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Reflection on Human Intelligence vs Artificial Intelligence and the Digital Society (from Theory to Practice)

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ABSTRACT:We do not pretend to deal exhaustively with this topic, because it is broad and complex for the space of a text, and we do not even know if we can deal with it without incurring in generalizations. Our intentions, which are much more modest, refer to documentary research for the understanding and development of Human Intelligence and Artificial Intelligence and some of their multiple relationships. This article aims to make a comparison between Human Intelligence and Artificial Intelligence so that it is possible to understand the main aspects in which Human Intelligence differs from Artificial Intelligence, since the latter originates in computing and how it can be inserted in the individual and organizational processes of the digital society. In addition, it seeks to highlight the great advances and potential risks of this technology, just like any other, it can provoke in the "actors" involved in its production, use, legislation (norms and rules in its use) and create a space for discussion.
KEYWORDS: *Human Intelligence, Artificial Intelligence; Intelligent Agents, Information, Disinformation, Digital Society.*

I. INTRODUCTION

The academic literature, despite technological advancements, makes a big difference between human intelligence (HI) and artificial intelligence (AI). AI is increasingly present in the lives of people and organizations, performing tasks that were previously exclusive to human intelligence. However, Artificial Intelligence and Human Intelligence are two forms of intelligence that have significant differences. Despite the advancements of AI, there are still characteristics that distinguish it from Human Intelligence.In an increasingly globalized world dominated by information and communication technologies, the comparison between artificial intelligence and human intelligence becomes inevitable. One of the main differences between these two forms of intelligence is related to memory. Human memory and artificial memory have distinct characteristics that highlight this distinction. One of the main factors that differentiate human memory from artificial memory is the capacity for creativity. While humans are able to adapt to new situations, learn from mistakes and modify their behavior according to circumstances, machines, no matter how advanced, rely on pre-existing algorithms and data to perform their tasks, without the ability to adjust autonomously.

In this article, we will study the important differences between these two types of intelligence, highlighting the capabilities and limitations of each. Understanding these distinctions is essential for the development and improvement of AI, as well as for reflection on the role and impact of technology in the Digital Society.

Globalization emerged during the 1980s, but the phenomenon began much earlier, in the period of the Great Navigations of the fifteenth and sixteenth centuries. This period was marked by the establishment of new trade routes in the world and intense movement of goods and people between countries on different continents. Cartographic discoveries and the development of new navigation techniques are at the origins of this event. The transformations in the international economic system and the improvement of communications and transportation have enabled the evolution of this process.

Globalization is **the name given to the phenomenon of integration of the world space** through information and communication technologies (ICTs) and also means of transport, which have been rapidly modernized and have provided, in addition to greater dynamization of territories, acceleration and intensification of the flows of capital, goods, information and people, all over the planet. This process is known as **globalization**.

The technical-scientific, technological and informational development has led to global globalization, that is, it has resulted in an integrated economic, social and cultural world space through global communication networks. The integration of the world space was only possible through technological advances in the communications and transport sectors.

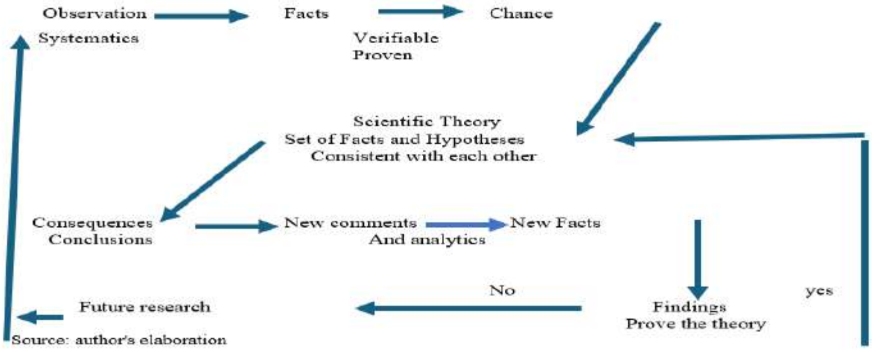
II. ScientificMethod

It is an exploratory study that seeks to organize the main challenges faced by people in the Digital Society and their meaning presented in the literature of the Humanities, Social Sciences (sociology, humanities, communication, marketing, economics, psychology, law, humanities, ethics, Information), the Exact Sciences (logic, mathematics and computer science), Applied Sciences (engineering) and the Philosophical Sciences.

