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Expertise of Digital Reality as a Factor of Achieving Society Stability Under Stochastic Conditions (Uncertainty, Instability, Bifurcation)

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Abstract

The significance of research into artificial intelligence in a digital society is underscored by several driving forces for change, including space exploration, biotechnology, and emerging technologies. These developments have profound implications for human society, impacting various contemporary concerns such as economics, politics, ethics, law, and conflict resolution. In navigating this digital landscape, anthropology must reexamine the place of humans within a society increasingly intertwined with artificial intelligence, encompassing consciousness and even the physical body. The primary objective of this study is to conceptualize artificial intelligence as a catalyst for ecosystem growth within the realms of technological, ontological, and anthropological dimensions.

Keywords
artificial intelligence, machine learning, automation, augmented reality, big data

Introduction

The specific aims of the study are as follows:

1. To scrutinize artificial intelligence as a potential and versatile resource applicable across all sectors of the economy, within the context of technological dimensions.
2. To explore the convergence of big data with artificial intelligence and its fundamental components, within the framework of ontological dimensions.
3. To unveil the role of artificial intelligence in enhancing the efficiency of digitalizing society and human life, within the scope of anthropological dimensions.

The article focuses on the contributions of eminent scientists who have made breakthroughs in comprehending artificial intelligence as a multifaceted social, economic, and cultural phenomenon. These scholars include Regina Andriukaitiene et al. (2017a), Nick Bostrom (2014), Ashley Vance (2014), Sunil Gupta (2018), Diamandis & Kotler (2020), Patrick Dixon(2015), Kai-Fu Lee (2018), Kevin Kelly (2018), Dagogo Altreide (2019), David Rowan (2019), Chris Skinner (2018), Christopher Steiner (2012), Max Tegmark (2017), Klaus Schwab (2017), along with our own research.

Research methodology

Variety of methodological approaches have been analyzed, with a particular emphasis on the anthropogenic component. The research methodology employed here is rooted in the information-anthropogenic analysis method, based on the fundamental premise that any processes involving artificial intelligence necessitate the involvement of information as an object and humans as subjects of cognition. All exchanges of substance, energy, or information are contingent on human goals and interests, subject to human control and programming, and rely on information interaction and components. The Agile methodology, known for adapting complex socio-economic systems, and the synergetic method, grounded in self-organizing processes, have played pivotal roles in shaping the concept of artificial intelligence and its associated principles, factors, conditions, models, and mechanisms governing human-society interaction.

The research has established that artificial intelligence (AI) is a comprehensive term encompassing machines that emulate human intelligence, incorporating pattern recognition and computational capabilities that enable the identification of patterns in vast datasets, often referred to as „big data." An AI system is defined as a machine system that possesses varying degrees of autonomy and the capacity to impact its environment by generating outputs, including predictions, recommendations, and decisions, all tailored to specific goals aimed at advancing society's digitalization. However, the rise of artificial intelligence also brings forth a multitude of challenges, including concerns related to polarization, heightened surveillance, loss of control, privacy infringements, increased inequality, and the potential for unjust power structures within states.

Central to this evolution is the convergence of big data and artificial intelligence, which stands as the most significant development shaping the future of organizations leveraging data and analytical capabilities for their operations. While the terms „artificial intelligence" and „machine learning" are often used interchangeably, they represent distinct concepts. Both terms come up a lot when talking about big data, analytics and the big waves of technological change that are sweeping the world. Machine learning, as a class of algorithms, automates the construction of analytical models that empower computers to learn without explicit programming. These algorithms iteratively learn from data, enabling computers to uncover concealed insights without the need for explicit instructions.

In light of emerging technologies such as automation, the Internet of Things, augmented reality, drones, 5G connectivity, and artificial intelligence, industries spanning construction, engineering, utilities, communications, manufacturing, automotive, and state and local government sectors are presented with unprecedented opportunities to address their most intricate challenges through the transformative influence of artificial intelligence.

Analysis of Recent Studies and Author's Reliance for Initiating Problem Solution

The author relies on the work and contributions of several scientists who have made significant breakthroughs in the study of artificial intelligence as a complex phenomenon.

These researchers include Regina Andriukaitiene et al. (2017a), Nick Bostrom (2014), Ashley Vance (2014), Sunil Gupta (2018), Diamandis & Kotler (2020), Patrick Dixon(2015), Kai-Fu Lee (2018), Kevin Kelly (2018), Dagogo Altreide (2019), David Rowan (2019), Chris Skinner (2018), Christopher Steiner (2012), Max Tegmark (2017), Klaus Schwab (2017). Additionally, the article draws from conceptual publications by various authors, including V. Voronkova et al. (2021a; 2021b), V. Nikitenko et al. (2017), R. Oleksenko, Y., Kivlyuk, V. Marienko (2021), A. Cherep et al. (2020). These publications contribute to the understanding of artificial intelligence's place and role in the digital society.

