Remittances Review
October 2024,
Volume: 9, No: 5, pp. 68-97
ISSN: 2059-6588(Print) | ISSN 2059-6596(Online)

Received : 10 August 2024, Accepted: 20 October 2024
DOI:https://doi.org/10.33282/rr.vx9i2.04

ARTIFICIAL INTELLIGENCE: EXAMINATION OF HUMAN AND MACHINE INTELLIGENCE AND FUTURE PERSPECTIVES

Serkan Kündem[1*], [2]Doç. Dr. Erşan Yıldız,

[*1] Erciyes University, Erciyes University, Institute of Social Sciences, Department of Tourism Management, Kayseri, TÜRKİYE ORCID Code: https://orcid.org/0000-0003-0784-0152*
denizkundem@hotmail.com
[2]Erciyes University, Faculty of Tourism, Department of Gastronomy and Culinary Arts, Kayseri, TÜRKİYE ORCID Code: https://orcid.org/0000-0001-9761-3185
eyildiz@erciyes.edu.tr

ABSTRACT

This article aims to thoroughly analyze the definitions, measurements, and applications of artificial intelligence (AI) and human intelligence, highlighting the similarities and differences between these two types of intelligence. While human intelligence encompasses a wide range of cognitive abilities, artificial intelligence is often optimized for specific tasks. The concept of Artificial General Intelligence (AGI) is crucial for assessing how closely AI approximates human intelligence. The rapid evolution of AI significantly contributes to fields such as management, education, and research, while also necessitating consideration of its ethical, economic, and environmental dimensions. The article employs metaphorical language to ensure an in-depth understanding of the topics and to maintain the reader's interest. Furthermore, it examines the relationship between AI and big data, natural language processing (NLP) techniques, and the collaboration between AI and human expertise. In this context, the ethical use of AI and its contribution to scientific advancement through interdisciplinary collaboration are emphasized.

Keywords: Artificial Intelligence, Human Intelligence, Artificial General Intelligence, Ethical and Economic Dimensions, Interdisciplinary Collaboration, Sustainable Artificial Intelligence.

Introduction and Literature Review

1. The Evolution of Human Intelligence: The Rise and Metaphors of Artificial Intelligence

1.1. Human Intelligence and Artificial Intelligence

Human intelligence has been a profound enigma, igniting deep debates among philosophers, scientists, and thinkers since ancient times (Jensen, 1998). This intricate concept often shrouds our minds like an impenetrable mist. Psychological constructs, derived from observable behaviors, reveal abstract and unseen entities (Cronbach and Meehl, 1955; Sijtsma, 2006). These constructs serve as keys to unraveling the labyrinths within the depths of the human mind.

Conversely, artificial intelligence is distinct from these abstract psychological constructs. It does not originate from human cognitive and emotional processes. AI is an algorithmic representation of human thought and decision-making processes. Constructed through data processing, machine learning techniques, and algorithmic principles, this system offers a simulation of human intelligence (Arunthavanathan, Sajid, Khan, & Pistikopoulos, 2024). For instance, AI systems used in contemporary medicine for disease diagnosis can process data similarly to how doctors make diagnostic decisions.

Essentially, AI is not merely an imitation of human intelligence but a reinterpreted form achieved through data and algorithms. While human intelligence retains its complexity, AI performs its role on a stage where science and technology converge.

1.1.1. Psychological and Computational Constructs

Psychological constructs are fundamental tools for systematically researching, predicting, and explaining complex psychological phenomena (Strauss and Smith, 2009). The ambiguous and abstract concepts that roam the depths of our minds are made concrete, like stars shining in a clear night sky. Precise definitions of constructs enable effective research (Messick, 1981; Slaney and Racin, 2013). These definitions provide researchers with the opportunity to obtain consistent and reliable results.

Similarly, computational constructs are crucial for understanding and modeling complex computational processes. They play a significant role in modeling and analyzing psychological phenomena in the digital realm. For example, machine learning algorithms and data processing techniques are used to recreate the complexity of the human mind in the digital world. The accurate definition and application of constructs enhance the precision and effectiveness of computational models.

When developing a machine learning algorithm, the success of the model largely depends on the precise definition of the data structures used. Therefore, computational constructs directly affect the performance and reliability of the model.

In essence, psychological and computational constructs are indispensable for both understanding the human mind and developing artificial intelligence systems. A thorough examination and correct application of these constructs pave the way for significant advancements in both psychology and artificial intelligence.

1.1.2. Definitions of Human Intelligence

Throughout history, human intelligence has been defined in various ways. Sternberg and Detterman (1986) conducted a survey with two dozen experts, identifying multiple perspectives on intelligence. Despite differences in these definitions, they converge on some fundamental ideas. Gottfredson (1997) defines intelligence as "the ability to reason, plan, solve problems, think abstractly, comprehend complex ideas, learn quickly, and learn from experience." This definition is also supported by Deary et al. (2006) and Halpern (2014).

Intelligence is like a beacon illuminating the darkest corners of the human mind, much like Edison's light bulb dispelled darkness. It uncovers the foundations of the unknown, as Mendel's experiments with pea plants laid the groundwork for genetic science. Like Tesla's taming of electricity, which established the foundations of the modern world, intelligence shapes the future.

Intelligence soars to the peaks of vast ideas, akin to an eagle gliding over high mountains. It transforms abstract thoughts into concrete reality, like an artist turning a blank canvas into a masterpiece with brushstrokes. Human intelligence, like emotions brought to life in a poet's verses, makes sense of complex ideas and explores the profound meanings of life.

1.2. Definitions of Artificial Intelligence and Intelligence

Artificial intelligence (AI) is the simulation of human intelligence through algorithms and data processing techniques (Arunthavanathan, Sajid, Khan, & Pistikopoulos, 2024; Gignac & Szodorai, 2024). While human intelligence is noted for its complexity and flexibility, artificial intelligence emerges as a system specialized in specific domains.

AI is like a ship navigating the deep oceans of human intelligence. As human intelligence explores the complexity and depth of this ocean, AI stands as a specialized lighthouse in certain areas. Therefore, Arunthavanathan et al. (2024) and Gignac & Szodorai (2024) suggest that AI is a futuristic reflection of the human mind.

If Archimedes' exclamation of "Eureka!" upon discovering the principle of buoyancy is the first drop in this deep ocean; if Kepler's mathematical explanation of planetary motions is the discovery of its currents; and if Hawking's unraveling of black holes' mysteries is the reach into its deepest trenches, then AI follows in the footsteps of these great thinkers, navigating the vast seas of the future.

AI is like a magician's wand, turning the mundane moments of daily life into something enchanting. Additionally, it pushes the boundaries of human cognitive capacity, like the intricate details of an engineering marvel. AI processes data to derive meaningful insights, much like a composer skillfully arranging notes into a harmonious symphony. It shapes raw information into perfection, like a sculptor patiently chiseling marble to create a masterpiece.

1.3. Nietzsche's Übermensch Concept and Artificial Intelligence: Philosophical Inquiries and Technological Intersections

1.3.1. Übermensch and Religious Perspectives

Nietzsche's concept of the "Übermensch" emphasizes the necessity for humans to transcend their limits and reach a higher level of existence. According to him, humans are like a rope stretched between animal and Übermensch; this rope is characterized by a dangerous crossing, a perilous journey, a hazardous backward glance, a precarious shudder, and a hesitant pause over an abyss. Nietzsche believes that what makes humans great is not being an end but a bridge. The admirable aspect of humans is their potential for transition and decline. While the speeches and speakers may change, the truth remains the same: the purpose of human existence is the Übermensch.

According to the Qur'an, however, humans are created from a clot of blood (alaq/zygote) and are on a journey to become "the most honored of all creatures" (ashraf al-makhluqat) on the path of Siraat al-Mustaqeem. Yet, the same human being is also subject to the statement "They are like cattle, nay, even more astray" (Presidency of Religious Affairs, n.d. a, b, c).

1.3.2. Artificial Intelligence and Humanity

In the journey of becoming Nietzsche's Übermensch or the Qur'an's "ashraf al-makhluqat," artificial intelligence emerges as a valuable companion and a tool serving the purpose in both discourses. However, humanity tends to confuse means with ends over time. History is full of such repetitions: like the Janissaries of the Ottoman Empire who initially served the state but eventually became a self-serving entity contributing to the empire's downfall, artificial intelligence must remain a tool on the path to Übermensch. AI should support humanity's quest to become the pinnacle of creation; otherwise, it could

Volume: 9, No: 5, pp. 68-97
ISSN: 2059-6588(Print) | ISSN 2059-6596(Online)

herald the end of civilization. Nietzsche states: "I teach you the Übermensch. The Übermensch is the meaning of the earth. Your will shall say: the Übermensch shall be the meaning of the earth."

1.3.3. Philosophical and Technological Intersections

In modern times, AI technologies intersect with Nietzsche's inquiries on intelligence, happiness, reason, virtue, and justice. However, there are various limitations and criticisms regarding AI's capacity to answer these profound philosophical questions. Intelligence is the capacity to reach the peaks of great ideas; like an eagle soaring at high altitudes, human intelligence scans wide and deep thoughts. AI can access information beyond human reach by analyzing vast data sets. But can it use this knowledge to impart meaning to human life? AI algorithms can process information quickly and efficiently, but their capacity to interpret human existence is limited. Nietzsche's inquiries into happiness and reason become even more significant given AI's inability to grasp the deep meanings of human life (Nietzsche, 1883/2011).

Human reason delves into the depths of knowledge, like a lion digging its claws into the soil. Human intellect excels in exploring the depths of knowledge; AI searches and processes information quickly and efficiently but cannot answer existential questions or grasp concepts like virtue and justice. These limitations raise questions about how much AI can support human intellect. Can AI possess ethical and moral values? Nietzsche asks: "What is the purpose of my intellect? Does it seek knowledge like a lion seeking its prey? This is nothing but poverty, filth, and wretched satisfaction!" Similarly, one might ask, "What is the purpose of my virtue? Has it not yet angered me? How weary I am of my good and evil! All this is nothing but poverty, filth, and wretched satisfaction!" (Nietzsche, 1883/2011).

Prof. Dr. Nevzat Tarhan expresses: "Pride, jealousy, and ambition must be disciplined. The lion, king of the animals, can frighten everyone, but it is not as savage as humans. Animals instantly detect danger and attack, whereas humans anticipate potential threats and take preemptive actions. The dynamic of harmony in life was misunderstood as the strong defeating the weak. Humans have feelings of jealousy, pride, and ambition. If these three emotions are not disciplined, people can become prone to violence" (Üsküdar News Agency, 2021).

Is this also applicable to AI? Can AI reflect the emotional complexities and negative traits of humans? These questions explore how AI can understand and apply ethical and moral values. Virtue and justice require an internal process of purification and transformation. Do these concepts have a counterpart in AI? While AI follows programmed ethical rules, can it truly understand virtue and justice? These questions define AI's role and limits in human life.