It is not a proposal of new terms and concepts, but rather an investigation that allows the identification of a common denominator among the different concepts already indicated in the literature, in a way that enables their grouping by identity, application/use and pertinence/aggregation of value in the context in which the terms are inserted. The data collection is characterized by bibliographic research on the terms and concepts related to the different scientific fields.

It is a descriptive and analytical approach seeking to know and analyze the existing cultural and/or scientific contributions on this subject, based on the literature review. The research was structured based on the systemic approach to understand the main challenges that citizens face in the Digital Society, seeking in practical, operational or application terms, the solution of the "real life" problems of organizations (public and private) and people.

Figure No. 1 – Schematic Representation of the Scientific Method



Source: author's elaboration

Research Theme and Problem

Human Intelligence and Artificial Intelligence allow the active relationship between people and with nature, through Information and Communication Technologies (ICT's). But the problem is that many people don't know what this means, what types/models of participation, ways of working, the limits and the path of the future, of the Digital Society.

It can be difficult for most humans to understand how machines work. However, an artificial intelligence system looks like a puzzle. To understand the way we think, perceive, and feel, it is useful to create an analogy between the nervous system and an intelligent machine.

With the sophistication of new technologies, man has created forms of artificial intelligence that work in a similar way to himself, improving the ability of computer systems to interpret and understand the virtual world. This includes object recognition, motion detection, and pattern identification in images. Automated reasoning refers to the ability of machines to process data (information), come to logical conclusions, and make decisions, based on those reasonings. This involves utilizing inference algorithms and logic to solve complex problems.

Isseus:

I. Are Human Intelligence and Artificial Intelligence Comparable?
II. What are the main differences?
III. What are the main challenges that Artificial Intelligence poses to Humanity?
IV. Could inaccurate or biased data lead AI to make wrong decisions? (e.g. in medicine, security, etc.)

Goals

The Information, Human, Social, Economic, Technological and Political Sciences, seek a solution to the challenges of the Digital Society, that is, to define the main paths and rules that allow to guide the citizens of the world, where the rights and duties (responsibilities) are equal, for all, without exception. These paths and the rules to be implemented by the (elected) rulers require a commitment from them and from the people in their implementation.

Artificial Intelligence is a multidisciplinary field of study that encompasses several areas of knowledge and represents a historical milestone in computer science, in its interdisciplinary approach that involves the contribution of several areas of knowledge to simulate Human Intelligence. Mathematical and Statistical Sciences provide the theoretical foundations for algorithm modeling and analysis, machine learning that focuses on the development of algorithms that allow computers to learn and improve with a database, involving the application of statistical techniques and optimization algorithms.

Cognitive Science studies the mental processes of human intelligence, related to the understanding and modeling of cognitive processes for the development of intelligent systems. Computational Neuroscience seeks to understand the workings of the human brain and apply these insights in the development of AI models and algorithms inspired by the human brain. The Philosophy of Mind explores the issues related to the nature of the mind, consciousness, and intelligence, offering the important theoretical perspectives for the field of AI. Computational linguistics involves the processing of natural language, focusing on the development of algorithms and techniques for computers to understand and process human language.

This article seeks to contribute to the clarification of the main challenges that people face with Artificial Intelligence, taking into account the comparison with Human Intelligence, in the change to the Digital Society, as well as the importance of the units of measurement for evaluating the decisions of the different powers and their meanings, within the scope of the different sciences, based on a theoretical framework. The objective is a debate on the challenges identified by scientific research, developed by the different Sciences, in the Digital Society. The theoretical discussion of the different units of measurement and the meanings of empirical research constitute the basis for the outline of its structure, presented at the end, bringing together the units of comparison and the main differences.