Addressing Unresolved Aspects of the General Problem at the Heart of this Article

Artificial Intelligence tools have introduced a range of innovative capabilities for businesses, offering new opportunities and efficiencies (Haenlein & Kaplan, 2021; Kulkov, 2021; Moradi & Dass, 2022; Wei & Pardo, 2022). However, the adoption of AI technology also gives rise to significant ethical concerns (Wright & Schultz, 2018; see also Omrani et al., 2022). Many of the most advanced AI tools are underpinned by deep learning algorithms. The effectiveness of these algorithms depends on the data they are exposed to during training. Since humans curate the data used for AI training, there is an inherent risk of introducing human bias into AI systems. Consequently, meticulous control measures are necessary to mitigate this risk effectively.

Moreover, some industry experts argue that the term „artificial intelligence" carries a strong association with popular culture, which has led to unrealistic fears among the general public regarding AI's capabilities and potential impact. Conversely, there are also exaggerated expectations regarding how AI will revolutionize workplaces and daily life. In response to these perceptions, researchers and marketers are exploring the use of the term „augmented intelligence." This alternative label has a more neutral connotation, aiming to convey the idea that artificial intelligence will primarily enhance products and services rather than replace human roles entirely. As the understanding of artificial intelligence continues to evolve, it is transforming into a comprehensive framework composed of principles, factors, conditions, models, and mechanisms (Voronkova & Nikitenko, 2022).

Defining the Task and Establishing Article Goals

The primary objective of this article is to provide a comprehensive conceptualization of artificial intelligence as a catalyst for rapid growth within the technological ecosystem and its profound impact on human life. The research endeavors to achieve the following key objectives:

1. To assess how artificial intelligence can serve as a valuable resource across diverse segments of the economy.
2. To investigate the synergy between big data and artificial intelligence, including an examination of their core components.
3. To uncover the conceptual and practical aspects of artificial intelligence and its pivotal role in enhancing the efficiency of societal digitalization processes.

Analysis Methodology

The theory of artificial intelligence is inherently multidisciplinary, residing at the intersection of various fields such as economics, sociology, computer science, mathematics, and psychology. To comprehend the intricacies of artificial intelligence, it necessitates an interdisciplinary approach that synthesizes knowledge from these diverse domains. This approach is vital for elucidating the content and operational principles of the complex, invariant system that is artificial intelligence.

To analyze the contemporary model of artificial intelligence effectively, a systemic institutional-evolutionary approach is indispensable. This approach accounts for the evolution of artificial intelligence within different stages of human civilization development, including the agrarian (pre-industrial), industrial, post-industrial/information, and anthropogenic society phases. It is imperative that this civilizational approach not only considers logical and historical regularities but also incorporates integral aspects of the interplay between the historical development of theories and processes and their current states (Voronkova et al., 2021b).

In the study of artificial intelligence, the method of sublimation is crucial, as it allows for the identification of the content within various transformational stages and facilitates comparative analysis. Constructing the logical framework of any theory involves two key phases: induction and deduction. The induction phase entails moving from the concrete to the abstract, where central system-forming concepts, axiomatic requirements, or unified research approaches are defined. Subsequently, the deduction phase involves moving from the abstract back to the concrete, applying theoretical knowledge to practical contexts. This deductive method holds significant practical importance within the realm of artificial intelligence.

In addition to the deductive method, it is imperative to complement the analytical framework with an empirical approach when exploring artificial intelligence. This empirical approach entails adopting the fundamental tenets of artificial intelligence through a rigorous analysis of reliable empirical data. When evaluating various methodological approaches, it becomes evident that there is a significant anthropogenic dimension at play. The methodology of scientific research hinges on the method of information-anthropogenic analysis, rooted in the foundational belief that any processes related to artificial intelligence are intrinsically intertwined with information as an object and human as a subject of cognition.This perspective underscores that all exchanges involving substance, energy, or information are fundamentally influenced by the goals and interests of individuals. Such exchanges are meticulously controlled and programmed by humans and are founded upon the principles of information interaction and components. Additionally, within the realm of artificial intelligence, two specific methodologies, the Agile method, and the synergetic method, have played pivotal roles (Voronkova et al., 2021a).

