

RESEARCH
ARTICLE**Artificial Intelligence: From Concept to Application in Modern Society****Djenat Kalli**

Prof.

Department of Social Sciences, University of Oum El Bouaghi
Algeria

Email: Djenat.kalli@univ-ueb.dz ; Orcid: 0000-0002-3187-11154

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Abstract

Intelligence is a concept that is difficult to define precisely. It can be considered the crucial element that grants us the ability to achieve goals in the world around us. Humans, as well as some animals and machines, possess varying levels of intelligence. To clarify the nature of artificial intelligence, it is essential first to define the true meaning of human intelligence, which relates to mental abilities such as adapting to our surroundings, thinking, analyzing, planning, solving problems, and reaching accurate conclusions.

Artificial intelligence is defined as the machine's ability to simulate the human mind and the way it functions, such as its ability to think and explore. These machines are designed to perform tasks that typically require human intelligence, such as visual perception, speech recognition, decision-making, and language translation. AI technologies include machine learning, which enables computers to learn from experience and improve their performance over time without being explicitly programmed. Artificial intelligence has a significant impact on how we do things and the ways we interact with one another. It has applications in various fields, including healthcare, defense, transportation, education, the labor market, and society in general.

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Introduction:

Over the past few decades, the world has witnessed a tremendous development in the field of artificial intelligence, making it one of the most prominent domains that have transformed the face of the world. What once began as a fictional idea in science literature has become a tangible reality thanks to significant advances in computing and machine learning.

Artificial intelligence is one of the most important modern technologies that significantly contribute to rapid technological advancement and increased opportunities for innovation and growth across various fields. AI plays a vital role in enhancing quality, expanding capabilities, improving operational efficiency, and boosting productivity. Despite the widespread adoption of AI technologies and the frequent discussions surrounding their capabilities, they remain surrounded by ambiguity or exaggeration, which may raise unrealistic expectations. This makes the true understanding of artificial intelligence, its technologies, and its actual potential unclear to many decision-makers and executives in both the public and private sectors.

Among the benefits of artificial intelligence is its ability to perform extensive analysis of big data and extract information and insights from extremely large datasets. AI also contributes to the advancement of medical sciences—machine learning and deep learning technologies have revolutionized the way we diagnose diseases and develop treatments. Another benefit of AI is automated human interaction through advanced voice response

technologies and service robots, which facilitate unprecedented ways of connecting humans with technology. Furthermore, AI plays a role in sustainability and the environment through disaster prediction, environmental analysis, and sustainable resource optimization.

Despite the tremendous progress and multiple benefits of artificial intelligence, there remain challenges and concerns related to data security, privacy, and AI ethics—especially the balance between protecting individual privacy and ensuring its responsible and ethical use.

This article aims to define the nature of artificial intelligence and assess its impact across various fields of life, while also addressing its risks by answering the following main question:

How has the concept of artificial intelligence evolved from theoretical vision to modern perception, and what are the cognitive and ethical implications of this development?

Study Objectives:

This study aims to:

- Analyze the development of the concept of artificial intelligence from its traditional theoretical framework to its modern form;
- Trace the historical and theoretical roots of the emergence of artificial intelligence and the evolution of its initial concepts;
- Identify the applications of artificial intelligence across various fields;
- Highlight the potential future impacts of artificial intelligence on humans and society.

1. Definition of Artificial Intelligence:

To define and clarify the concept of artificial intelligence, we must first define human intelligence, as this will help us later understand artificial intelligence, which simulates—or in many cases surpasses—human intelligence in various fields.

First: Definition of Human Intelligence

Scientists have long differed in how to define and interpret human intelligence, with each scholar approaching it according to their area of expertise. Alfred Binet defined it as “the ability to understand, judge, and think well,” while the English philosopher Herbert Spencer described it as “the mental adaptation to external relations.”

From a scientific perspective, intelligence is often associated with academic and research-based abilities. Rezin and Dzint defined intelligence as: “a set of acquired scientific and intellectual abilities that allow for the acquisition of knowledge and its effective use to solve problems in an objective and constructive manner.”

Thus, human intelligence reflects the ability to solve problems using symbols and search techniques, as well as benefiting from prior experience to acquire new knowledge and apply it to find solutions to specific problems.