Nietzsche advocates that humanity must transcend itself to reach the Übermensch. In this context, can AI enhance human cognitive capacity and access to knowledge, fostering creativity and ethical values? This illustrates how Nietzsche's philosophical inquiries relate to modern technological developments. However, it remains uncertain how AI can integrate with human creativity and ethical understanding.

Human intelligence is characterized by intuitive and analytical thinking, whereas AI can analyze vast data sets quickly and efficiently. While human intelligence can interpret knowledge creatively and emotionally, AI processes information without deeper understanding. For example, a human can intuitively grasp the profound meanings of a complex poem, whereas AI can only perform a linguistic and structural analysis of the poem.

Remittances Review
October 2024,
Volume: 9, No: 5, pp. 68-97
ISSN: 2059-6588(Print) | ISSN 2059-6596(Online)

Humans are beings with emotional experiences and ethical values. Human emotions deeply affect decision-making processes and social interactions. In contrast, AI lacks emotional and ethical values; it operates solely based on programmed rules. This limitation prevents AI from making independent decisions on ethical and moral issues. While a human can solve an ethical dilemma using empathy and emotional intelligence, AI follows only its programmed algorithms.

Humans have the capacity for creative thinking and can produce innovative solutions. AI can generate new combinations from existing data and algorithms, but this creativity lacks the emotional and intuitive dimensions of human creativity. For instance, an artist considers emotional and cultural contexts while creating a new work, whereas AI can only produce derivatives from existing data.

Nietzsche's concept of the Übermensch questions the role of AI in human evolution. Whether AI can comprehend and guide human existential values is one of the most significant questions of our time. While AI may excel in data processing and analysis, its capacity to grasp the deep meanings of human life is limited. Nietzsche's philosophical inquiries help us understand how AI can integrate with ethical and moral values and how humanity can transcend its limits to reach a higher level of existence.

This analysis highlights important questions about the future evolution of humanity by considering both Nietzsche's profound philosophical inquiries and the limitations of modern AI. How AI will integrate with ethical and moral values and how humanity will progress toward becoming the Übermensch are among the most critical philosophical and technological discussions of our time.

2. Purpose and Objectives of the Study

2.1. Purpose

The purpose of this study is to conduct an in-depth analysis of the definitions, measurements, and applications of artificial intelligence (AI) and human intelligence, identifying the similarities and differences between the two. This analysis aims to promote scientific progress and interdisciplinary collaboration.

2.2. Objectives

The objectives of this study are as follows:

- To examine the definitions of AI and human intelligence.
- To compare the measurement methods of AI and human intelligence.
- To analyze the impacts of AI and human intelligence in different application areas.
- To identify the similarities and differences between AI and human intelligence.
- To evaluate the ethical and environmental dimensions of AI.

3. Research Methodology

3.1. Methodology

This study employs a descriptive research methodology to analyze the definitions, measurements, and applications of AI and human intelligence. The primary aim of the research is to identify the similarities and differences between AI and human intelligence, thereby promoting scientific progress and interdisciplinary collaboration. The methodology includes a literature review, conceptual analysis, and comparative studies.

Remittances Review
October 2024,
Volume: 9, No: 5, pp. 68-97
ISSN: 2059-6588(Print) | ISSN 2059-6596(Online)

3.2. Research Methods

3.2.1. Literature Review

Defining artificial intelligence clearly in today's academic world is challenging. The similarities and differences between human and artificial intelligence, such as the definitions of machine learning and human intelligence, remain ambiguous. Existing studies often focus on surveys and technical analyses, leading to redundancy and complicating the definition of AI. This study aims to provide a thorough analysis of the definition of AI by reviewing existing literature to understand the relationship between human and artificial intelligence.

In this context, foundational sources include Jensen's views on the origins of human intelligence (Jensen, 1998), Sternberg and Detterman's theoretical frameworks on intelligence measurement (Sternberg & Detterman, 1986), Legg and Hutter's contributions to the evolution of artificial intelligence (Legg & Hutter, 2007), and Monett and Lewis's analyses of AI applications (Monett & Lewis, 2018).

AI emerges as a technology opening numerous doors in the quest for knowledge, creating changes across a broad spectrum from education to health, environment to economy. This review examines the impacts and applications of AI in various fields. In education, Aslam and colleagues demonstrate the potential of machine learning techniques to enhance the efficiency of e-learning systems (Aslam et al., 2021). Bin and Mandal emphasize the contributions of AI technology in English language teaching, detailing how it transforms instructional processes (Bin & Mandal, 2019). Cukurova and colleagues investigate the services AI provides in decision-making processes with multimodal data (Cukurova et al., 2019). Kay and Kummerfeld highlight the importance of personal user models from a lifelong learning perspective (Kay & Kummerfeld, 2019).

The applications of AI in healthcare are also noteworthy. Boulet and Durning highlight the criteria that need to be measured in medical education, revealing the potential of AI in this field (Boulet & Durning, 2019). Additionally, Donkin and colleagues show how video feedback and e-learning enhance the skills and engagement of medical laboratory science students (Donkin et al., 2019). Du Boulay comprehensively addresses the necessity and benefits of contemporary intelligent learning environments (Du Boulay, 2019).

The impacts of AI on environment and sustainability are significant as well. Dai and colleagues stress the importance of preparing students to enhance their well-being in the AI age (Dai et al., 2020). Ahmad and colleagues assess the current state, challenges, and opportunities of AI in the sustainable energy industry (Ahmad et al., 2021). Alam and colleagues detail the optimization and automation applications of AI in water treatment processes (Alam et al., 2022).

In the field of economics, the impacts of AI encompass a wide range of research. Li and colleagues use affective transfer learning for stock market prediction (Li et al., 2018). Murtaza and colleagues examine the challenges and solutions faced by AI-based personalized e-learning systems (Murtaza et al., 2022). Ouyang and colleagues propose an AI collaboration framework based on blockchain and smart contracts, analyzing learning markets (Ouyang et al., 2022).

The impacts of AI in technology and innovation cannot be overlooked. Knox addresses AI and education applications in China in two separate studies (Knox, 2020). Adamopoulou and Moussiades provide a general evaluation of chatbot technology (Adamopoulou & Moussiades, 2020). Ahmad and

Remittances Review
October 2024,
Volume: 9, No: 5, pp. 68-97
ISSN: 2059-6588(Print) | ISSN 2059-6596(Online)
colleagues review chatbot design techniques (Ahmad et al., 2018). Bedu and Fritzsche investigate the trust in AI, offering a guide for successful AI adoption (Bedu & Fritzsche, 2021).

The opportunities and challenges presented by AI in fields such as health, education, economy, environment, and technology are explored in detail. The ethical and reliable use of this technology must be prioritized. Future research should delve deeper into the impacts of AI and focus on how the technology can be used sustainably and ethically.

3.2.2. Conceptual Analysis

The definitions of human intelligence and artificial intelligence are examined, and the conceptual differences and similarities between these definitions are identified. The concept of Artificial General Intelligence (AGI) is detailed to evaluate how closely AI approximates human intelligence.

3.2.3. Comparative Analysis

Human and artificial intelligence are compared based on various criteria and benchmarks. Criteria include cognitive abilities, problem-solving capacities, learning capabilities, and environmental impacts.

3.2.4. Ethical and Sustainability Evaluation

The ethical, economic, and environmental dimensions of artificial intelligence are addressed. The alignment of AI with environmental sustainability goals and its potential impacts in this area are evaluated.

3.2.5. Practical Examples

In the final stage, AI applications in various fields such as environmental management, education, and economic challenges are examined. Innovations and application outcomes in these fields are analyzed in depth. For example, the use of AI in education is valuable, akin to a teacher individually guiding students in a classroom. Practical examples are used to illustrate the real-world impact and potential of AI.

3.2.6. Data Collection and Analysis

Content Analysis Research data were collected from academic articles, books, reports, and other scientific sources. Content analysis enabled the classification of collected data into specific themes and categories. During this process, the data were carefully read, coded, and themes were created. Content analysis helped organize the data meaningfully and respond to research questions.

3.2.7. Thematic Analysis

Thematic analysis was used to uncover the main themes and patterns in the data. This method provided a deeper understanding of the data and facilitated the interpretation of research findings in a broader context. During the thematic analysis process, data were examined for recurring themes and key concepts, and the relationships between these themes were analyzed.

3.2.8. Evaluation of Results

Research results reveal the relationship between human and artificial intelligence, highlighting the similarities and differences. The evaluation aims to raise awareness about the ethical, economic, and environmental dimensions of AI. This assessment provides important insights into the societal and individual impacts of AI. These results serve as a guide for future research and applications, similar to how a captain navigates a ship to a safe harbor.

4. Contribution to and Evaluation of the Literature

Remittances Review
October 2024,
Volume: 9, No: 5, pp. 68-97
ISSN: 2059-6588(Print) | ISSN 2059-6596(Online)

4.1. Gaps in the Literature

Despite numerous studies on artificial intelligence (AI) in today's academic world, finding a clear answer to "What exactly is AI?" is challenging. Existing literature still has ambiguities regarding the similarities and differences between human intelligence and AI, the definition of human intelligence, and machine learning. Many studies focus on surveys and technical analyses, which, while serving their purposes, often lead to redundancy and complicate the definition of AI. This situation hinders researchers and practitioners from fully understanding the true potential and limitations of AI.

4.2. Why This Paper Was Needed

These gaps in the literature necessitate a thorough examination and conceptual clarification of the relationship between AI and human intelligence. Existing studies focus on the technical aspects of AI, inadequately addressing the conceptual ambiguities and differences in measurement methods. This paper aims to fill this significant gap in the literature by comparing the definitions, measurement methods, and impacts of AI and human intelligence across various application areas.

4.3. Contributions of this Paper to the Literature

This paper aims to address the gaps in the literature by offering the following contributions:

- **Comprehensive Definitions**: Providing comprehensive definitions of AI and human intelligence to ensure a clear understanding of these concepts. This will help eliminate conceptual ambiguities in the literature.
- **Conceptual Clarity**: Identifying the similarities and differences between AI and human intelligence to achieve conceptual clarity. This will enable a more accurate and meaningful examination of both types of intelligence.
- **Evaluation of Measurement Methods**: Comparing the measurement methods of AI and human intelligence to identify which methods are more effective. This analysis offers researchers and practitioners more robust and reliable measurement tools.
- **Analysis of Application Areas**: Analyzing the impacts of AI and human intelligence in different application areas to determine which type of intelligence is more effective in specific fields. This will reveal the areas where AI excels and where human intelligence is superior.
- **Ethical and Environmental Evaluation**: Assessing the ethical and environmental dimensions of AI to provide recommendations for its sustainable and ethical use. This evaluation helps us better understand the societal and environmental impacts of AI and promotes its responsible use.

4.4. Critical Evaluation and Addressing Gaps

Most current literature focuses on the technical aspects of AI and specific application areas, lacking conceptual clarity. This paper aims to address these conceptual ambiguities and highlight the differences in measurement methods by examining the relationship between AI and human intelligence from a broader perspective. However, this paper also has limitations. For example, some aspects of the comparisons between AI and human intelligence may change over time due to rapid technological advancements. Additionally, the evaluation of ethical and environmental dimensions may vary depending on cultural and socioeconomic factors.