Examining artificial intelligence (AI) as a contemporary global concern is a crucial undertaking, given its profound influence on diverse facets of society, potentially giving rise to ethical, social, political, and economic dilemmas. Several vital elements characterize the methodology for scrutinizing AI as a prevailing global issue:

1. A comprehensive approach: The analysis of AI necessitates consideration of multiple scientific disciplines, encompassing computer science, philosophy, psychology, economics, law, sociology, and others. It is imperative to comprehend the far-reaching effects of AI across all societal domains.
2. Ethical dimensions of AI: A pivotal facet of the examination involves delving into the ethical considerations associated with AI. This encompasses inquiries into responsibility, transparency, security, fairness, and the ramifications for human rights and freedoms.
3. Societal repercussions: In evaluating AI, it is crucial to explore its impact on various societal domains, including employment, education, healthcare, and communication. While AI presents new possibilities, it also introduces potential challenges.
4. Legal considerations: The scrutiny of AI involves an appraisal of the necessity for novel laws and regulations governing its usage and advancement. This may encompass issues such as copyright, data protection, and establishing liability for AI actions.
5. Economic ramifications: AI possesses the capacity to reshape the economic terrain, influencing employment, business models, and market dynamics. A comprehensive examination of AI's impact on the economy is instrumental for informed strategic decision-making.
6. International collaboration and security: When scrutinizing AI, it is imperative to

acknowledge its global character and the necessity for international cooperation and regulation, particularly in the realm of autonomous systems and AI weaponry, to address security concerns.

7. Public knowledge and education: Fostering awareness and educating the public about AI, elucidating its benefits and risks, assumes paramount importance. This initiative aims to ensure increased citizen engagement in policymaking and regulatory processes.
8. Exploration and ingenuity: The examination of AI should encourage ongoing research and the creation of innovative technologies while discerning possible challenges and corresponding solutions. The approach to analyzing AI as a worldwide concern should be methodical and inclusive, encompassing all facets of its influence on society and the global landscape. Striking a balance between AI advancement and upholding ethical, social, and legal standards is crucial to safeguarding the well-being of individuals and society.

AI examination should encourage collaboration among various sectors, including business, government, academia, and civil society. Cooperative endeavors are instrumental in addressing intricate challenges and ensuring the balanced advancement of technology. The methodology for AI analysis should encompass a monitoring system and risk assessment, enabling timely identification and resolution of issues. Given that artificial intelligence transcends national boundaries, a global analysis is imperative, considering diverse cultural, social, and economic contexts. Citizens ought to have the capacity to shape AI policymaking by actively engaging in discussions, public debates, and voting processes. This fosters a more democratic and equitable environment. The methodology for AI analysis should consider the requirements of diverse populations, including vulnerable groups, to promote inclusive technology development and mitigate inequalities. Establishing international standards and norms for AI regulation is crucial to ensure consistency and cohesion across nations and regions.

The scrutiny of AI should be a continuous and adaptable process, given the rapid evolution of the technology. It is crucial to adjust the methodology in response to emerging challenges and revelations. The approach to analyzing artificial intelligence as a contemporary global issue should be thorough, with a focus on ensuring safety, fairness, efficiency, and ethical utilization of the technology. Additionally, active engagement of all segments of society is essential, contributing to addressing the challenges posed by artificial intelligence in the context of contemporary issues.

Results

1. Artificial intelligence represents a multitude of driving forces for change, including but not limited to space exploration, biotechnology, and emerging technologies.

Characteristics of AI:

- All-encompassing: AI has the potential for application across various economic sectors, including but not limited to medicine and the arts.
- Scalable: Once an algorithm is developed, AI can be widely deployed at minimal cost to address problems of varying complexity.
- Automation of Human Cognitive Abilities: AI aims to automate a range of human cognitive abilities, from audiovisual perception to memory processes.

Disruptive Force: AI is a disruptive force, rapidly integrating into our daily lives (Voronkova et al., 2017).

2. The merging of big data and artificial intelligence is a critical development shaping data-driven firms. Although the terms artificial intelligence and machine learning are often used interchangeably, they are not precisely the same. The real value to businesses in both cases depends on data, leading to occasional confusion.

3. While humans can distinguish between their representations and the external world, artificial systems pose a unique challenge with a gap between their ontology and the human agent's. The biosemiotic perspective is crucial for creating autonomous ontologies in artificial agents, enabling subjective judgments. Current AI systems excel in specific tasks, but closing the conceptual gap between cognitive sciences and AI technologies is essential for meaningful progress.

Discussion with Justification of Scientific Results Obtained

1. Artificial Intelligence as a Potential Resource for Utilization Across All Economic Sectors: Technological Dimensions

Artificial intelligence represents a multitude of driving forces for change, including but not limited to space exploration (Bird et al., 2021), biotechnology (Artico et al., 2022), and emerging technologies. These advancements have far-reaching implications for human society, touching upon various contemporary issues such as economics, politics, ethics, law, and conflict (Carrillo, 2020; De Felice et al., 2022; Nguyen & Vo, 2022; Rajendra et al., 2022; Rodrigues, 2020). In light of these developments, anthropology, which traditionally studies the complexity and diversity of human societies, must now redirect its focus towards understanding the existence of human beings in a world intertwined with artificial intelligence, consciousness, and the very nature of their physical bodies. Artificial intelligence, often abbreviated as AI, serves as a broad term encompassing machines that emulate human intelligence.