From the above, it becomes clear that there is no single, precise definition of human intelligence, which in turn has led to the absence of a unified and comprehensive definition of artificial intelligence. (Ben Mars Hala, Mkhansha Maria, 2024, p. 09)

Second: Definition of Artificial Intelligence

Artificial intelligence is defined as the ability of a machine to simulate the human mind and its functions, such as thinking and exploring. With the tremendous advances in computing, it has become clear that machines are

capable of performing tasks more complex than previously imagined—such as exploring and proving complex mathematical theorems or playing chess at a high level of skill. AI is characterized by its speed, precision, and large storage capacity. However, no current program has yet been able to match the flexibility of the human mind, especially in tasks requiring deductive and analytical reasoning.

On the other hand, some applications have been able to rival expert-level performance in specific tasks, such as medical diagnosis, computer search engines, and the ability to recognize speech and handwriting. (Artificial Intelligence, 2021, p. 02)

Artificial intelligence is a field of computer science that aims to design systems and programs capable of performing tasks that require thinking, learning, and reasoning similar to that of humans. AI relies on a broad set of technologies and tools that allow computer systems to process and analyze data, extract patterns, and make decisions based on the available information.

Artificial intelligence can be categorized into narrow AI and strong (general) AI, as follows: (Ghada Nasr Hussein Al-Morsi, 2024, p. 76)

Narrow AI refers to specialized artificial intelligence systems that are capable of performing specific tasks—often outperforming humans in those tasks. However, their capabilities are limited to the specific domain for which they were designed.

General AI refers to artificial intelligence systems that possess cognitive abilities similar to those of humans. These systems have the ability to understand, learn, and apply knowledge across a wide range of tasks in ways that resemble human intelligence. They can think, reason, and solve problems.

2. Types of Artificial Intelligence:

To identify the types of artificial intelligence, we rely on two classifications: : (Ben Mars Hala, Mkhansha Maria, 2024, pp. 12-15)

First: Types of Artificial Intelligence Based on Capability

Artificial intelligence can be classified according to its capabilities into three types:

✓ Artificial Narrow Intelligence (ANI):

This type can effectively process a specific problem for a particular purpose. It can, for instance, play chess professionally or recognize objects in a specific image. Weak AI performs basic or partial tasks, such as study robots and voice response services like Apple's *Siri* and Amazon's *Alexa*.

✓ Artificial General Intelligence (AGI):

In this type, intelligent machines are capable of performing human tasks without human intervention. They can engage in deep thinking and solve problems creatively. For example, computers can rapidly process massive datasets, such as Uber's self-driving cars.

✓ Artificial Superintelligence (ASI):

This type can exceed human intelligence levels, outperforming even highly skilled specialists such as expert surgeons. It features unique learning capabilities, allowing machines to develop cognitive abilities through their own experiences. These machines can learn, plan, and make decisions independently and rapidly. It is worth noting that this type is still under development and represents the future of AI.

Second: Types of Artificial Intelligence Based on Purpose

Artificial intelligence can also be classified according to its intended use into four types: reactive AI, limited memory AI, theory of mind AI, and self-aware AI.

✓ **Reactive Artificial Intelligence:**

This is the oldest and simplest type, with systems that are purely reactive—without the ability to form memory or use past experiences in decision-making. IBM's *Deep Blue* chess-playing program is the ideal example of this type. It identifies current pieces and predicts possible moves to choose the best option without any awareness of past moves. Reactive machines are useful for performing basic functions by reading and responding to external stimuli—for example, scanning emails or recommending movies based on recent Netflix searches.

✓ **Limited Memory Artificial Intelligence:**

This type has the ability to store data and make predictions based on past information. Limited memory AI offers more capabilities than purely reactive devices. Machines with limited memory can use historical data to make decisions—such as smart robots used in education, instant messaging apps, virtual assistant applications in smartphones, and self-driving cars. These cars store speed limits and driving data (e.g., traffic signals), then analyze them to avoid collisions and ensure safe arrival. Reactive and limited memory AI are currently the most common and widely available forms of AI.

✓ **Theory of Mind Artificial Intelligence:**

This is a highly advanced form of AI that not only mimics the real world but also interacts with its individual components. It understands people, beings, and objects around it, realizing that each has emotions and feelings that influence behavior. This level of understanding is vital for developing societies, as it forms the basis of social relationships and interactions. Therefore, AI systems under this category can understand each person individually and adjust their behaviors accordingly.