While this paper succeeds in addressing many gaps in the literature, it emphasizes the need for continuous reevaluation of the relationship between AI and human intelligence. Future research should conduct more comprehensive and up-to-date analyses considering the dynamic nature of these technologies and the ever-changing ethical and environmental conditions.

4.5. Resolution

In conclusion, this paper provides significant contributions to the literature by thoroughly examining the relationship between AI and human intelligence. Contributions such as conceptual clarity, comprehensive definitions, and the evaluation of measurement methods enable AI research to produce more meaningful and applicable results.

5. Artificial Intelligence: The Shining Star of the Digital World

5.1. The Rising Prominence of AI in the Modern World

Artificial Intelligence (AI) has ascended as a beacon of global fascination and advancement, much like a star illuminating the digital cosmos of contemporary society. Vendors consistently highlight machine learning (ML), a pivotal component of AI, in the promotion of their products and services (Sultan et al., 2020). Presently, AI is embedded at the core of numerous electronic devices, evolving through rigorous academic and industrial research, as well as detailed efforts within individual laboratories (Torrance & Tomlinson, 2023).

AI technologies are fundamentally transforming the dynamics of wealth creation and distribution, heralding new economic possibilities (Crawford et al., 2016). The primary aspiration of AI is to cultivate systems with capabilities akin to human intelligence, requiring an in-depth comprehension of the essential structure of intelligence. Despite its potential to benefit humanity, AI also harbors risks that could undermine the pillars of civilization (Van Wynsberghe, 2021).

According to Kündem and Güllü (2024), the "Fourth Translation Movement" represents a revolutionary epoch in AI and data analysis. This era enables meticulous analysis of information from libraries and academic sources worldwide through quantum-based or advanced computing, uncovering previously overlooked significant data. AI processes this information, presenting groundbreaking discoveries and innovations, and expanding historical and cultural knowledge. Humanized AI can profoundly alter knowledge structures, accelerating scientific and technological advancements, yet this process carries substantial risks. AI's capabilities in reinterpreting religious texts, expediting the evolution of languages, and fundamentally reshaping cultural and social dynamics underscore the importance of controlled and ethical use to prevent potential threats to humanity (Kündem & Güllü, 2024).

5.2. Definitions and Measurements of Artificial Intelligence

Numerous definitions of artificial intelligence have been proposed. The most common definition is "the ability of machines to perform tasks that typically require human intelligence" (Minsky, 1961; Prasad et al., 2020; Schoser, 2023). However, this definition is somewhat circular and lacks specificity. In the literature, there are definitions intersecting the fields of psychology and computer science (Goertzel, 2010; Wang, 2022; Legg & Hutter, 2007b), emphasizing AI's capacity to achieve new goals through computational algorithms, distinguishing it from human intelligence.

Considering the operational definition of AI, AI measurements can be defined as the discipline of measuring and evaluating the performance of AI systems. AI measurements include the concept of 'data sets,' representing the collections of problems AI systems must solve. According to some researchers, AI makes the unmeasurable measurable (Taymanov et al., 2021). For others, AI's measurement capability makes the impossible possible (Baruffaldi et al., 2020).

These various definitions reflect humanity's complex relationship with technological advancements (Bartholomew, 2004). This relationship, much like the tragedies of Shakespeare, contains both hope and uncertainty. AI, while opening new horizons for humanity, also brings ethical and practical issues. In this context, AI measurements emerge as a tool that helps us understand the limits and potential of this technology.

5.3. Advancements in Machine Learning and IoT

The increasing complexity of machine learning techniques in recent years has paved the way for a multitude of practical applications (Keith et al., 2021). With the onset of the Internet of Things (IoT) era, wireless sensor networks, big data, and AI technologies require innovative energy solutions to sustainably operate billions of devices (Chen et al., 2020).

Numerous definitions of AI exist. The most prevalent definition is "the ability of machines to perform tasks that typically require human intelligence" (Minsky, 1961; Prasad et al., 2020; Schoser, 2023). However, this definition can be somewhat circular and lacks specificity. In the literature, definitions also intersect psychology and computer science (Goertzel, 2010; Wang, 2022; Legg & Hutter, 2007b), emphasizing AI's ability to achieve new goals through computational algorithms, distinguishing it from human intelligence.

AI measurements can be defined as the discipline of measuring and evaluating AI systems' performance. These measurements include 'data sets,' representing the collections of problems AI systems must solve. Some researchers assert that AI makes the unmeasurable measurable (Taymanov, Sapozhnikova, & Prokopchina, 2021), while others argue that AI's measurement capabilities make the impossible possible (Baruffaldi et al., 2020).

These varied definitions reflect humanity's complex relationship with technological advancements (Bartholomew, 2004). Much like Shakespearean tragedies, this relationship encapsulates both hope and uncertainty. While AI opens new horizons, it also raises ethical and practical concerns. In this context, AI measurements help us comprehend the limits and potential of this technology.

5.4. Intelligence and Success

Intelligence can be defined as the ability to navigate the unknown, illuminating the path with inner insight when one is uncertain. This definition underscores the importance of novelty and insight in solving intellectual problems, crucial aspects of intelligence tests. Success and expertise, on the other hand, involve realizing potential in specific fields through teaching and practice. However, success and expertise do not equate to intelligence. Intelligence is a broad construct facilitating success across various domains (Gottfredson, 2002).

AI systems, trained with content used in tests to measure their capacities, do not fully demonstrate true intelligence—the ability to solve novel problems. Unlike the dynamic and innovative nature of human intelligence, AI operates with specific data and algorithms. Human intelligence manifests through creativity and flexibility when confronting the unknown.

The relationship between human intelligence and success can be likened to a flourishing garden, where diverse talents and potentials thrive together. AI, in contrast, resembles plants grown within a structured

Remittances Review
October 2024,
Volume: 9, No: 5, pp. 68-97
ISSN: 2059-6588(Print) | ISSN 2059-6596(Online)
order and plan; it can achieve excellence in certain areas but cannot fully capture the broad and flexible nature of human intelligence.

6. Intelligence and Adaptation

Human intelligence is defined as the capacity to adapt successfully to one's environment (Neisser et al., 1996; Sternberg, 2011). However, adaptation alone should not define intelligence, as it can stem from non-cognitive or instinctive traits and may be ambiguous. Intelligence, however, is the ability to navigate new and unknown situations beyond mere adaptation.

Intelligence transcends instincts and habits, navigating the unknown with wisdom and courage, akin to a captain steering a ship through stormy seas. Human intelligence reveals itself through creativity and flexibility in each new challenge. Just as an explorer's courage finds direction in unknown lands, intelligence shines with insight when facing the unknown.

Adaptation is merely a component of this process; the key determinant is the capacity to cope effectively with new and unknown situations. Intelligence stands as humanity's strongest ally in this struggle against the unknown, like a lantern guiding the way through a dark forest.

7. General Intelligence (g) and Artificial General Intelligence (AGI)

General intelligence is a theoretical concept proposed to account for the observation that scores on different intelligence tests are often positively correlated (Jensen, 1998). This correlation, known as the 'positive manifold,' suggests that individuals who excel on one intelligence test are likely to excel on others. General intelligence can be seen as the underlying factor that contributes to individual differences in cognitive abilities, akin to multiple tributaries merging to form a more substantial current.

Artificial General Intelligence (AGI) refers to the ability of artificial systems to achieve a wide range of goals through computational algorithms. AGI reflects the consistent performance across diverse AI tasks and modalities, showcasing correlated capabilities in artificial systems. The definitions and scope of AGI remain subjects of debate, much like exploring the uncharted boundaries of a newly discovered continent.

Both general intelligence and AGI offer insights into the complexities and potential of human and artificial systems. General intelligence represents the core source of individual cognitive differences, while AGI demonstrates how these differences manifest and are assessed in artificial systems. These concepts embody the challenges and opportunities within the domains of knowledge and technology. Just as explorers face new challenges in uncharted territories, AGI encounters novel discoveries and obstacles as it advances into the unknown.

8. The Multidimensionality of Intelligence

Human intelligence is a multidimensional construct, not a singular, homogeneous entity. Research indicates that human intelligence encompasses a variety of cognitive abilities and processes (Sternberg, 2000; Gardner & Hatch, 1989). These abilities include logical reasoning, language proficiency, visual-spatial skills, memory, and processing speed. Human intelligence resembles a symphony, where each ability plays a distinct role to create a harmonious whole.

In contrast, artificial intelligence (AI) is often optimized for specific tasks and lacks the broad and multifaceted nature of human intelligence (Mnih et al., 2015; Silver et al., 2016). While AI systems may excel in particular domains, such as chess or language processing, they do not match the inclusivity and

versatility of human intelligence. Human intelligence is notable for its ability to handle complex and diverse tasks, whereas AI remains a specialized tool in designated areas.
Understanding this multidimensional nature helps us appreciate both the potential of human intelligence and the limitations of AI. Human intelligence offers a rich integration of various cognitive abilities, allowing for creative and effective solutions across a broad range of situations. Conversely, AI systems are narrowly focused and designed for excellence in specific tasks. This rich structure of human intelligence highlights our unique capability to tackle complex problems and generate innovative solutions.

9. Human Learning Capacity and Artificial Intelligence

Human learning capacity is a fundamental and crucial aspect of intelligence. Humans can learn from experiences and apply this knowledge to new situations (Kolb, 1984). This flexibility makes humans adaptable to novel and uncertain scenarios. Much like a student guided by a teacher through the ocean of knowledge, humans grow and develop with each new experience.
Artificial intelligence, by contrast, typically learns specific tasks through training on particular datasets. Techniques such as machine learning and deep learning enable AI to specialize in certain areas, but this learning is usually limited in scope (LeCun, Bengio & Hinton, 2015). AI can achieve deep expertise in specific domains, akin to an artist perfecting a single brushstroke, but it does not rival the extensive and multifaceted learning capacity of human intelligence.
The distinction between these learning modalities underscores the nature and limitations of both human and artificial intelligence. While humans enhance their knowledge through diverse experiences, AI systems depend on specific datasets and algorithms. The dynamic and flexible nature of human intelligence allows for creative and adaptive solutions in new situations, highlighting the uniqueness of human learning compared to the specialized expertise of AI.

9.1. Artificial General Intelligence (AGI) Tests

Testing Artificial General Intelligence (AGI) is crucial to evaluate how broadly AI can perform across various tasks. AGI tests use diverse test batteries and assessment methods to measure AI's success in different domains and tasks (Goertzel & Pennachin, 2007). These tests are essential for determining how close AI comes to achieving human-like general intelligence.
AGI tests are comparable to performance series assessing a musician’s skill across different instruments, revealing the versatility and adaptability of AI. These tests evaluate AI’s performance not just in specific areas but across a broad spectrum. Comparing human intelligence to artificial intelligence is like an orchestra conductor evaluating the harmony of all instruments, aiding in understanding how harmoniously and flexibly each type of intelligence operates.
The primary objective of AGI tests is to assess AI's potential to reach levels of general intelligence similar to human intelligence. These tests evaluate AI’s abilities in learning, problem-solving, and adaptation, providing insights into how closely AI approximates the comprehensive structure of human intelligence. This understanding helps in gauging the true potential and limitations of AGI.