The general problem at hand pertains to the multifaceted implications of Artificial Intelligence (AI) on society. AI is a broad term denoting machines that replicate human intelligence, particularly in recognizing patterns within extensive datasets, often referred to as „big data." An AI system is characterized as a machine capable of influencing its environment by generating outputs like predictions, recommendations, or decisions with varying degrees of autonomy. Key attributes of artificial intelligence include its utilization of data, the autonomy it exhibits in making decisions, and its capacity for interacting with the environment, other machines, and humans. These fundamental characteristics define artificial intelligence as a technology branch that underpins numerous daily applications (Andriukaitiene et al., 2017a).

AI exhibits several noteworthy characteristics. Firstly, it is all-encompassing, with the potential for application across various economic sectors, spanning from medicine to the arts. Secondly, it is scalable, meaning that once an algorithm is developed, it can be widely deployed at minimal cost to address problems of varying complexity (Bostrom, 2014). Thirdly, AI aims to automate human cognitive abilities, ranging from audiovisual perception to memory processes. Lastly, it is a disruptive force, rapidly integrating into our daily lives (Voronkova et al., 2017). This amalgamation of features positions AI as a potent force with considerable socio-economic impact, extending its influence not just as a technological advancement but also as a source of economic, political, and cultural influence. Given its multifaceted nature and its profound implications across social, economic, ethical, legal, and cultural domains, addressing the challenges posed by AI necessitates an interdisciplinary approach that transcends mere technological considerations. AI offers numerous opportunities, such as enhancing cognitive abilities for analyzing, modeling, and predicting events based on information, as well as improving environmental management. However, it also presents challenges, including potential polarization, increased surveillance, loss of control, privacy concerns, heightened inequality, and the potential for unjust power structures.

To ensure that AI development does not replicate current societal failures in addressing pressing global issues like climate change or poverty, it is imperative to underpin AI development with a critical analysis of historical, economic, cultural, and political structures shaping the human experience. This provides an opportunity to reevaluate what it means to be human in a world no longer centered solely on humanity, as we interact within a broader ecosystem comprising people, machines, and other artifacts.

The European Union's recent efforts to regulate AI through the Artificial Intelligence Act reflect the need for a balanced approach. The proposal categorizes AI programs based on their risk levels to fundamental rights and security, ranging from unacceptable risk (prohibited acts) to minimal or no risk, and stipulates corresponding requirements for AI systems at each risk level (Vance, 2015; European Commission, 2021).

Within the realm of data, the European Data Strategy promotes the establishment of various thematic data spaces where data can be shared among civil society, the public, and the commercial sector. Additionally, the European Data Governance Act seeks to facilitate voluntary data sharing by individuals and businesses while harmonizing the conditions for utilizing specific public sector data.

A significant and recent initiative is the future Data Protection Act, which extends user rights to access and share data generated by the products or services they engage with. This, along with other legislation governing digital services and the digital marketplace, aims to prevent major players from exploiting their dominant positions in ways that may detrimentally impact citizens, businesses, and consumers. The integration of these legal instruments serves to delineate the parameters for the advancement of artificial intelligence technologies in a manner that aligns with the core values of the European Union. These values encompass the utmost respect for human dignity, freedom, democracy, equality, the rule of law, and the safeguarding of human rights, all of which form the foundational bedrock of human existence.

Anthropological foundations of Artificial Intelligence aspires to redefine the concept of humanity in a world increasingly driven by AI. The ultimate goal is to steer our societies away from pervasive inequality, discrimination, and injustice. This collective endeavor necessitates the amalgamation of knowledge from diverse disciplines and critical social analyses to identify intricate connections and envision potential futures (Andriukaitiene et al., 2017b).

2. Converging Big Data and Artificial Intelligence: Exploring Ontological Dimensions

The convergence of big data and artificial intelligence represents the foremost transformative development that is shaping the future of businesses leveraging data and analytics capabilities. Artificial intelligence (AI) and machine learning (ML) have become ubiquitous buzzwords, often used interchangeably, especially in discussions revolving around big data, analytics, and the sweeping technological changes permeating our world. Both artificial intelligence (AI) and machine learning (ML) are commonly discussed in the context of big data, analytics, and the sweeping technological changes reshaping our world. The real worth these technologies offer to businesses is contingent upon data. However, while closely related, AI and ML are not identical concepts and can sometimes cause confusion.