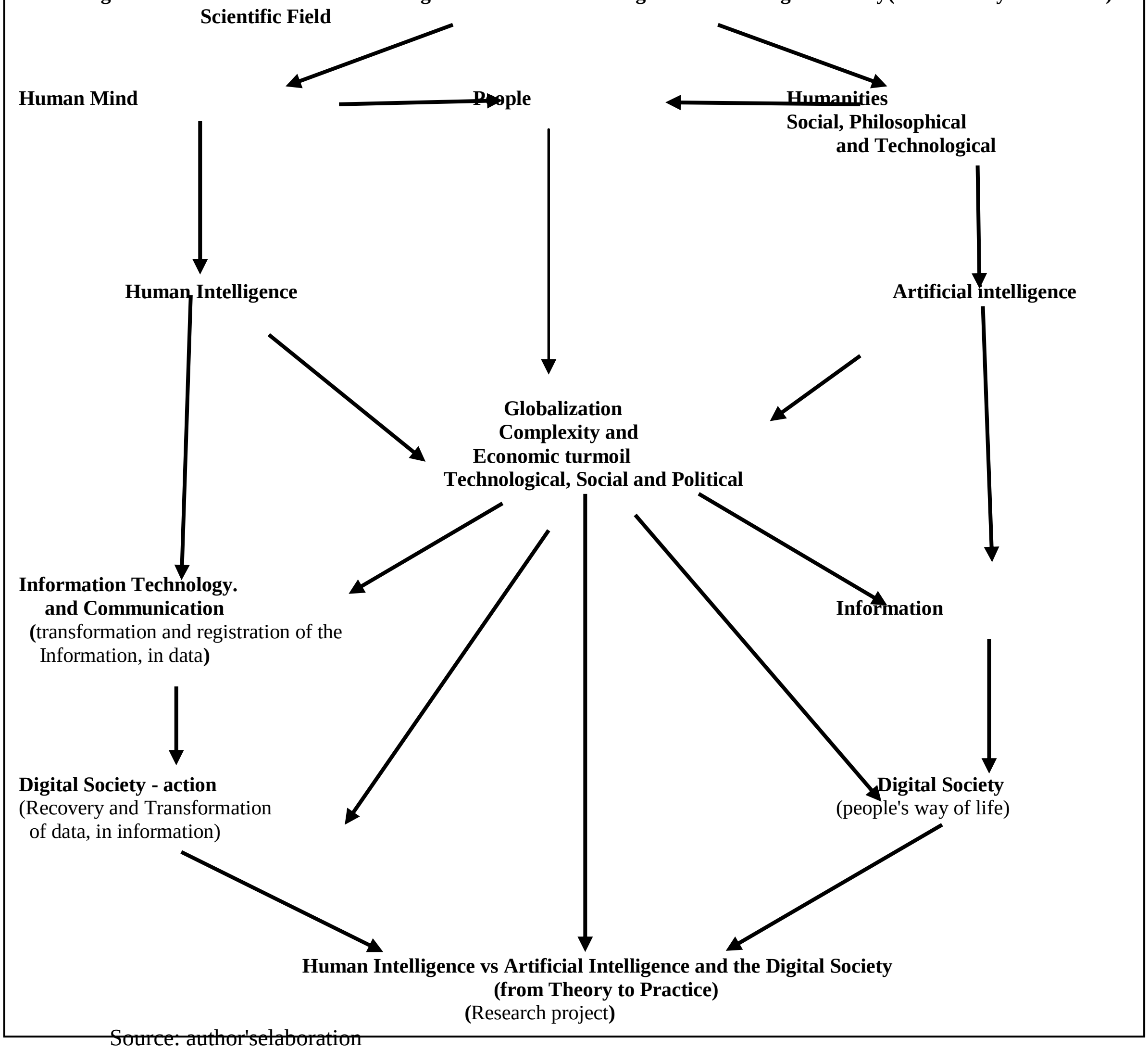
Methodological Approach

As for its nature, the research is qualitative since it does not privilege statistical study. Its focus is to obtain descriptive data, that is, the incidence of topics of interest in fields such as Information Sciences, Humanities, Computational, Ethical, Social, Economic and Political Sciences, as well as other Sciences. Regarding the extremities, the research is exploratory and descriptive, insofar as the technique used is categorized, consensually, as a direct documentation study, which provides for the consultation of sources related to the study, in different *media*, printed or electronic. The complexity and turbulence of the digital society have led to the globalization of research, as essential processes for the development and innovation of science and technology. Information is the source of the energy that drives the "*engines*" of the Digital Society, but in order to use it we need to convert it into a usable form **: knowledge, (Murteira, 2001).**

The digital society is a complex society of technological innovation and communication, in which there are the creation of new environments and changes in the dynamics of people, in the way they understand reality, modifying the way, how they relate to other people and how they conceive themselves in the face of their own reality. Both senses can be understood as a result of the technological revolution, promoted mainly from the attempts to understand human intelligence, via computational bases. As a consequence, the pre-modern notion of information, as the *information* that shapes or shapes the human mind, is gradually being replaced by information, as a "data structure", Boland, (1987), representing intangible realities too large to be directly experienced by people's senses.