✓ **Self-Aware Artificial Intelligence:**

In this category, machines possess self-awareness and unique emotions, making them more intelligent than humans. This type does not yet exist in reality and is expected to be the next frontier in international competition. Professor Nick Bostrom of Oxford University defined it as: “a level of intelligence that surpasses the best human minds in every field—including scientific creativity, general wisdom, and social skills.”

3. Characteristics of Artificial Intelligence Applications:

Artificial intelligence applications possess a set of characteristics that make them an effective investment across various fields, including the following: (Souad Boubaha, 2022, pp. 97-98)

- ✓ AI applications in devices and machines enable them to analyze problems.
- ✓ AI applications allow devices and machines to recognize voices and speech and to move objects.
- ✓ Some AI-enabled devices are capable of understanding inputs and analyzing them to deliver outputs that efficiently meet user needs.
- ✓ AI applications enable continuous learning, where the learning process is automatic and self-directed without supervision.
- ✓ They are capable of processing massive amounts of information.
- ✓ They can detect and analyze patterns in data more effectively than the human brain.

- ✓ They can find solutions to unfamiliar problems using their cognitive capabilities.

In addition to the above, other features and advantages can be noted, such as:

- ✓ Using intelligence to solve presented problems even in the absence of complete information.
- ✓ The ability to think and perceive.
- ✓ The ability to acquire and apply knowledge.
- ✓ The ability to learn and understand from past experiences.
- ✓ The ability to use previous experiences and apply them in new situations.
- ✓ The ability to use trial and error to explore different matters.
- ✓ The ability to respond quickly to new situations and circumstances.
- ✓ The ability to handle difficult and complex situations.
- ✓ The ability to deal with ambiguous situations where information is lacking.
- ✓ The ability to distinguish the relative importance of the elements of presented situations.
- ✓ The ability to imagine, be creative, and understand and perceive visual information.
- ✓ The ability to provide information to support managerial decision-making.

4. Transition to Artificial Intelligence

There is no doubt that artificial intelligence is one of the fundamental pillars of technological transformation in the modern era. To ensure the optimal utilization of its technologies and correct implementation, it is necessary to adhere to best practices in this field. The most prominent of these include: (Artificial Intelligence – The Artificial Intelligence Series for Executives, 2024)

➤ **Implementing Pilot Projects:**

Focus on useful, uncomplicated, and applicable projects whose impact can be measured to demonstrate the effectiveness of artificial intelligence and build trust. Specialized expertise may be sought to achieve results within a period ranging from six (6) to twelve (12) months.

➤ **Building an Internal Team:**

In the long term, it is essential to build an in-house team specialized in artificial intelligence, instead of relying on external sources. This helps in developing internal capabilities and creating a competitive advantage.

➤ **Training and Qualification:**

Develop internal skills through intensive training and continuous qualification. Educational materials and specialized online training courses can be utilized for this purpose.

➤ **Developing an AI Strategy:**

After implementing several pilot projects, an artificial intelligence strategy should be developed to provide a clear vision and a deeper understanding of application priorities and use cases in both the short and long term.

➤ **Enhancing Internal and External Communication:**

Launch communication programs targeting all stakeholders inside and outside the organization, with the aim of clarifying the potential of AI technologies, how to benefit from them, and addressing the concerns that may arise around their use.

5. Advantages and Disadvantages of Artificial Intelligence

First: Advantages of Artificial Intelligence

The use of artificial intelligence technology by companies and individuals offers numerous advantages and benefits in various forms. The most notable of these include: (Advantages and Benefits of Artificial Intelligence, n.d.)

✓ **Error-Free Processing:**

When tasks are performed by humans, errors are inevitable due to human nature. However, the use of AI-powered machines has increased the accuracy of these operations, making them nearly flawless. This accuracy depends on how well the machines are designed and programmed, ensuring reliable results.

Therefore, AI-driven devices have outperformed humans in terms of efficiency, as the algorithms used to build AI-based models rely on complex mathematical structures that enhance performance and reduce errors.

✓ **Helps with Repetitive Tasks:**

Humans often struggle with repetitive tasks, which can reduce their efficiency and productivity. AI technology addresses this issue, as machines do not require rest and can maintain high productivity levels over extended periods. As a result, manufacturers have adopted this technology to continuously produce goods and meet market demands.

✓ **Always Available:**

One of the key advantages of AI systems is their ability to operate continuously, providing services 24 hours a day—unlike humans, who typically work no more than 8 hours a day.

This feature ensures uninterrupted service delivery and meets user needs around the clock. An example of this is the use of chatbots in customer service applications across various sectors.