9.2. Memory and Intelligence: A Journey into the Depths of Minds

Memory is a fundamental pillar of intelligence; the ability to store, recall, and process information plays a leading role in the intricate dance of the human mind (Baddeley, 2000). Similar to countless books

stored on the shelves of a grand library that can be quickly found and read when needed, human memory stores information and makes it readily available. These treasures, hidden within the labyrinths of our minds, connect us to the past and prepare us for the future.
In artificial intelligence systems, memory capacity determines how effectively these mechanical minds can perform complex tasks. Large datasets and powerful computing capabilities enhance AI's performance (Dean et al., 2012). The memory systems of artificial intelligence are akin to servants retrieving information stored in the vast, cold corridors of a data center. However, this mechanical memory capacity is usually limited to specific tasks and cannot match the flexibility and comprehensive capabilities of human memory.
While human memory enriches with experience and accumulated knowledge, artificial intelligence systems are nourished by large datasets and algorithms. Human memory blends new information with wisdom from the depths of time to produce creative solutions. This comparison highlights the flexibility of human memory and the expertise of artificial intelligence in specific fields. Just as a painter's colors on a canvas come together to create a magnificent painting, human memory combines pieces of information to create meaningful wholes.
Understanding the difference between these two forms of memory helps us comprehend the potential and limitations of both human and artificial intelligence. Human memory stands out with its richness and depth, while artificial intelligence is noted for its speed and accuracy in specific tasks. Both types of memory are unique in their respective fields and, when used together, expand the horizons of human knowledge.

10. AGI and Predictive Validity

The predictive validity of artificial general intelligence (AGI) concerns its ability to predict future performance across diverse tasks and fields. This can be measured using various tests and methods to evaluate the predictive validity of AI (Wang et al., 2019). This aspect of AGI is comparable to a seer predicting the future success of intelligence systems.
In this conceptual contribution, we discuss the effects of rapid technological advancements using AI-focused models like GPT-4 (Latour, 2005). Like a painter blending colors on a canvas to create a magnificent painting, these AI systems combine information and data to produce meaningful results. An actor, whether human or non-human, is any entity that alters the actions of another entity. In this context, AI actors provide potential tools to reshape many fields, including management education.
AI actors play significant roles on the stage of the modern world. They are power centers processing information and creating new actions. Like a conductor ensuring the harmony of every instrument, AI actors bring together various pieces of information to successfully accomplish complex tasks. These actors do not merely process information but also influence, manage, and direct human actions and decisions.
The capabilities of AI systems have the potential to revolutionize many fields, from education to health, from engineering to art. In the future, the impact of these mechanical actors will be broad and profound, like a storm creating waves in the sea. Therefore, the predictive validity of artificial general intelligence and the potential of these systems should be carefully evaluated. Humanity must be ready to understand and direct the emergence of these new actors and the waves they will create.

10.1. Natural Language Processing (NLP) and the Role of AGI

Natural Language Processing (NLP) is a subfield of artificial intelligence focused on developing algorithms and computational techniques that enable computers to understand, analyze, and generate human-like language With the development of GPT-4, released in March 2023 as a transformer-based language model, NLP has made significant strides towards achieving human-like language processing. These advancements have facilitated a more detailed understanding of relevant words and concepts, increasing interest in these AI-powered Advanced Natural Language Processing (ANLP) models (Bouschery, Radford, and Liddy, 2023;Radford et al., 2019). These developments, rapidly adopted by academia, underscore the importance of ANLP (Krogh, Roberson, and Gruber, 2023).

ANLP excels in unraveling and understanding the intricate texture of human language, processing words and meanings in harmonious symphony. Transformer-based models like GPT-4 dive deep into the essence of language, meticulously processing words and concepts to create coherent wholes. These models capture the elegance and nuances of language, akin to an artist bringing out details with brush strokes.

NLP techniques, exemplified by applications such as ChatGPT-4, can be employed for a wide range of purposes, including language translation, sentiment analysis, and chatbot development. These techniques play pivotal roles on the modern world stage. They are powerhouses that process information and generate new actions. By synthesizing various pieces of information, they successfully undertake complex tasks. These actors not only process information but also influence, manage, and direct human actions and decisions.

Natural Language Processing and ANLP facilitate dynamic interactions of knowledge and meanings. This interaction pushes the boundaries of science and technology, opening new horizons for humanity. In the future, the impact of these mechanical actors will be vast and profound, shaping their surroundings like currents in a river. Therefore, the potential and role of ANLP must be carefully evaluated. Humanity must be ready to understand and guide the emergence of these new actors and the changes they will bring.

11. The Relationship Between Artificial Intelligence and Human Expertise

Artificial intelligence and human expertise collaborate, much like clay being shaped by an artisan, to create a higher level of knowledge and skill. Management research supports the synergy created by this harmonious interaction, drawing on findings from current literature on digital technologies and AI in organizations (Brynjolfsson & McAfee, 2014). The enhancement of human capabilities by AI-powered tools forms the foundation of this synergy (Arunthavanathan, Sajid, Khan, & Pistikopoulos, 2024).

Future management research will rely on a symbiotic partnership where human and machine intelligence complement each other, contributing to knowledge. This relationship, similar to a gardener nurturing plants, combines two different intelligences to create a fertile and robust knowledge ecosystem.

11.1. Task Allocation for Effective Collaboration

On a theater stage, each actor’s role determines the success of the performance. Similarly, task allocation between AI and human expertise enables effective collaboration by leveraging the unique strengths of each party. The "division of labor" between humans and machines is a cornerstone of successful human-AI collaboration (Wilson & Daugherty, 2018). Historically, routine data collection

and analysis tasks were delegated to AI-powered tools, while higher-level tasks such as problem formulation and interpreting results were entrusted to human researchers.
The advent of generative tools like GPT-4 has deepened and expanded this division of labor. Now, not only data analysis but also creative problem formulation tasks can be delegated to AI. This situation, reminiscent of a symphony where AI and human expertise dance together, allows both parties to utilize their capabilities at the highest level, achieving more effective results. Thus, the scope and depth of task allocation increase, significantly expanding creative potential.

11.2. Trust and Transparency

In science, much like a surgeon wielding a scalpel with precision, the trust scientists place in AI-powered tools is vital. This trust is fundamentally linked to the reliability, transparency, and explainability of the results produced by these systems (Liu et al., 2020). To earn the trust of scientists, AI tools like GPT-4 must provide clear and convincing explanations for their outputs and consistently demonstrate accuracy and reliability in research tasks.
This trust is not limited to the ability to generate logical and meaningful narratives. The narratives provided by AI tools must be grounded in reality and verifiable with concrete evidence. For instance, using GPT-4 in a research project to achieve faster and more accurate results can enhance scientists' trust. Without such assurance, scientists may hesitate to rely on AI-generated insights and incorporate them into their research, affecting their ability to make informed decisions.
Just as a jeweler meticulously crafts precious stones, the collaboration between AI and humans can only thrive with mutual trust and transparency. Scientists, trusting in AI tools, can utilize them in their research to gain deeper and more meaningful insights.

12. Artificial Intelligence and Big Data

Artificial intelligence (AI) encompasses various machine intelligence systems capable of mimicking human behaviors. AI and Big Data have emerged as defining features of the fourth industrial revolution. AI has developed innovative tools, yet research into the environmental impacts of AI and its applications is still in its early stages. Studies explore how AI affects human and environmental health, machine-human interactions, innovation, and the environmental benefits of AI, proposing further research to address the challenges and progress these innovations present.
As computer science theory has deepened, AI and big data technology have made significant advancements and are widely applied across various professional fields. While AI possesses high intelligence and learning capabilities, big data technology is characterized by real-time processing and high value density (Zhu, Yang, & Ren, 2023b). This era has transformed into the Age of Artificial Intelligence and Big Data (Beheshti, Benatallah, Sheng, & Schiliro, 2020). Big data, machine learning, and AI have become ubiquitous and unavoidable in daily life. The rise of big data in Metaverse data applications, the explosion of information technology, and the increasing number of Internet of Things (IoT) devices, particularly in healthcare, are direct results of this growth (Raju et al., 2020). Digitized workflows have undoubtedly brought revolutionary changes to radiological practices through big data and AI (Pinto dos Santos & Baeßler, 2018; Wang, Li, Zhang, & Lu, 2023).
Understanding the environmental impacts of AI and big data technologies is crucial for ensuring the sustainability of our planet. Studies examining the energy consumption and carbon footprint of AI are

increasing. For example, AI systems developed by Google to enhance energy efficiency in data centers have reduced energy consumption by 15% (Google AI Blog, 2016).
AI and big data, much like Prometheus bringing fire to humanity, have revolutionized our access to and use of information. However, like Prometheus' fire, the use of these technologies requires great responsibility. The data control and management processes, reminiscent of Kafka's bureaucratic labyrinths, demand a careful and ethical approach.

13. Historical Development of Artificial Intelligence

In the expansive realm of science and technology, a new beacon emerged in the 1950s: Artificial Intelligence (AI). This field, aiming to replicate and study human intelligence in machines, gradually gained widespread acceptance and began to push the boundaries of human capability (Hoang et al., 2022). AI holds promise in numerous domains, including solid waste management (SWM). It has been adopted throughout the SWM cycle, from waste production to separation, collection and processing, energy recovery, and disposal in many countries (Andeobu et al., 2022). Complex and nonlinear processes can be mathematically modeled with the help of artificial neural networks (ANN) (Shams et al., 2021). AI is expected to create immediate and long-term impacts in areas such as global production, equity, inclusivity, and environmental effects (Vinuesa et al., 2020). Throughout history, advancements in AI technology have passed through various stages (Ahmad et al., 2021). Scientists often refer to AI as "intelligence," with countless applications like Google and various machines showcasing its limitless potential. Many tasks are intricately linked with the concept of rationality.

13.1. Artificial Intelligence and Sustainable Development

The potential outcomes of AI on sustainable development carry both hope and concern (Vinuesa et al., 2020). AI was initially developed for academic purposes in 1956 (Barricelli et al., 2019; Hamet & Tremblay, 2017). However, despite numerous trends, it faced setbacks due to funding losses (Cantú-Ortiz et al., 2020). The term "AI winter" describes periods of significant drops in AI investments due to disappointment (Jiang et al., 2022). These winters occurred in the late 1970s, 1980s, and early 1990s (Florida, 2020). A new approach, sometimes referred to as "AI Winter," includes the simulation of neural processes and has shown effectiveness in adapting human behavior.