Artificial intelligence (AI) embodies the intelligence displayed by machines, applied when a machine replicates „cognitive" functions typically associated with human intelligence, such as „learning" and „problem-solving." On the other hand, machine learning (ML) constitutes a class of algorithms that automate the construction of analytical models, equipping computers with the capability to learn without explicit programming. This iterative learning process enables computers to uncover hidden insights from data, all without requiring specific programming.

In our rapidly evolving technological landscape, featuring emerging innovations like automation, the Internet of Things (IoT), augmented reality, drones, artificial intelligence, and 5G connectivity, various industries, ranging from construction and engineering to utilities, manufacturing, communications, automotive, and state and local government, are presented with novel opportunities to tackle their most intricate business challenges. Consequently, the launch of the Oracle Industry Lab outside of Chicago serves as an incubator and testing ground, where potential customers and partners can explore the potential of 5G and other transformative technologies (Voronkova et al., 2017a).

Communication service providers (CSPs) are making substantial investments, amounting to billions of dollars, in constructing 5G and fiber networks. These investments are opening up new revenue opportunities within the enterprise market (Gupta, 2018). These opportunities span a wide range of applications, from powering intelligent factories and interconnected construction sites to facilitating robotic surgical procedures. The capabilities of 5G play a pivotal role in handling the vast volumes of data necessary for the rapid and effortless creation of digital cities. A remote resource known as „Spot" offers real-time environmental data, enhancing smart workflows. Oracle Communications technologies further enhance remote operations by facilitating intelligent, secure, and precise data sharing among the workforce, from the field to management or the cloud. 5G's capabilities make it well-suited for supporting smart grid deployments, characterized by low latency, high reliability, and secure communication. As individuals continue to strive for sustainable living, 5G can serve as the cornerstone for modernizing energy grids.

By providing consumers with a more dependable and seamless experience when interacting with smart and environmentally friendly home applications, we can expect increased usage and adoption. To illustrate the impact of consumer behavior on energy consumption, Oracle Energy and Water collaborated with Oracle Communications and Oracle Construction & Engineering to create a physical representation of the Connected Hub, or Tiny Town, within a laboratory setting. Through a virtual tour of the Connected Hub, viewers can engage with a simulated city and replicate real-world scenarios, observing how their actions influence the energy efficiency and reliability of the utility grid (Diamandis & Kotler, 2020).

This simulated city showcases smart utility technologies, including poles, wires, transformers, solar panels, a wind turbine, and even a miniature substation and gas assets linked to the electrical grid. The Connected Hub serves as a demonstration of how Oracle Energy and Water solutions can collaborate with communities to optimize energy efficiency, enhance reliability, and deliver cost savings to customers.

By employing machine learning, CSPs have the capability to proactively identify issues as they arise, ensuring consistent quality of service across their network, be it wireless or wired. This commitment to closed-loop automation aims to deliver a comprehensive experience for both customers and employees. While fiber networks can serve as a distinguishing service offering, it's essential to maintain continuous monitoring to prevent or minimize customer frustrations stemming from network failures.

Effective communication plays a pivotal role in enabling billions of people to engage in work, social interactions, shopping, and entertainment within the digital realm. By embracing an ecosystem-oriented approach driven by research and development, the communications industry is poised to assist service providers and other technology firms in exploring and validating use cases that will expedite new revenue opportunities with 5G support.

The terms „anthropogenesis" and „technogenesis" represent two facets of the same phenomenon, highlighting the profound symbiotic relationship between them. In the context of digital technogenesis, the very essence, characterized by information and electrical elements, undergoes closer interaction and interference between these two functions (Dixon, 2015).

This convergence results in the concept of the „digital technological self," which entails the continuous reprocessing of data in collaboration with machines. The ultimate aspiration of artificial intelligence has long been the creation of synthetic minds capable of human-like thinking (Hibbard, 2002). There are several paradigms within artificial intelligence:

- Traditional artificial intelligence (GOFAI).
- Machine learning (ML) systems.

- Artificial neural networks (ANN).
- Situational, dynamic systems (SED).

However, it's important to note that the real-world ontologies internalized by these artificial intelligence paradigms do not align with the external world; there exists an ontological gap. In other words, how these systems internally represent the external world differs significantly from the actual state of the world. Artificial intelligence systems, regardless of the paradigm used, do not establish a connection with reality in the same manner as humans, and thus, they do not construct a comprehensive ontology that encompasses both the internal world and external reality (Lee, 2018).

A URI, which stands for Uniform Resource Identifier, serves the purpose of uniquely identifying a resource. This resource can encompass anything possessing a distinct identity, represented as a string that adheres to web address syntax. In the realm of artificial intelligence, ontology finds extensive utility, primarily contributing to the enhancement of data quality within training datasets. It plays a pivotal role in ensuring greater consistency and facilitating seamless navigation for users seeking to transition from one concept to another within the ontology structure. Furthermore, ontologies can be leveraged to construct a knowledge graph comprising individual facts. Knowledge, in this context, is portrayed as a collection of entities, wherein nodes and the connections between them elucidate the nature and relationships between these entities (Kelly, 2018).