The research method is likely to make meanings interact with each other. This interaction can range from the simple communication of ideas to the mutual integration of concepts, epistemology, terminology, methodology, procedures, data and research organization. This is an exploratory study that seeks to clarify and organize the concepts presented in the literature of the different sciences. It is necessary to understand, through a theoretical review of the concepts, through the reference documents; of a psychosocial analysis of the concepts and meanings, applied to the Digital Society, in the context of people's social and economic life. The research was structured based on the systemic approach, to understand people's problems and possible improvements. This conceptual model is represented as follows:

Figure 1 – Reflection on Human Intelligence vs Artificial Intelligence and the Digital Society(from Theory to Practice)



Source: author'selaboration

The model of approach for intervention in information actions in the academic space is presented, with the purpose of producing, sharing information and knowledge among participants, in addition to promoting the development of skills of search, retrieval, organization, appropriation, production and dissemination of relevant information for scientific researchers, in the digital society.

III. THEORETICAL-METHODOLOGICAL FRAMEWORK OF THE RESEARCH

Humanities

The human sciences are a set of knowledge that aims at the **study of man as a social being,** that is, it is the human sciences that carefully gather the organized knowledge about the creative production of man and knowledge, based on specific discourses. Its aim is to unravel the complexities and turbulences of society, its creations, and its thoughts. It is important to keep in mind that everywhere, human beings establish relationships with each other, whether they are of friendship, affection, or power. The human sciences seek to understand how these relationships are formed and how they evolve over time.

Thus, as a human condition, they have a multiple character, so they address theoretical characteristics, such as philosophy and sociology, while also addressing practical and subjective characteristics. As it is an area of knowledge that has as its object of study the human being, in sociability, the social sciences are based on disciplines such as philosophy, history, law, cultural anthropology, science of religion, archaeology, social communication, psychology, art theory, cinema, management, dance, music theory, design, literature, letters, philology, among others.

Humanism was a **philosophical and cultural movement that emerged in Europe during the 14th century**. He was inspired by Greco-Roman culture and philosophy, prioritized reason over faith, and was interested in the concept of the human being as the center of the universe. Although there have been various "humanisms", such as those of the Middle Ages or the humanism of the court of Charles the Great, but **when we talk about humanism we usually talk about the Italian Renaissance**, which is known, as Renaissance humanism. In general, any study devoted to the reading and interpretation of classical texts is a humanistic study. Philosophical works that emphasize the human being, above all else, are also called humanistic. Examples of this are the works of Werner Jaeger, Erich Fromm, Erasmus of Rotterdam, and Jean-Paul Sartre.

Humanism from this anthropocentric perspective, inspired by scientific studies during Greco-Roman Classical Antiquity, diminished the cultural relevance of the ethnocentrism that had dominated European society since the Middle Ages. As an intellectual movement, Humanism disregarded the claim of the scholastic method as critical thinking, valuing rationality. According to humanist thought, human beings are the supreme divine creation, thus being able to synthesize knowledge by themselves. In this way, the human being was both a creature and a creator of the world, and could thus act as the architect of his existence.

The multifaceted nature of the term and its breadth compel academic studies of humanism to treat the term with care. Although they share some general characteristics, **it is not the same to talk about Renaissance humanism as it is to talk about existentialist humanism.**

Humanistic thought prioritized the human being before the religious. Humanism **was a European philosophical, intellectual and cultural movement that emerged in the fourteenth century and** was based on the integration of certain values considered universal and inalienable of the human being. This current of thought arose in opposition to theological thought, in which God was the one who ensures the fulfillment of the duties and obligations of others and the center of life.

Humanist thought **is an anthropocentric doctrine** that tries to ensure that the human being is the measure from which cultural parameters are established. This group favored the sciences and was interested in all disciplines, whose purpose was to develop the values of the human being. Great thinkers of antiquity (e.g. Aristotle and Plato) **argued that knowledgegave power to people, giving them happiness and freedom, and as such,** through classical works knowledge was expanded and a more cultured society was created.

In 1945, the philosopher Jean Paul Sartre gave a lecture on the postwar climate, and what he said had a profound impact on all philosophical thought from that time on. This conference was called "Existentialism is a Humanism" and marked a milestone by presenting a new conception of man and humanism. Paris in ruins after the Second World War, this conference set the tone for the search for a new human horizon, a **new moral horizon that embodies man's responsibility and his existence**, beyond progress and the devastating consequences of war.