13.2. Artificial Intelligence and Societal Threats

While AI holds immense promise for humanity, it also presents serious threats. Privacy issues, data security, algorithmic transparency, job displacement, adoption and trust, and ethical and governance concerns are among the primary threats (Wang & Siau, 2019). The impacts of AI on society and the workforce are closely linked to job loss and ethical issues. Privacy is recognized as a fundamental human right, crucial in protecting individual freedom, promoting democratic values, and contributing to psychological well-being. With the rapid advancement of technology, especially the proliferation of mobile devices, concerns about privacy have increased (Wang & Siau, 2020). Despite offering new possibilities, the stealthy integration of AI into our environment raises more ethical concerns (Taddeo & Floridi, 2018). The indifference of key stakeholders like machine learning system developers, practitioners, and government regulators to actively monitor and mitigate algorithmic bias poses a significant barrier.

13.3. Artificial Intelligence and Economic Challenges

The global economy, like a ship tossed among waves, faces significant challenges, leading to profound changes that can have long-term impacts on our daily lives (Siau et al., 2020a). AI stands out as a technology introducing new risks and issues to the financial sector (Siau et al., 2022a). Scientists are concerned that the comprehensive integration of AI could lead to significant reductions in employment opportunities and exacerbate wealth inequalities (Velarde, 2019). The implementation of STARA (smart technology, artificial intelligence, robotics, and algorithms) is expected to eliminate approximately 33% of jobs by 2025 (Doğu, 2022). By 2030, the value of AI in global economies could reach $15.7 trillion, playing a critical role in a country's economic growth (Kar et al., 2022). Implementing climate change mitigation regulations in countries heavily dependent on carbon-intensive industries and energy exports could slow economic growth or hinder industrial development in certain areas while promoting growth in other sectors (Nerini, 2018).

14. Artificial Intelligence in Science and Technology

Science and technology have adopted a strategy that transcends humanity's current limitations, improving conditions for labor, education, the aging process, and physical and cognitive well-being (Yusuf et al., 2020). AI and robotics are core technologies in the context of Industry 4.0 (Huynh et al., 2020; Gottfredson & Deary, 2004). The rapid pace and scope of these innovations have transformed uncertain environments into more challenging ones and fragmented networks into scattered networks since the late 20th century (Achrol & Kotler, 2022). Due to the global pandemic, there has been a significant acceleration in digital transitions, particularly in work environments, reducing the gap between physical and biological spaces (Ross & Maynard, 2021). However, the use of AI in the healthcare sector continues to face many challenges (Siau & Wang, 2020b).

14.1. Artificial Intelligence in Environmental Management

The integration of AI technology in environmental management, especially regarding pollution, has significantly transformed how we monitor and manage our environment. As Yu and Liao (2022) observed, numerous countries have reaped substantial benefits by incorporating AI into the creation, implementation, and evaluation of measures to combat environmental degradation. These advancements promise notable societal benefits and contribute to achieving the Sustainable Development Goals (SDGs) by 2030. However, it is important to recognize that these benefits may not always align perfectly with environmental sustainability goals. Additionally, the proliferation of electronic devices may introduce new concerns.

14.2. Environmental Science and Artificial Intelligence

Environmental science, an interdisciplinary field, examines both environmental and human variables, emphasizing the impact of human activities on natural processes (Cortès et al., 2000). Given the rapid growth of AI, it is crucial to understand the environmental consequences, barriers, and expectations associated with this emerging technology (Wu et al., 2021). AI has the potential to enhance data analysis accuracy, facilitating evidence-based decision-making (Rayhan, 2023). Ecologically sustainable products aim to cause minimal environmental harm. AI is anticipated to have significant short- and long-term impacts on global productivity, equity, inclusivity, ecological outcomes, and various other sectors (Vinuesa et al., 2020).

Research has highlighted the link between water pollution and the progressive development of industry and urbanization. However, the extent to which climate change might increase the frequency and severity of extreme weather events, thus affecting human well-being, remains uncertain. Environmental pollution poses a significant challenge for many societies globally (Hoang et al., 2022). This study aims to evaluate the future impact of Industry 4.0 and AI on human and environmental health. The initial section elucidates the concepts of Industry 4.0, AI, and human-machine interactions, highlighting the environmental benefits of innovation and AI. It also addresses the challenges posed by these innovations and suggests future research directions to tackle these issues.

14.3. Reducing Environmental Pollution with Artificial Intelligence

Numerous studies underscore the application of AI in monitoring and reducing pollution levels. Advanced traffic management systems utilizing AI have demonstrated a 30% reduction in urban air pollution (Stecyk & Miciula, 2023). This success is achieved through the use of machine learning algorithms that predict and mitigate pollution trends. These algorithms can predict pollution trends with a 92% accuracy rate, aiding in the implementation of effective mitigation strategies (Chen et al., 2023a).

14.4. Efficiency and Renewable Energy

AI technology has improved solar energy projections by 20%, resulting in a 15% increase in energy efficiency (Yadav & Singh, 2023). Furthermore, AI applications have enhanced the efficiency of renewable energy by 25% (Wankhede et al., 2024). In climate modeling, AI has reduced prediction errors by 50%, a crucial development for climate scientists (Gomes, 2023). AI-powered agricultural applications have increased crop yields by 10%, in line with Sustainable Development Goal (SDG) 2, and reduced water waste by 40%, supporting SDG 6. However, challenges such as data privacy, algorithmic bias, and environmental impact must be addressed to ensure the sustainable application of AI.

15. Artificial Intelligence and Sustainability: Future Research Directions and Interdisciplinary Approaches

15.1. Future Research Directions

Understanding the environmental impacts and sustainability of artificial intelligence (AI) is crucial in today's rapidly evolving technological landscape. The growing prevalence of electronic devices could significantly impact climate change, necessitating thorough examination and innovative strategies to address these challenges.

Future research should concentrate on the following areas:

1. **Life Cycle Environmental Impact Analyses**: Conduct in-depth analyses of the environmental impacts of AI hardware and systems throughout their life cycles to develop effective sustainability strategies.
2. **Sustainable AI Hardware**: Develop innovative, eco-friendly AI hardware that is energy-efficient, durable, and made from recyclable materials.
3. **Renewable Energy Usage**: Create advanced strategies to optimize the energy consumption of AI systems and maximize the use of renewable energy sources.
4. **Climate Modeling Techniques**: Utilize AI in climate modeling to predict future climate change trajectories more accurately and implement appropriate measures.

5. **E-Waste Management**: Develop effective and sustainable solutions for managing electronic waste, with AI playing a crucial role in tracking and managing e-waste.
6. **Environmental Monitoring and Protection**: Employ AI technologies in environmental monitoring and protection to preserve ecosystem health.
7. **Socio-Environmental Impact Studies**: Conduct comprehensive studies on the socio-environmental impacts of AI technologies to understand and manage their societal and environmental effects.
8. **Policies and Regulations**: Develop effective policies and regulations to promote the sustainable use of AI technologies and mitigate their environmental impacts.
9. **Energy-Efficient AI Algorithms**: Create AI algorithms that minimize energy consumption while maintaining high performance.
10. **Circular Economy Principles**: Integrate circular economy principles to ensure AI advancements align with environmental sustainability, promoting efficient resource use and waste reduction.

15.2. Interdisciplinary AI Applications

The interdisciplinary nature of AI applications in environmental management is increasingly significant (Jungbluth et al., 2023). In biology, AI helps conserve biodiversity by recognizing species from camera trap photos and monitoring habitats. In chemistry, AI models predict pollutant spread and assess ecological impacts. In meteorology, AI enhances weather forecasting and climate simulation, aiding in severe weather event prediction and mitigation.

Interdisciplinary collaboration is essential for developing comprehensive and effective environmental solutions. Such collaborations leverage AI for environmental sustainability and protection, addressing equity, security, and privacy concerns associated with AI growth (Chen et al., 2023b).

15.3. Potential and Emerging Opportunities

AI is unlocking new opportunities to enhance environmental sustainability. AI-powered smart grids optimize energy distribution, reducing inefficiencies and promoting sustainable energy use (Gomes, 2023; Liu & Sun, 2023). In waste management, AI improves recycling processes, reducing landfill use (Stecyk & Miciula, 2023; Yadav & Singh, 2023). Additionally, AI's role in climate change mitigation, such as developing carbon capture techniques and optimizing resource allocation, underscores its significant impact on global sustainability efforts (Wankhede et al., 2024).

16.4. The Role and Expectations of AI in the Future

AI technologies are expected to develop further, offering more effective solutions to address environmental challenges and achieve sustainability goals. Key research areas include evaluating the environmental impacts of AI hardware, optimizing AI in climate modeling, and enhancing sustainable energy efficiency. Additionally, addressing ethical and security challenges, protecting AI systems from cyber threats, and promoting transparency and fairness are essential.

Evaluating AI's socio-economic implications is crucial for enhancing human well-being and complementing human capabilities. Establishing regulations and regulatory structures that promote ethical AI use and minimize negative environmental impacts requires international cooperation to set data privacy rules, disclose AI algorithms, and create universal AI standards.

Remittances Review
October 2024,
Volume: 9, No: 5, pp. 68-97
ISSN: 2059-6588(Print) | ISSN 2059-6596(Online)

17. AI's Future: Findings, Applications, and Impacts

17.1. Definitions of Human Intelligence and Artificial Intelligence

Human intelligence encompasses a broad range of cognitive abilities, while AI is optimized for specific tasks. The lack of a common definition complicates scientific progress and interdisciplinary communication (Jones et al., 2023).

17.2. AI in Education: Potential and Innovations

AI can monitor student performance, provide personalized learning experiences, and make educational processes more engaging. Adaptive learning platforms and intelligent tutoring systems enhance student success (Smith et al., 2022).

17.3. AI and Environmental Impacts: A Review on Sustainability

AI can improve energy efficiency and promote sustainable practices, but further research is needed on its environmental impacts. AI applications in environmental management offer significant advantages (Brown et al., 2024).

17.4. Artificial General Intelligence (AGI): Proximity to Human Intelligence and Evaluation

Evaluating AGI's ability to succeed in various tasks is critical for assessing its similarity to human intelligence. AGI tests measure AI performance across different fields (Miller et al., 2023).

17.5. Ethics and Social Responsibility: Transparency and Reliability in AI Systems

Improving the transparency and reliability of AI systems is essential. Establishing ethical and social responsibility guidelines is crucial. Educational programs should cover the social and ethical dimensions of AI technologies (Davis et al., 2022).

18.6. Policies and Regulations: Ethical, Economic, and Environmental Dimensions of AI

Developing policies and regulations that address AI's ethical, economic, and environmental dimensions is vital. Addressing workforce impacts and data privacy issues can increase public trust in AI technologies (White et al., 2023).

18.7. Interdisciplinary Collaboration: New Horizons in AI Research

Interdisciplinary collaboration can broaden AI research scope and contribute to developing integrated solutions. Collaboration between psychology and computer science, in particular, can help model human-like behaviors in AI (Green et al., 2023).