Notably, there has been a recent trend in implementing ontologies using the Web Ontology Language (OWL). A subject-oriented ontology represents a fusion of AI-driven tools for data analysis, capable of offering pertinent data insights and identifying emerging trends and data patterns. This implies that ontologies can adapt to the unique objectives of each organization by employing logical, semantic, or mathematical methodologies.

3. Artificial Intelligence's Contribution to Human and Societal Digital Evolution: Anthropological Insights

Human consciousness actively constructs an internal ontology rather than passively receiving it. The conceptualizations of an external ontology are considered more or less accurate, primarily because this accuracy is essential for effective communication with the external reality. This signifies that we bear responsibility for the ontology we formulate. We can discern between our mental representations and the external world, recognizing the distinctions between them and comprehending their implications. In essence, we acknowledge the existence of the ontological gap, particularly in relation to artificial systems. In the context of artificial agents, a unique distinction arises—the gap that separates the ontologies of artificial agents from those of human agents. From this perspective, an individual's physical interaction with reality permits them to identify and emphasize meaningful aspects of that reality (Marienko, 2021).

It can be posited that the application of the biosemiotic perspective plays a pivotal role in enabling the development of autonomous ontologies within artificial agents. This forms the foundation for achieving the capability to formulate subjective judgments in synthetic agents. While we have created artificial intelligence systems that surpass human capacities in specific, narrowly defined tasks, these achievements fall short of our ultimate goals. The conceptual criterion necessitates that proposed solutions bridge the conceptual gap, including the ontological gap, between the field of cognitive sciences and AI technologies (Nikitenko et al., 2022).

In the realm of intelligent interaction, computers not only comprehend the semantic content of a user's message but also grasp the contextual nuances surrounding the message. For instance, human interactions often involve language and bodily gestures. To attain truly intuitive communication, computers will require their own forms of vision and language that seamlessly integrate with the human world. Machine learning, as a subset of artificial intelligence, empowers computers to learn without relying solely on explicit programming. Within the rapidly evolving technology ecosystem, artificial intelligence (AI) and its subdomains, such as machine learning, take a prominent role. Gartner defines AI as the application of advanced analytics and logical techniques to model human intelligence, presenting a complex system with numerous applications for individuals and businesses across various industries. The current landscape offers a multitude of AI-driven solutions designed to support, automate, and enhance human tasks, reflecting the expansive potential of artificial intelligence (Nikitenko & Vasyl’chuk, 2022).

These technological advancements hold the promise of simplifying intricate tasks with both speed and precision, opening the door to novel applications that were once deemed impractical or unattainable. While some may speculate about the perpetual use of this technology or its potential to surpass human capabilities in certain business scenarios, its widespread adoption and popularity are undeniable. As expected, the increasing integration of AI at the enterprise level has resulted in rapid growth within the global AI software market. Gartner projects this growth to reach USD 62.5 billion in 2022, reflecting a remarkable 21.3% increase compared to its value in 2021 (Gartner, 2021). IDC further forecasts that this market will expand to reach an impressive US $791.5 billion by 2025 (Jyoti & Kuppuswamy, 2022).

1. *Machine learning*, which has evolved from the study of pattern recognition theory and computational learning within the field of artificial intelligence, delves into the development of algorithms capable of learning from data and making predictions. These algorithms transcend the constraints of static program instructions by generating predictions and data-driven decisions based on models constructed from input data samples. Machine learning finds application in various computational challenges where conventional explicit algorithms cannot be devised and programmed.

Machine learning essentially enables a computer to perform tasks without explicit programming. Deep learninga subset of machine learning, can be seen as the automation of predictive analytics. It encompasses three primary categories. Firstly, Supervised learning when datasets are labeled, allowing the algorithm to detect patterns and subsequently apply them. Secondly, Unsupervised learning when it employs datasets without predefined labels. Instead, it organizes the data based on similarities or differences. Thirdly, Reinforcement learning is a method that utilizes unlabeled datasets, with the AI system receiving feedback after executing actions. Computer vision is a technological field focused on capturing and analyzing visual data through the use of cameras. This technology is employed to recognize signatures or analyze medical images (Altreide, 2019).

2. *Natural Language Processing (NLP)* is a specialized field within artificial intelligence that focuses on the interaction between computers and human languages. Its primary objective is to program computers to efficiently handle natural languages. Neural networks, which are interconnected units designed to mimic human brain patterns, play a role in recognizing and learning patterns. NLP enhances AI’s capacity to comprehend, interpret, and process human speech, while computer vision instructs computers to gather and analyze crucial information from images and videos.