Characteristics of humanism:

- He developed an anthropocentric notion of the world and **set aside the theocentric idea.**
- It is **a much purer model of knowledge** than existed in the Middle Ages.
- **He defended the idea of using** human **reason** as an engine in the search for answers, leaving aside the beliefs and dogmas of faith.
- **He reformed the existing teaching** model , giving importance to the study of the classics of Latin and Greek and opening new schools that promoted the study of other classical languages and letters.
- **He developed the sciences, such** as grammar, rhetoric, literature, philosophy, morals, and history, intimately linked to the human spirit.
- **It sought to eliminate any closed system** that did not allow for the multiplicity of perspectives of thought. It was thought that with this change the total development of man would be achieved: physical and spiritual, aesthetic and religious.

Humanism and the Renaissance

The Renaissance was a historical period that stretched from the fourteenth century to the sixteenth century, which sought to leave the Middle Ages behind and give way to the Modern Age. This period was characterized by a great artistic and scientific development and by social, political and economic changes that sought to bury the vestiges of the Middle Ages (which they considered a dark phase) and lead to the development of the bourgeoisie.

Humanism was an intellectual current that developed in this historical period and promoted an anthropocentric view of the world, leaving aside the theocentric tradition and highlighting the capacities of man and human reason. Humanists did not see man from a theological perspective. They valued the human being for what he is: a natural and historical being. Unlike the men of the previous age, the humanists ceased to see man from the theological point of view. They were men of religion, mostly Christians, but they looked for the answers to their questions about the world and things in ancient thinkers. They invalidated **religion, but considered that it had a civil function** and that it was a tool for maintaining the peace of society. Among the most prominent scholars of this era are:

- **Leonardo Bruni (1370-1444) -** Italian historian and politician of notable performance in the rescue of the classics of Greco-Roman literature.
- **Giovanni Pico della Mirandola (1463 – 1494) -** Italian philosopher and thinker, his most representative work "The 900 Theses" is a compendium of the most resonant philosophical ideas that existed until then.
- **Erasmus of Rotterdam (1466-1536) -** Dutch philosopher and theologian, he was a critic of the institutions, the power of the time, and the abuses of the members of the Catholic Church to which he belonged. He defended his "adages" (sayings) of freedom of thought and Greco-Roman traditions. In addition, he sought that all people could have access to the gospel and with it, to the teachings of Jesus Christ. His work: "In Praise of Madness" had a great impact.
- **Thomas More (1478-1535) -** English theologian and politician, he devoted much of his life to practicing law and the study of Greco-Roman theology and culture. "Utopia" was one of his famous works, written entirely in Latin. He was beheaded in 1535 for refusing to sign the act establishing King Henry VIII as the leader of the Anglican church.
- **Juan Luis Vives (1492-1540) -** Spanish philosopher, he was a precursor of the idea of applying reforms in the academic field and the need for social assistance to the most needy.

Types of Humanism

- **Christian Humanism -** A religious movement in which as a matter of principle man can be realized from a Christian framework.
- **Evolutionary Humanism -** A current of thought that oscillates between philosophy, epistemology and anthropology and places the human being at the center of the Universe.
- **Secular humanism -** A movement that relies on certain philosophical currents and the scientific method to discard those supernatural explanations, such as creationism, that exist about the origin of the universe and humanity.

Importance and impact of humanism

Humanism is considered one of the predominant ideologies during the Renaissance, first and foremost, because **its anthropocentric ideas represented a paradigm shift**. This current focused on the development of the qualities of the human being and conceived rationality as a way of understanding the world.

The importance of humanism lies in the **rescue and dissemination of Greco-Roman traditions**. During this period, translations of the great classical works were made that allowed access to a larger portion of the population. In addition, **he promoted educational reforms** to make knowledge more accessible and valued humanistic studies, contributing to the development of sciences such as rhetoric, literature and grammar. Humanism stands out for having expanded values, such as tolerance, independence and free will.

Humanist **philosophy**, in this sense, clashed with the expectations of the Middle Ages. Although the Middle Ages had a rich cultural life, it was still strongly linked to the Catholic Church, which helped dictate social positions and behaviors as determined by a culture that exalted man's submission to God. Humanism, however, defended man's ability to shape his destiny. In doing so, he shifted not only the social focus from collectivism to individualism, placing in the human being himself the ability to alter the reality in which he lived without depending on divine favor or will, but also the inspiring axis for the attainment of new knowledge. In this sense, it was the ancient sages who were seen as the best bases for these advances.