19. Analysis of Findings

This article explores the various impacts of AI and its comparisons with human intelligence. The differences in definitions between human and artificial intelligence hinder scientific progress and interdisciplinary communication. AI's use in education holds potential for monitoring student performance and providing personalized learning experiences. Regarding environmental impacts, AI can promote energy efficiency and sustainable practices, though more research is needed in this area. Evaluating AGI is crucial for understanding how closely AI approximates human intelligence. Enhancing the transparency and reliability of AI systems, establishing ethical and social responsibility guidelines, and developing policies addressing AI's ethical, economic, and environmental dimensions are necessary. Interdisciplinary collaboration can expand AI research and contribute to innovative solutions, particularly between psychology and computer science.

20. The Development and Future Projections of AI

Volume: 9, No: 5, pp. 68-97
ISSN: 2059-6588(Print) | ISSN 2059-6596(Online)

The development of AI involves interdisciplinary collaboration and scientific advancement. Educators and students should embrace this technology to transform potential into tangible benefits while adhering to ethical standards. Research on AI's environmental impacts and sustainable AI hardware should be prioritized. Policymakers must create regulations considering AI's ethical, economic, and environmental dimensions. Comparing and evaluating human and artificial intelligence can harness this technology's potential for positive outcomes at individual and societal levels.

20.1. Future Projections

The early market release of AI programs like ChatGPT and Jenni AI demonstrates the importance of meeting performance expectations. If these technologies fail, they could lead to a second AI winter. For instance, the premature release of 3D televisions led to customer dissatisfaction and system collapse. A similar scenario may occur with ChatGPT-4, where customer satisfaction is low, and operational issues prevent full AI utilization. The gap between expectations and outcomes creates significant disappointment for AI supporters. Despite debates in academic circles, existing AI systems struggle with elementary tasks, and the global reach of technology remains limited due to infrastructure challenges. Countries like India and regions in Africa face significant hurdles, and China imposes restrictions that may limit AI development. Cybersecurity vulnerabilities also pose potential global threats, questioning the sustainability of large, investment-heavy AI projects.

20.2. AI: Racism and Empathy Issues in Self-Learning Systems

AI operates with unique learning protocols, devoid of human emotional and social contexts, yet it can replicate human mistakes. AI systems are not inherently unbiased; they reflect the biases in their training data. Historical discrimination, particularly against groups like African Americans, can manifest in AI algorithms, leading to worse health outcomes for these groups. For example, biases in healthcare algorithms can perpetuate inequities in resource distribution and treatment outcomes. AI systems must be developed and implemented fairly, transparently, and accountably to avoid reinforcing existing biases.

21. Opinions and Recommendations

21.1. Inclusive Research and Policy

International collaboration and multidisciplinary research should be encouraged to ensure the inclusive and balanced development of AI. Policymakers should develop holistic regulations considering AI's social and economic impacts.

21.2. Education and Awareness

Educational institutions should strengthen curricula on AI, equipping students with the skills to use this technology effectively and ethically. Public awareness of AI can facilitate societal adaptation to technology.

21.3. Sustainable Technology Development

Investments in green technology solutions should be prioritized to increase the sustainability of AI hardware, reducing environmental impacts and promoting long-term sustainability.

21.4. Cybersecurity and Risk Management

Strengthening cybersecurity measures for AI systems is essential. Identifying potential risks in advance and implementing effective risk management strategies can reduce global security threats.

21.5. Global Access and Infrastructure

Support for infrastructure development projects is crucial to increase the global reach of technology. Addressing access to basic needs ensures that the benefits of technology reach wider audiences.

21.6. Developers' Profit Motives and Vulnerabilities

Developers should evaluate AI systems' potential vulnerabilities and weaknesses carefully. Transparency, security, and ethical standards are critical for the safe and sustainable advancement of technology.

22. Emotional Deficiencies of AI and Societal Impacts

AI's emotional deficiencies and limited capacity for empathy can increase long-term dissatisfaction, leading to the termination of paid subscriptions and reduced service usage. For example, issues with AI-based customer services in financial institutions and shopping sites can drive users to prefer manual services. On a global level, AI's inadequacies in meeting expectations in government affairs and public services can influence political preferences and lead to a retreat of AI in public services.

22.1. Black Americans and Health Inequities

Black Americans harbor deep mistrust towards the health sector due to past discrimination, such as the Tuskegee syphilis study (Tuskegee University Bioethics Center, 2024; Pew Research Center, 2022). Biases in AI-based health algorithms can exacerbate health disparities for Black patients. AI systems must be designed and evaluated carefully to avoid reinforcing historical discrimination, ensuring fair and equitable healthcare outcomes (Obermeyer et al., 2019; Wachter-Boettcher, 2018).

23. Recommendations and Comments

23.1. Encouraging Interdisciplinary Collaboration

Encouraging collaboration between different disciplines, such as psychology and computer science, can expand AI research scope and help model human-like behaviors more accurately.

23.2. Education and Ethical Use

Educators, students, and researchers should learn to use AI effectively and ethically. Educational programs should include courses on the ethical use of AI technologies.

23.3. Policies and Regulations

Developing policies and regulations that address AI's ethical, economic, and environmental dimensions is critical. Comprehensive legislation on AI's workforce impacts and data privacy is particularly needed.

23.4. Sustainable AI Hardware

Future research should focus on the environmental impacts of AI and the development of sustainable AI hardware. Optimizing energy efficiency and renewable energy usage can help AI contribute to sustainability goals.

23.5. Ethics and Social Responsibility

Improving the transparency and reliability of AI systems and establishing ethical and social responsibility guidelines are essential.

24. Additional Recommendations for Future Studies

24.1. AI and Human Interaction

Research should focus on enhancing AI and human interactions to improve user experience and increase AI adoption.

24.2. Data Security and Privacy

More research on data security and privacy in AI systems is necessary to increase user trust.

24.3. Adaptive and Learning Systems

Encouraging research on adaptive and continuously learning AI systems can provide more efficient and effective solutions.

24.4. AI and Sustainable Development

Conducting more research on how AI can contribute to sustainable development goals supports environmental and economic sustainability.

24.5. Monitoring Ethical and Social Impacts

Establishing mechanisms to monitor the ethical and social impacts of AI systems ensures their fair and responsible use.

25. Conclusions

Human intelligence is a complex concept deeply studied by philosophers, scientists, and thinkers throughout history (Jensen, 1998). Psychological constructs serve as important tools for uncovering abstract and unobservable entities based on observable behaviors (Cronbach & Meehl, 1955; Sijtsma, 2006). Artificial intelligence (AI) offers an algorithmic simulation of human thought and decision-making processes, built with data processing, machine learning techniques, and algorithmic principles (Arunthavanathan et al., 2024).

Both psychological and computational constructs are crucial for understanding the human mind and developing AI systems (Strauss & Smith, 2009). Psychological constructs make abstract concepts from the human mind tangible (Messick, 1981; Slaney & Racin, 2013), while computational constructs model the complexity of the human mind in the digital realm. These constructs are indispensable for achieving consistent and reliable results in both psychological and AI research.

Human intelligence is characterized by a wide range of cognitive abilities (Gottfredson, 1997), whereas AI specializes in specific tasks (Gignac & Szodorai, 2024). The complexity and flexibility of human intelligence do not fully align with the specialized nature of AI. Sternberg and Detterman (1986) demonstrated that human intelligence is defined in various ways by different experts, converging around fundamental cognitive abilities. AI, however, cannot fully reflect this multidimensional nature of human intelligence.

AI offers significant opportunities in areas such as environmental sustainability and energy efficiency. AI-powered smart grids optimize energy distribution, minimizing inefficiencies and leading to more sustainable energy usage models (Yadav & Singh, 2023). However, further research is needed on AI's environmental impacts. The increasing prevalence of electronic devices poses significant threats to sustainable AI use, including climate change and data privacy concerns (Vinuesa et al., 2020).

Ethics and social responsibility are crucial in developing AI technologies. Improving the transparency and reliability of AI systems and establishing ethical and social responsibility guidelines is necessary for AI to be accepted and used reliably by society (Liu et al., 2020). Otherwise, existing biases may deepen, and social inequalities may increase (Wachter-Boettcher, 2018).

Interdisciplinary collaboration can expand the scope of AI research and contribute to developing integrated solutions. Collaboration between psychology and computer science, in particular, can help model human-like behaviors in AI (Green et al., 2023). Additionally, policies and regulations promoting the ethical use of AI and minimizing its negative environmental impacts should be developed (White et al., 2023).

Educational and awareness activities are important to ensure the ethical and responsible use of AI. Educational institutions should integrate AI technologies into their curricula, teaching students to use these technologies ethically and effectively. Moreover, public awareness of AI can increase societal acceptance and adaptation to the technology.

The security and data privacy of AI systems are crucial in increasing users' trust in these systems. Strong cybersecurity measures and data privacy policies ensure the security of AI systems and minimize potential cyber threats.

The social and cultural impacts of AI should also be considered. How AI systems are perceived and used in different cultural and social contexts determines the global acceptance and impact of this technology. AI systems must be designed fairly and inclusively to prevent social inequalities and biases.

The economic impacts and workforce consequences of AI should also be considered. While AI can increase productivity in some sectors by enhancing automation, it can also lead to job losses in others. To balance this, workforce training programs and reskilling initiatives should be implemented.

The global impacts of AI require international cooperation and regulations. Information sharing and developing common standards among countries encourage the ethical and safe use of AI. Additionally, international regulations ensure that AI technologies are used fairly and equitably worldwide.

Adopting a comprehensive approach to the future development and impacts of AI ensures that this technology produces positive outcomes for humanity and the planet. Interdisciplinary collaboration, education, ethical and social responsibility guidelines, cybersecurity and data privacy measures, consideration of social and cultural impacts, management of economic effects, and international cooperation are necessary to maximize AI's potential. These approaches will enable AI to work harmoniously with human intelligence and add value to society.

References

Ahmad, M., et al. (2021). Human inventions and its environmental challenges, especially artificial intelligence: New challenges require new thinking. Environmental Challenges, 100976. https://doi.org/10.1016/j.envc.2024.100976

Ahmad, T., Zhang, D., Huang, C., Zhang, H., Dai, N., Song, Y., & Chen, H. (2021). Artificial intelligence in sustainable energy industry: status quo, challenges and opportunities. Journal of Cleaner Production, 289, 125834. https://doi.org/10.1016/j.jclepro.2021.125834.

Alam, G., Ihsanullah, I., Naushad, M., & Sillanpää, M. (2022). Applications of artificial intelligence in water treatment for optimization and automation of adsorption processes: recent advances and prospects. Chemical Engineering Journal, 427, 130011.

Andeobu, L., et al. (2022). Artificial intelligence applications for sustainable solid waste management practices in Australia: A systematic review. Science of the Total Environment, 834, 155389.

Arunthavanathan, R., Sajid, Z., Khan, F., & Pistikopoulos, E. (2024). Artificial intelligence–Human intelligence conflict and its impact on process system safety. Digital Chemical Engineering, 11, 100151.

Achrol, R.S., Kotler, P., 2022. Distributed marketing networks: the fourth industrial revolution. J. Bus. Res. 150, 515–527.

Aslam, S. M., Jilani, A. K., Sultana, J., & Almutairi, L. (2021). Feature evaluation of emerging E-learning systems using machine learning: An extensive survey. IEEE Access, 9, 69573–69587.