✓ **Rational Decision-Making:**

AI systems, when integrated into devices, are not influenced by emotions. This enables them to make logical and accurate decisions. These devices use cognitive computing to assist in making practical decisions in real time.

✓ **Digital Assistance:**

All AI-powered applications provide digital assistance, which organizations use to perform various automated tasks, thereby saving human resources.

Digital assistants also support individuals in their daily lives through AI-based applications like Google Maps, Grammarly, and Alexa. Additionally, they help doctors monitor patients in remote areas by providing valuable data about them.

✓ **Faster Decision-Making:**

AI systems facilitate faster decision-making than humans by quickly reviewing all relevant aspects. As a result, companies gain a competitive edge by having sufficient time to make better decisions.

✓ **Use in Hazardous Situations:**

In many cases, humans cannot undertake dangerous tasks, such as deep-sea exploration or handling hazardous materials. AI systems can be used effectively in such situations, allowing scientists to make discoveries with minimal risk to human life.

✓ **Emergence of New Innovations:**

The use of AI has led to the development of numerous technologies that provide innovative solutions, such as early cancer detection, which has significantly benefited the healthcare sector.

✓ **Enhanced User Engagement:**

One of AI's major strengths is its ability to enhance user engagement by analyzing massive amounts of user data and providing personalized experiences—such as recommending specific content or online shopping suggestions.

✓ **Scalability:**

Companies that adopt AI systems gain the advantage of managing growing data volumes and user demands while maintaining accuracy and efficiency. This scalability is especially beneficial during growth phases.

Second: Disadvantages of Artificial Intelligence

There are several disadvantages associated with the use of artificial intelligence, including: (Abed Jameel Al-Sufyani, 2024, pp. 6-7)

- ✓ **Reduced Human Interaction:** While artificial intelligence may enable interaction with computers, it cannot replace the human relationship between teacher and students. Human interaction remains essential for social and emotional development.
- ✓ **Dependence on Technology:** The use of AI in education may lead students to become overly reliant on technology, which can reduce their social skills and problem-solving abilities—both of which are necessary for daily life.
- ✓ **Lack of Qualitative Assessment:** Although artificial intelligence is capable of evaluating quantitative aspects such as multiple-choice questions, it is limited in assessing qualitative elements like creativity, problem-solving, and critical thinking.

The researcher notes that artificial intelligence has many advantages—for example, it can retain information indefinitely unless the input data is modified. AI is also capable of analyzing large volumes of information in record time, designing new and updated websites, generating accurate model maps, and handling programming languages and algorithms with precision.

However, despite these advantages, AI has certain drawbacks. It relies on internet connectivity, so if problems occur with the internet, AI features may become non-functional. Additionally, software malfunctions can occur, requiring time to repair. Furthermore, some AI programs require payment to access their full features and capabilities.

6. Risks of Artificial Intelligence

As for the risks or threats that may arise from the negative use of certain artificial intelligence systems, this section will address three key areas that face significant threats from AI technologies, as emphasized by a number of experts in the field. These areas are: employment, national security, and autonomous weapons. (Al-Asad Saleh Al-Asad, 2023, pp. 171-173)

✓ **Employment:**

The growing use of artificial intelligence in many economic, social, and political sectors has led to a reduced reliance on human labor—especially as robots have acquired the ability to perform tasks that were once considered exclusive to humans.

According to the *Jobs of the Future 2040* report, many current jobs are expected to disappear with the advent of automation and the entry of robots into various domains. The report also noted, however, that over 157 million new job openings are expected by 2040. According to a study by the *McKinsey Global Institute*, more than 800 million employees around the world may lose their jobs, which represents one-fifth of the global workforce.

In this regard, a study published at the World Economic Forum in 2018 by researchers from *Oxford University* revealed that 1.4 million jobs in the United States are at risk due to new technologies by 2026, and that 47% of current jobs are threatened to become computer-based.

✓ **National Security:**

A 2017 study conducted by researchers from *Harvard Kennedy School*, titled *Artificial Intelligence and National Security*, concluded that “future advances in artificial intelligence are likely to become a transformative national security technology,” comparable to nuclear weapons, airplanes, computers, and biotechnology.

