivering targeted and relevant content to customers, businesses can increase customer engagement, conversion rates, and overall revenue (Canhoto & Clear, 2020).
- 2) Pricing Optimisation: Businesses can increase revenue by dynamically adjusting prices based on market conditions, competitor pricing, and customer behavior (Canhoto & Clear, 2020).

E. Customer Satisfaction

AI has the ability to analyze customer sentiment and feedback through non-traditional channels like social media, review forums, etc. Businesses can improve customer satisfaction and loyalty by monitoring and addressing customer concerns and feedback in real time (Nguyen et al., 2021). AI technologies using Voice and NLP enhance customer interaction with devices and systems, improving convenience and satisfaction (Huang & Rust, 2022). Businesses can use AI to extract insights from customer feedback and continuously improve their offerings (Dantsoho et al., 2021).

F. Competitive Advantage

After analyzing the details discussed earlier, it is clear that AI can provide various capabilities to organizations, resulting in a competitive advantage for the overall business. It includes:

- 1) Enhanced Decision making
- 2) Improved efficiency and productivity
- 3) Personalized Customer Experience
- 4) Innovation and new business models
- 5) Operational Optimisation
- 6) Improving marketing and customer insights
- 7) Process optimization and cost reduction
- 8) Improved planning and forecasting

(Birnbbaum et al. (2005); (Wamba-Taguimdje et al., 2020); (Lee et al., 2019); (Jarrahi et al., 2022). (Papagiannidis et al., 2022). (Mi et al., 2023). (Awamleh & Bustami, 2022). (Sharma et al., 2021).

IV. CHALLENGES IN THE USE OF AI FOR BUSINESS

Businesses encounter critical challenges while adopting AI. These challenges are listed below.



Figure 3: Business Challenges of Using AI

<u>BUSINESS CHALLENGE</u>	<u>DETAILS</u>
ORGANIZATIONAL AND MANAGERIAL CHALLENGES	Businesses must assess their readiness for AI adoption, including evaluating infrastructure, processes, and culture. This involves aligning to organizational goals, securing investment support, and fostering a culture of innovation and learning (Jöhnk et al, (2020). AI adoption can introduce risks such as cybersecurity threats, algorithmic bias, and disruption of existing processes. To ensure successful adoption of AI technologies, businesses must identify and manage these risks (Alami et al., 2020).
LACK OF QUALITY OF DATA	The effectiveness and accuracy of an AI system largely depends on the quality of data used for its training and decision-making process. However, collecting and managing good quality data can be a challenging task. Proper governance processes must be in place to ensure the availability of high-quality data.
ETHICAL CONCERNS	Businesses must establish ethical AI processes to address transparency, accountability, bias and privacy concerns (Kioko et al., 2022).
CULTURAL AND ORGANIZATIONAL CHANGE	Businesses must overcome cultural barriers to AI adoption by fostering an innovative environment with training and support for employees (Mogaji & Nguyen, 2021).
LEGAL AND REGULATORY CONSIDERATIONS	The adoption of AI technologies raises legal and regulatory considerations, including intellectual property rights, data protection, and compliance with industry-specific regulations. Businesses need to navigate these legal and regulatory challenges to ensure compliance and mitigate risks (Chaudhuri et al., 2022).
CHANGE MANAGEMENT	Effective change management strategies are crucial for successful AI adoption, as businesses may face challenges in managing cultural and organizational changes such as employee resistance, training, and communication (Lahlali et al., 2021).

Table 1: Business Challenges of Using AI

V. CONCLUSION

It's crucial for businesses to adopt AI capabilities to stay competitive in today's market. However, this also comes with its own set of challenges. It's equally important for businesses to align their organizational strategy with AI strategy so that the competitiveness of AI can bring real value to the business. Since AI is still a relatively new and rapidly growing field, businesses are still trying to understand its true potential and threats fully. That's why it's essential to focus on AI within the organization and stay ahead of the curve.

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