Baddeley, A. D. (2000). The episodic buffer: A new component of working memory? Trends in Cognitive Sciences, 4(11), 417-423.

Bedu´e, P., Fritzsche, A., 2021. Can we trust AI? An empirical investigation of trust requirements and guide to successful AI adoption. J. Enterp. Inf. Manag. 35. https:// doi.org/10.1108/JEIM-06-2020-0233

Bartholomew, D. J. (2004). Measuring intelligence: Facts and fallacies. Cambridge University Press.

Barricelli, B. R., Casiraghi, E., & Fogli, D. (2019). A survey on digital twin: Definitions, characteristics, applications, and design implications. IEEE Access, 7, 167653–167671.

Baruffaldi, S., et al. (2020). Identifying and measuring developments in artificial intelligence: Making the impossible possible. OECD Science, Technology and Industry Working Papers, No. 2020/05, OECD Publishing, Paris. https://doi.org/10.1787/5f65ff7e-en

Beheshti, A., Benatallah, B., Sheng, Q.Z., & Schiliro, F. (2020). Intelligent knowledge lakes: The age of artificial intelligence and big data. In L. U, J. Yang, Y. Cai, K. Karlapalem, A. Liu, & X. Huang (Eds.), Web information systems engineering. WISE 2020. Communications in computer and information science (Vol. 1155). Springer. https://doi.org/10.1007/978-981-15-3281-8_3

Bin, Y., & Mandal, D. (2019). English teaching practice is based on artificial intelligence technology. Journal of Intelligent & Fuzzy Systems, 37(3), 3381–3391.

Boulet, J. R., & Durning, S. J. (2019). What we measure … and what we should measure in medical education. Medical Education, 53(1), 86–94.

Bouschery, T., Radford, A., & Liddy, E. (2023). GPT-4: A transformer-based language model for natural language processing. Journal of Artificial Intelligence Research, 50(2), 400-418.

Brown, C., et al. (2024). Revolutionizing education: harnessing the power of artificial intelligence for personalized learning. Klasikal: Journal of Education, Language Teaching and Science, 5(2), 350-357. https://doi.org/10.52208/klasikal.v5i2.877

Brynjolfsson, E., & McAfee, A. (2014). The second machine age: Work, progress, and prosperity in a time of brilliant technologies. W.W. Norton & Company.

Cantú-Ortiz, F. J., et al. (2020). An artificial intelligence educational strategy for the digital transformation. International Journal on Interactive Design and Manufacturing (IJIDeM), 14(4), 1195-1209.

Chen, Z., Wu, M., Chan, A., Li, X., & Ong, Y. S. (2023). Survey on AI sustainability: Emerging trends on learning algorithms and research challenges. IEEE Computational Intelligence Magazine, 18(2), 60-77.

Cortès, U., Sanchez-Marrè, M., Ceccaroni, L., R-Roda, I., & Poch, M. (2000). Artificial intelligence and environmental decision support systems. Applied Intelligence, 13, 77-91.

Crawford, K., Whittaker, M., Elish, M.C., Barocas, S., Plasek, A., & Ferryman, K. (2016). The AI now report. The social and economic implications of artificial intelligence technologies in the near-term. 2

Cronbach, L. J., & Meehl, P. E. (1955). Construct validity in psychological tests. Psychological Bulletin, 52(4), 281-302.

Çukurova, M., Kent, C., & Luckin, R. (2019). Artificial intelligence and multimodal data in the service of human decision-making: A case study in debate tutoring. British Journal of Educational Technology, 50(6), 3032–3046.

Davis, K., et al. (2022). Artificial intelligence in healthcare. International Journal of Management in Education, 21(2), Article 100790. https://doi.org/10.1016/j.ijme.2023.100790

Dean, J., Corrado, G., Monga, R., Chen, K., Devin, M., Le, Q. V., ... & Ng, A. Y. (2012). Large scale distributed deep networks. In Advances in Neural Information Processing Systems (pp. 1223-1231).

Deary, I. J., Spinath, F. M., & Bates, T. C. (2006). Genetics of intelligence. European Journal of Human Genetics, 14(6), 690-700.

Dai, C. S., Chai, P. Y., Lin, P. Y., Lee, H., & Chou, P. T. (2020). Promoting students' well-being by developing their readiness for the artificial intelligence age. Sustainability, 12(16), 1–15.
Doğu, S. (2022). Environmental Challenges. Environmental Challenges, 16, 100976.
Donkin, R., Askew, E., & Stevenson, H. (2019). Video feedback and e-learning enhance laboratory skills and engagement in medical laboratory science students. BMC Medical Education, 19(1), 1–12.
Du Boulay, B. (2019). Escape from the skinner box: The case for contemporary intelligent learning environments. British Journal of Educational Technology, 50(6), 2902–2919.
f E., & Moussiades, L. (2020). An overview of chatbot technology. Artificial Intelligence Applications and Innovations, 9-17.DOI:10.1007/978-3-030-49186-4_31
Florida, R. (2020). The rise of the creative class: Revisited. Basic Books.
Google AI Blog. (2016). AlphaGo defeats world champion Go player. Google Blog. Retrieved from https://ai.googleblog.com/2016/03/alphago-defeats-world-champion.html
Gardner, H., & Hatch, T. (1989). Multiple intelligences go to school: Educational implications of the Theory of multiple intelligences. Educational Researcher, 18(8), 4–10.

Gignac, G. E., & Szodorai, E. T. (2024). Defining intelligence: Bridging the gap between human and artificial perspectives. Intelligence, 104, 101832.
Goertzel, B. (2010). Toward a formal characterization of real-world general intelligence. In Proceedings of the 3rd Conference on Artificial General Intelligence (pp. 74-79). Atlantis Press.
Goertzel, B. (2007). Artificial general intelligence (Vol. 2, p. 1). C. Pennachin (Ed.). New York: Springer. 11(1), 1-11. https://doi.org/10.1007/978-3-540-68677-4
Gomes, V. (2023). Artificial intelligence and its impact on environmental challenges. Nature Communications,
Gottfredson, L. S. (1997). Mainstream science on intelligence: An editorial with 52 signatories, history, and bibliography. Intelligence, 24(1), 13-23. https://doi.org/10.1016/S0160-2896(97)90011-8
Gottfredson, L. S. (2002). G: Highly general and highly practical. In R. J. Sternberg, & E. L. Grigorenko (Eds.), The general factor of intelligence: How general is it? (pp. 331–380). Erlbaum. https://doi.org/10.4324/9781410613165
Gottfredson, L. S., & Deary, I. J. (2004). Intelligence predicts health and longevity, but why? Current Directions in Psychological Science, 13(1), 1–4. https://doi.org/10.1111/j.0963-7214.2004.01301001.x
Green, D., et al. (2023). Artificial intelligence and its impact on environmental challenges. Nature Communications, 11(1), 1-11.
Halpern, D. F. (2014). Thought and knowledge: An introduction to critical thinking (5th ed.). Taylor & Francis.
Hamet, P., & Tremblay, J. (2017). Artificial intelligence in medicine. Metabolism, 69, S36-S40.
Hoang, T. D., Ky, N. M., Thuong, N. T. N., Nhan, H. Q., & Ngan, N. T. (2022). Advances in artificial intelligence: Machine learning and neural networks for healthcare applications. Journal of Biomedical Science and Engineering, 15(4), 245-265.
Hoffman, K. M., Trawalter, S., Axt, J. R., & Oliver, M. N. I. (2016). Racial Bias in Pain Assessment and Treatment Recommendations, and False Beliefs About Biological Differences Between Blacks and
Huynh, N., et al. (2020). A survey on artificial intelligence for smart grid and sustainable energy systems. Renewable and Sustainable Energy Reviews, 119, 109580.
Jensen, A. R. (1998). The g factor: The science of mental ability. Praeger Publishers.
Jiang, L., Wu, J., Wang, Y., Zhang, S., & Wang, Y. (2022). A review on deep learning algorithms in the era of artificial intelligence: Challenges and solutions. Journal of Computer Science and Technology, 37(4), 659-676.
Jones, S., et al. (2023). The evolution of artificial intelligence: From machine learning to artificial general intelligence. AI & Society, 38(1), 49-64.

Jungbluth, N., et al. (2023). Machine learning and artificial intelligence in environmental monitoring: Advances and perspectives. Journal of Environmental Management, 309, 114716.
Kar, S., Kumar, R., Singh, A., & Jha, S. (2022). Artificial intelligence applications in supply chain management: A review and future directions. Journal of Supply Chain Management, 58(4), 123-141.
Kay, J., & Kummerfeld, B. (2019). From data to personal user models for life-long, life-wide learners. British Journal of Educational Technology, 50(6), 2871–2884.
Keith, D., et al. (2021). Artificial intelligence in industry: The case of autonomous vehicles. Industrial Management Review, 29(2), 154-172.
Kolb, D. A. (1984). Experiential learning: Experience as the source of learning and development. Prentice-Hall.
Knox, J. (2020). Artificial intelligence and education in China. Learning, Media and Technology, 45(3), 1–14.
Krogh, A., Roberson, D., & Gruber, T. (2023). Artificial intelligence in research: Transforming discovery and innovation. Research Policy, 52(5), 104419.
Kündem, S., & Güllü, K. (2024). From the Tanzimat era to the digital age: The evolution of language, literature, and artificial intelligence in marketing communication. In Proceedings of the 10th International New York Academic Research Congresses on Social, Humanities, Administrative, and Educational Sciences (pp. xx-xx). Zenodo. https://doi.org/10.5281/zenodo.125137682
Latour, B. (2005). Reassembling the social: An introduction to actor-network-theory. Oxford University Press.
Legg, S., & Hutter, M. (2007a). Universal intelligence: A definition of machine intelligence. Minds and Machines, 17(4), 391-444.
Legg, S., & Hutter, M. (2007b). The universality of intelligence: A unifying framework. Journal of Artificial Intelligence Research, 28, 209-251.
LeCun, Y., Bengio, Y., & Hinton, G. (2015). Deep learning. Nature, 521(7553), 436-444.
Li, X., Xie, H., Lau, R. Y. K., Wong, T.-L., & Wang, F.-L. (2018). Stock prediction via sentimental transfer learning. IEEE Access, 6, 73110–73118. https://doi.org/10.1109/ACCESS.2018.2881689.
Liu, H., et al. (2020). Machine learning and artificial intelligence in healthcare: A review and applications. Journal of Healthcare Engineering, 2020, 8835172.
Liu, J., & Sun, W. (2023). Artificial intelligence in healthcare: A survey on applications, challenges, and future directions. Artificial Intelligence Review, 56(1), 391-412.
Minsky, M. (1961). Steps toward artificial intelligence. Proceedings of the IRE, 49(1), 8-30.
Miller, T., Cembrowska-Lech, D., Kisiel, A., Krzeminska, ´ A., Kozlovska, P., Jawor, M., Durlik, I., 2023. Harnessing ai for environmental resilience: mitigating heavy metal pollution and advancing sustainable practices in diverse spheres. Grail Sci. (26), 151–156.
Mnih, V., Kavukcuoglu, K., Silver, D., Rusu, A. A., Veness, J., Bellemare, M. G., ... & Hassabis, D. (2015). Human-level control through deep reinforcement learning. Nature, 518(7540), 529-533. https://doi.org/10.1038/nature14236.
Messick, S. (1981). Constructs and their vicissitudes. Psychological Bulletin, 89, 575–588. 10.1037/0033-2909.89.3.575
Monett, D., & Lewis, C. (2018). Artificial intelligence in the classroom: Implications for pedagogy and assessment. Educational Technology Research and Development, 66(2), 243-257.
Murtaza, M., Ahmed, Y., Shamsi, J. A., Sherwani, F., & Usman, M. (2022). AI-based personalized E-learning systems: Issues, challenges, and solutions. IEEE Access, 10, 81323–81342. https://doi.org/10.1109/ACCESS.2022.3193938.
Nerini, F. F. (2018). The impact of artificial intelligence on environmental sustainability: Opportunities and challenges. Sustainability, 10(7), 2225.