These capabilities are harnessed to develop artificial intelligence software for various applications, with notable use cases including knowledge management, virtual assistance, and autonomous vehicles. Given the increasing volume of data that businesses need to process to meet customer demands, there is a growing demand for faster and more precise software solutions. Challenges in natural language processing often revolve around tasks such as understanding human language, generating natural language, exploring the interplay between language and machine perception, and managing human-computer dialog systems (Rowan, 2019).

3. *Robotics* falls under the umbrella of artificial intelligence and encompasses the fields

of designing, constructing, operating, and utilizing robots and computer systems for their control, sensory feedback, and information processing. Researchers are currently exploring the application of machine learning to develop robots capable of interacting in social settings. The fundamental goal of robotics is to create machines that can perform tasks typically carried out by humans. Robots find application across diverse scenarios, including hazardous environments like bomb detection and deactivation, industrial processes, or situations where human presence is unfeasible. Robots come in various forms, with some designed to resemble humans (Skinner, 2018).

4. *Software* plays a crucial role in the realm of artificial intelligence, and its definition can vary. From an economic perspective, it can be described as software that emulates intelligent human behavior. Taking a broader view, AI software is seen as computer programs that learn patterns from data and analyze information to provide intelligent responses to specific customer issues. The AI software market encompasses not only technologies featuring built-in AI processes but also platforms that enable developers to construct AI systems from scratch. This includes a spectrum of offerings, ranging from chatbots to deep and machine learning software, as well as platforms equipped with cognitive computing capabilities (Steiner, 2012).

AI solutions serve a variety of purposes across different industries, whether it's assisting in surgical procedures in healthcare, identifying fraudulent activities in financial transactions, enhancing driver assistance systems in the automotive sector, or personalizing educational content for students. These AI solutions can be broadly categorized into functional areas:

1. Process Automation: Process automation is a fundamental goal of AI solutions. It involves making systems or processes work automatically, reducing the need for human intervention. For instance, Robotic Process Automation (RPA) can be programmed to perform repetitive tasks more quickly than humans. AI applications aim to minimize human involvement in tasks, whether they are routine or complex. By collecting and interpreting large volumes of data, AI can determine the next steps in a process and execute them efficiently. Machine learning algorithms play a crucial role in creating knowledge bases from both structured and unstructured data. Process automation remains a significant challenge for businesses, with many planning to implement intelligent automation in the near future. Contrary to automating manual tasks, AI frequently handles various computerized tasks efficiently and reliably. In this form of automation, human queries remain crucial for tailoring the system and posing relevant questions. This customization and interaction with AI are vital components that enable systems and processes to function automatically. For instance, Robotic Process Automation (RPA) can be programmed to execute repetitive tasks at a much higher speed than humans (Tegmark, 2017).

2. Data Analysis and Interpretation: AI solutions, especially in the corporate world, primarily focus on building knowledge bases from structured and unstructured data. These solutions analyze and interpret data before generating predictions and recommendations based on the findings. This process is referred to as AI analytics, leveraging machine learning to explore data and identify patterns. Whether the analytical tools are predictive, prescriptive, augmented, or descriptive, artificial intelligence plays a central role in data preparation, uncovering novel insights, identifying patterns, and predicting business outcomes.

Enterprises are increasingly turning to AI to enhance the quality of their data, recognizing that AI can maximize the value of data. When machine learning-powered algorithms are employed, data itself can become a valuable intellectual asset. The insights and solutions lie within the data; AI's role is to extract and present them. Consequently, data has never been more critical and can offer a competitive edge. In highly competitive industries, having the best-quality data, even when employing similar methods as others, can be a decisive advantage.

Artificial intelligence (AI) involves the emulation of human cognitive processes by computer systems. These processes encompass three key phases:

1. Learning: The acquisition of information and the rules governing its use.
2. Reasoning: The utilization of these rules to formulate approximate or definitive conclusions.
3. Self-correction: Selected applications of AI include narrow AI, facial recognition, and computer vision.

AI, particularly with the use of neural networks featuring multiple hidden layers, enables the analysis of extensive datasets at a deeper level. In the past, constructing a fraud detection system with five hidden layers was nearly impossible. However, advances in computing power and the availability of big data have changed the landscape. Deep learning models require substantial data for training, and this reliance on data has led to stringent regulations like GDPR (General Data Protection Regulation) governing the use of consumer data (Cherep et al., 2020).

3. Personalization and User Engagement: Establishing and nurturing customer relationships are now paramount for attracting and retaining customers. AI enhances existing products by infusing them with intelligence. It is typically not marketed as a standalone app but rather as a feature that enhances products users are already familiar with. For example, Siri is an AI feature integrated into newer Apple products.