In the final report of the *U.S. National Security Commission on Artificial Intelligence*, published at the beginning of 2021, it was stated that AI technologies exacerbate two ongoing national security challenges:

- **First:** Increased reliance on digital technologies in all aspects of life makes society more vulnerable to cyber intrusion—affecting every sector, from corporations and universities to governments, private organizations, and individual households. Simultaneously, the modern world is saturated with new sensors—in the *Internet of Things (IoT)*, cars, phones, homes, and social media platforms—that collect streams of data. These can be fed into AI systems, enabling them to identify, target, manipulate, or coerce individuals.
- **Second:** Adversaries—whether states or non-state actors—challenge the United States through cyberattacks and espionage instead of direct military confrontation. Moreover, these AI-enabled capabilities are likely to be used across the entire conflict spectrum—as tools of first resort in non-military confrontations, as precursors to military actions, or in coordination with military operations during war.

✓ **Autonomous Weapons:**

One of the most significant military applications of artificial intelligence is the development of *Autonomous Weapon Systems*, which are defined as: “any weapon system capable of independently

performing its essential functions, including the ability to search, detect, track, select, and engage targets without human intervention.”

These systems—also referred to as *lethal autonomous robots* or *killer robots*—can search for, identify, and attack targets, including humans, without any human control.

7 Algeria’s Strategies in the Field of Artificial Intelligence

The tools and means for implementing economic intelligence in Algeria rely on technologies adopted by certain providers of IT solutions. The broad application of economic intelligence cannot be achieved without the necessary media and communication infrastructure, such as purchasing high-cost equipment and software, which also requires financial support. Although Algeria is not currently listed in international rankings and indicators related to artificial intelligence, the country has already begun laying the foundations to move forward in this field.

According to an official source from the Ministry of Higher Education, Algeria has developed its national strategy for artificial intelligence, which includes, as part of an ambitious program, the establishment of a national university dedicated to training top-performing high school students to become engineers.

The same source adds that Algeria is counting first on this specialized university, and later on a technological hub, to establish a technology city that will serve as a foundation for an industry and economy based on artificial intelligence and advanced technology—ultimately aiming to eliminate its dependence on a hydrocarbon-based economy.

According to the official website of the National School of Artificial Intelligence (ENSIA), the school is presented as: "A center of excellence in higher education whose mission is to train engineers specialized in the theory and applications of artificial intelligence and data science."

In addition, Algeria established the Center for the Development of Advanced Technologies (CDTA) in 2003, by virtue of Executive Decree No. 457/03 dated 7 Shawwal 1424 AH (corresponding to December 1, 2003). The CDTA is a scientific and technological institution whose mission is to conduct scientific research, technological innovation, development, and training in various fields including science and information technology, industrial technologies, robotics, storage systems, materials processing, laser technologies, software engineering, artificial intelligence, and more. (Al-Asad Saleh Al-Asad, 2023, p. 174)

Conclusion:

Artificial intelligence is not merely a distant future; it is our present, marking a radical transformation in the financial services industry. With ongoing technological advancement, AI will continue to enhance the financial sector and drive greater growth and prosperity. By leveraging AI in the financial domain, decision-makers and financial experts in both the public and private sectors can benefit from its many advantages, such as improved decision-making capabilities, increased efficiency in financial operations, enhanced customer experience, and the fight against financial fraud.

Ensuring access to high-quality data remains the most challenging aspect of AI development. It requires a proactive approach to data collection, accessibility, and encouragement of its use in accordance with national data policies and regulations. In addition to strengthening data governance and quality controls, it is crucial to address existing data gaps and find innovative ways to overcome them—such as partnering with external data providers, utilizing indirect data sources, and developing synthetic data generated by algorithms, among others. Instilling a culture of data sharing and regulation is a key solution to maximizing data value and enabling AI applications in government services. Once data access issues are resolved, extensive efforts must be made to classify and organize data for use in AI models. These necessary steps underscore the importance of AI collaboration across various domains—such as sustainability—due to its shared impact on entities addressing these issues.

It is essential to keep pace with recent developments in AI technologies and adapt their use in performance analysis and financial planning. AI improves financial operations by enabling forecasting and reducing financial risks.

In conclusion, artificial intelligence plays a pivotal role in transforming the financial sector and improving the performance of financial activities. As technology evolves and the use of AI expands, its benefits and applications are expected to grow in the future, enabling further operational enhancements and more effective achievement of financial goals.

Conflict of Interest Statement

The author declares no conflicts of interest related to this work. The research and views expressed are solely those of the author and do not necessarily reflect the official positions of the Department of Social Sciences, University of Oum El Bouaghi, or any affiliated institutions.

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