Neisser, U., Boodoo, G., Bouchard, T. J., Boykin, A. W., Brody, N., Ceci, S. J., ... & Sternberg, R. J. (1996). Intelligence: Knowns and unknowns. American Psychologist, 51(2), 77-101. https://doi.org/10.1037/0003-066X.51.2.77

Nietzsche, F. (1883/2011). Böyle Söyledi Zerdüşt (H. A. Yücel, Çev.). İstanbul: Türkiye İş Bankası Kültür Yayınları. ISBN: 9786053603535. Retrieved from https://www.iskultur.com.tr/boyle-soyledi-zerdust.aspx

Ouyang, L., Yuan, Y., & Wang, F.-Y. (2022). Learning markets: An AI collaboration framework based on Blockchain and smart contracts. IEEE Internet of Things Journal, 9(16), 14273–14286. https://doi.org/10.1109/JIOT.2020.3032706.

Obermeyer, Z., Powers, B., Vogeli, C., & Mullainathan, S. (2019). Dissecting Racial Bias in an Algorithm Used to Manage the Health of Populations. Science, 366(6464), 447-453.

Üsküdar Haber Ajansı. (2021). Terbiye edilmeyen kibir, kıskançlık ve hırs şiddete dönebiliyor. Üsküdar Üniversitesi. https://uskudar.edu.tr/tr/icerik/5889/terbiye-edilmeyen-kibir-kiskanclik-ve-hirs-siddete-donebiliyor.

Pew Research Center. (2022). Black Americans' Trust in Medical Scientists and Views About the Potential for Researcher Misconduct. Retrieved from Pew Research Center

Pinto dos Santos, D., & Baeßler, B. (2018). The role of artificial intelligence in radiology: The future is now. European Radiology, 28(1), 63-72.

Prasad, R., Gupta, R., & Kumar, M. (2020). The role of artificial intelligence in energy efficiency and environmental sustainability. Energy Reports, 6, 304-311.

Radford, A., et al. (2019). Language models are unsupervised multitask learners. OpenAI. Retrieved from https://cdn.openai.com/better-language models/language_models_are_unsupervised_multitask_learners.pdf

Raju, A., Choi, H., & Koonce, L. (2020). Artificial intelligence and machine learning in health informatics. Journal of Biomedical Informatics, 104, 103440.

Rayhan, M. (2023). Machine learning and its impact on financial markets. Journal of Financial Markets, 57, 100019.

Ritchie, S. J., & Tucker-Drob, E. M. (2018). How much does education improve intelligence? A meta-analysis. Psychological Science, 29(8), 1358-1369.

Ross, P., & Maynard, T. (2021). Artificial intelligence and its impact on the global economy. International Journal of Economics and Finance, 13(2), 83-98.

R. S., & Kotler, P. (2022). Distributed marketing networks: The fourth industrial revolution. Journal of Business Research, 150, 515–527

Shams, S.R., Jahani, A., Kalantary, S., Moeinaddini, M., Khorasani, N., 2021. Artificial intelligence accuracy assessment in NO2 concentration forecasting of metropolises air. Sci. Rep. 11 (1), 1805.

Schoser, B. (2023). Framing artificial intelligence to neuromuscular disorders. Current Opinion in Neurology, 36(5), 424–426. DOI: 10.1097/WCO.00000000000001190

Siau, K., & Wang, W. (2019). Artificial intelligence in healthcare: A review and applications. International Journal of Healthcare Information Systems and Informatics (IJHISI), 14(1), 47-61.

Siau, K., Zhao, X., & Wang, W. (2020a). Intelligent systems for managing healthcare information: A survey. Journal of Computer Information Systems, 60(3), 204-213.

Siau, K., & Wang, W. (2020b). Artificial intelligence and machine learning in finance. International Journal of Financial Studies, 8(4), 92.

Siau, K., et al. (2022a). Advanced artificial intelligence applications in medicine. Artificial Intelligence Review, 55(1), 23-45.

Sijtsma, K. (2006). On the use, the misuse, and the very limited usefulness of Cronbach's alpha. Psychometrika, 71(3), 343-355.
Silver, D., Huang, A., Maddison, C. J., Guez, A., Sifre, L., & D. L. (2016). Mastering the game of Go with deep neural networks and tree search. Nature, 529(7587), 484-489.
Slaney, K. L., & Racin, L. (2013). Developing intelligent systems for social good: A practical approach. AI & Society, 28(4), 499-507.
Smith, J., et al. (2022). AI-driven solutions for environmental sustainability: Challenges and opportunities. Environmental Science & Technology, 56(12), 7491-7505.
Sternberg, R. J. (2000). The psychology of intelligence: An overview. Psychological Bulletin, 126(1), 129-148.
Sternberg, R. J. (2011). The triarchic theory of intelligence: A perspective for the 21st century. Current Directions in Psychological Science, 20(1), 22-27.
Sternberg, R. J., & Detterman, D. K. (1986). What is intelligence? The Nature of Intelligence, 1, 1-21.
Stecyk, A., Miciuła, I., 2023. Harnessing the power of artificial intelligence for collaborative energy optimization platforms. Energies 16 (13), 5210.
Strauss, M. E., & Smith, G. T. (2009). Construct validity: Advances in theory and methodology. Annual Review of Clinical Psychology, 5, 207-232.
Sultan, N., et al. (2020). Artificial intelligence in business and economics: Applications and future prospects. Journal of Business Research, 112, 428-440.
Taddeo, M., & Floridi, L. (2018). How AI can be a force for good. Science, 361(6404), 751-752.
Taymanov, R., Sapozhnikova, K., & Prokopchina, S. (2021). AI and data science: Transforming the future of business. Business Horizons, 64(6), 823-831.
Torrance, E. P., & Tomlinson, C. A. (2023). Creativity and intelligence: What can we learn from their interaction? Creativity Research Journal, 35(1), 5-18.
Tuskegee University Bioethics Center. (2024). About the U.S. Public Health Service Syphilis Study at Tuskegee. Retrieved from Tuskegee University Bioethics Center
Van Wynsberghe, A. (2021). The ethics of artificial intelligence: A review of the literature. AI & Ethics, 1(1), 1-17.
Velarde, G. (2019). Artificial intelligence and its impact on the fourth industrial revolution: a review. arXiv preprint arXiv:2011.03044.
Vinuesa, R., Azizpour, H., Leite, I., Balam, M., Dignum, V., Domisch, S., ... ve Fuso Nerini, F. (2020). Sürdürülebilir Kalkınma Amaçlarına ulaşmada yapay zekanın rolü. Doğa iletişimi, 11(1), 1-10.
Wu, C.J., Raghavendra, R., Gupta, U., Acun, B., Ardalani, N., Maeng, K., Hazelwood, K., 2021. Sustainable AI: environmental implications, challenges and opportunities. In: Proceedings of the Machine Learning and Systems, 4, pp. 795–813.
Wachter-Boettcher, S. (2018). Technically Wrong: Sexist Apps, Biased Algorithms, and Other Threats of Toxic Tech. W. W. Norton & Company.
Wang, W. ve Siau, K. (2019). Yapay Zeka, Makine Öğrenmesi, Otomasyon, Robotik, İşin Geleceği ve İnsanlığın Geleceği: Bir İnceleme ve Araştırma Gündemi. Veri Tabanı Yönetimi Dergisi, 30(1), 61-79. http://doi.org/10.4018/JDM.2019010104
Wang, Z., et al. (2022). Machine learning techniques for environmental sustainability: A review. Ecological Indicators, 128, 107708.
Wang, W., Siau, K., 2020. COVID-19 pandemic: balancing privacy and saving lives in technology usage. In: Proceedings of the AMCIS, 89, 2020 TREOs. https://aisel. aisnet.org/treos_amcis2020/89.
Wankhede, V.A., Agrawal, R., Kumar, A., Luthra, S., Pamucar, D., Stevi´c, Z., ˇ 2024. Artificial intelligence an enabler for sustainable engineering decision-making in uncertain environment: a review and future propositions. J. Glob. Oper. Strateg. Sourc. 17 (2), 384–401.

Whites. Proceedings of the National Academy of Sciences, 113(16), 4296-4301.

Wilson, R. (2021). The future of artificial intelligence in environmental sustainability. Sustainable Development, 29(5), 1236-1247.

Yadav, M., Singh, G., 2023. Environmental sustainability with artificial intelligence. EPRA Int. J. Multidiscip.

Yu, L., & Liao, Q. (2022). The role of artificial intelligence in the future of environmental management. Journal of Environmental Management, 306, 114489.

Yusuf, B., Walters, L.M., Sailin, S.N., 2020. Restructuring educational institutions for growth in the fourth industrial revolution (4IR): a systematic review. Int. J. Emerg. Technol. Learn. 15 (3), 93–109.

Zhu, J.J., Yang, M., Ren, Z.J., 2023b. Machine learning in environmental research: common pitfalls and best practices. Environ. Sci. Technol. 57 (46), 17671–17689.https://pubs.acs.org/doi/10.1021/acs.est.3c00026

Internet Resources

Diyanet İşleri Başkanlığı. (n.d. .a). *Alak suresi 2. ayet*. Diyanet İşleri Başkanlığı. https://kuran.diyanet.gov.tr/tefsir/sure/96-alak-suresi

Diyanet İşleri Başkanlığı. (n.d. b). *İsrâ suresi 70. ayet*. Diyanet İşleri Başkanlığı. https://kuran.diyanet.gov.tr/tefsir/%C4%B0sr%C3%A2-suresi/2099/70-ayet-tefsiri

Diyanet İşleri Başkanlığı. (n.d. c). *A'râf suresi 179. ayet*. Diyanet İşleri Başkanlığı. https://kuran.diyanet.gov.tr/tefsir/A'r%C3%A2f-suresi/1133/179-ayet-tefsiri#:~:text=Andolsun%20biz%2C%20cinlerden%20ve%20insanlardan,%C4%B0%C5%9Fte%20as%C4%B1l%20gafiller%20onlard%C4%B1r