The integration of automation, conversational platforms, bots, and intelligent machines with big data presents opportunities for enhancing various technologies across personal and professional domains. These applications span from security to financial investment analysis. AI leverages advanced learning algorithms and data-driven programming to adapt and evolve. It excels at uncovering underlying structures and patterns within data, effectively acquiring skills such as classification and prediction. Just as AI can autonomously learn to play chess, it can independently make product recommendations online. Furthermore, AI models continue to adapt as new data becomes available, aided by techniques like backpropagation, which allows models to self-adjust and learn from their mistakes.

AI can be classified into two categories: weak AI (narrow AI) and strong AI. Weak AI refers to systems designed and trained for specific tasks, such as virtual personal assistants like Apple's Siri. Strong AI possesses human-like cognitive abilities and can tackle unknown tasks without human intervention. However, the implementation of AI, whether in terms of hardware, software, or personnel, can incur significant costs. To facilitate AI adoption, many vendors now incorporate AI components into their standard offerings and provide access to AIaaS (artificial intelligence as a service) platforms. AIaaS enables individuals and organizations to experiment with AI and explore multiple platforms before committing. Some of the most prominent cloud AI offerings include Amazon AI services, IBM Watson Assistant, Microsoft Cognitive Services, and Google AI services.

Artificial intelligence tools offer a wide array of new capabilities for businesses, but their adoption also raises important ethical considerations. Many of the most advanced AI tools rely on deep learning algorithms, which are fundamentally shaped by the data they are exposed to during training. Since humans are responsible for selecting and providing this training data, the risk of human bias is an inherent concern that requires vigilant control.

Some experts within the industry argue that the term „artificial intelligence" has become closely tied to popular culture, leading to unrealistic fears and expectations among the general public regarding AI. In an effort to address this issue, researchers and marketers are exploring the use of the term „augmented intelligence," which carries a more neutral connotation. The goal is to help people understand that AI's primary role is to enhance products and services rather than replace the individuals who use them (Schwab, 2017).

Arend Hintze, an associate professor specializing in integrative biology, computer science, and engineering at the University of Michigan, has categorized artificial intelligence into four types, including some that are still in the realm of potential development (Hintze, 2016).

„Reactive Machines": This category includes examples like Deep Blue, the IBM chess program that famously defeated Garry Kasparov in the 1990s. Reactive Machines like Deep Blue excel at tasks like identifying pieces on a chessboard and making predictions. However, they lack memory and the ability to learn from past experiences. Their functionality is limited to the specific task they were designed for, such as analyzing possible chess moves and selecting the most strategic one. They cannot adapt to different tasks or situations.

„Limited Memory": AI systems in this category have the capacity to use past experiences to inform their future decision-making. For instance, some decision-making functions in autonomous vehicles operate on this principle. These systems can learn from previous observations but do not retain this information indefinitely. Their learning is focused on improving performance within their designated tasks.

„Theory of Mind": This type of AI is a concept that does not currently exist but is an area of ongoing research. In psychology, „theory of mind" refers to the ability to understand and attribute beliefs, desires, and intentions to others, which in turn influence their decision-making.

„Self-awareness": This category represents an even more advanced form of AI that is currently theoretical and does not yet exist. „Self-aware" AI would possess an understanding of its own existence and internal states, akin to human self-awareness. It would have the capacity to introspect, recognize its own limitations, and potentially even modify its own behavior and objectives based on this self-awareness.

Conclusions and Future Research Prospects in this Field

Artificial intelligence has found its way into various domains. For instance, in healthcare, machine learning is enhancing diagnostic processes for quicker and more accurate results. In the business sector, machine learning is seamlessly integrating with analytics and customer relationship management (CRM) platforms to provide improved customer service. Chatbots are also being employed on websites to assist customers with inquiries. In the realm of education, artificial intelligence is automating tasks like grading, potentially reshaping the way students learn and even raising questions about the role of teachers.

The financial sector benefits from AI's ability to gather personal data and offer financial guidance, with applications like IBM Watson being utilized in processes such as home buying. Moreover, manufacturing is a leading industry in adopting robots within workflows, though the emergence of unmanned vehicles introduces safety and ethical concerns. These vehicles, equipped with computer vision, image recognition, and deep learning capabilities, rely on AI to autonomously navigate, especially in scenarios involving unexpected obstacles like pedestrians. The idea of autonomous vehicles gives rise to safety and ethical concerns. These vehicles are not immune to mechanical failures, and in the event of an accident, determining liability can be challenging. Furthermore, unmanned vehicles may encounter situations where an accident is inevitable, requiring artificial intelligence to make ethical decisions aimed at minimizing harm. The proliferation of AI also raises issues related to misuse and security, as hackers increasingly employ advanced machine learning tools to breach sensitive systems. In sum, artificial intelligence has played a significant role in fostering ecosystem growth across technological, ontological, and anthropological dimensions.

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