Some of the most significant examples of humanist thought are in the "Discourse on the Dignity of Man", a work by Giovanni Pico Della Mirandola. Considered one of the first books of modern philosophy, in which he presents the main thesis, about creation having occurred with God, allowing human beings the special freedom to build themselves. Through this emancipation, according to the author, the human being cannot have a determined destiny, since it is the artisan himself who will decide what he will be, finding in the process his essence through the rationality provided by God.

Although it is in the articulation of the themes, and not exactly in the argument used, where the originality of Giovanni Pico Della Mirandola is found, the fact is that he represents a new line of thought that began to be adopted by several scientists, painters, philosophers and scholars in general during the beginning of the Modern Era – even though most of the European population still lived marginalized. away from such intellectual and cultural processes. Because of this, one can characterize Humanism, as well as its heir movement, the Renaissance, as having occurred mostly in the midst of the European social-economic elite, who had the resources and time for self-improvement valued by Humanism.

An example is in Leonardo da Vinci. Born in a small village near Florence, Leonardo would study for most of his life, until he mastered an impressive variety of sciences such as engineering, architecture, sculpture and astronomy, teaching himself music, mathematics, physics and Latin. Gaining friends in high social circles due to his great intellectual abilities, he became one of the most celebrated Western artists of all time, being one of the most recognizable names of the Renaissance today. Among his major works are Mona Lisa, Virgin of the Rocks and The Last Supper.

Philosophical Sciences

Considering philosophical practice as the art of interpreting reality from the formulation of conceptual schemes about the human being, nature and society, will Philosophy be able to face the problems that arise from the new organizational dynamics of society today? We understand that Philosophy alone, without interdisciplinary tools of analysis, does not seem capable of facing, perhaps even formulating, the problems raised by ICTs.

Floridi (2011, p. 14) characterizes IF as follows: a philosophical area that is related to:

a) Critical research into the conceptual nature and basic principles of information, including its dynamics, use and sciences; and refers to IF as a new area of investigation in Philosophy, guided by the investigation of the content of information and not only in its form, quantity and probability of occurrence (thus differing from the proposal of Shannon & Weaver, (1949/1998). Importantly, IF does not seek to develop a "unified information theory" but to integrate the different forms of theories that analyze, evaluate, and explain the various information concepts advocated.

b) The characterization, in turn, indicates, according to Floridi (2011, p. 15-16), that the IF has its own methods for analyzing philosophical problems, both traditional and new. These methods have information as their central element, are interdisciplinary in nature and maintain the relationship with computational methods, in addition to using concepts, tools and techniques already developed in other areas of Philosophy (e.g., Philosophy of Artificial Intelligence, Cybernetics, Philosophy of Computing, Logic, among others).

Thus, IF will provide a broad conceptual framework for addressing the issues that emerge from the "new" dynamics of contemporary society, Floridi, (2011, p. 25). An example of this dynamic are the possibilities of interaction provided by ICTs which, depending on the degree of familiarity of people with such technologies, promote a sense of dependence on being online. In addition, even if people do not want to be online most of the time, this feeling remains due to the spread of informational devices in everyday life, such as cameras, credit cards, among others. In this situation, the question arises: what are the implications of the insertion of ICTs in society for people's daily actions?

Considering (a) and (b), Floridi (2002, 2011) argues that IF constitutes a new paradigm and an autonomous area of investigation in Philosophy. It is characterized as a new paradigm, as it would break with previous paradigms of Philosophy, since it is neither anthropocentric nor biocentric, admitting information as the central focus in the analysis of concepts and social dynamics. On the other hand, the autonomy of the IF would be sustained by the presence of its own topics (problems, phenomena), methods (techniques, approaches) and theories (hypotheses, explanations), according to other areas already recognized as legitimately philosophical, Floridi, 2002, 2011; Adams & Moraes, (2014).

Among the topics of IF, the question "what is information?", referring to the ontological and epistemological natures of information, stands out. It is the answer to this question that directs the paths to be developed by the IF and delimits its scope of investigation, Floridi, (2011). The importance of this issue is also due to the fact that, as we have indicated, there is no consensus among scholars in their proposals.

Since the "informational turn in philosophy", several conceptions of information have been developed in an attempt to respond to concerns about the ontological and epistemological status of information. Although Adams (2003) indicates the milestone of the informational turn in Philosophy with the publication of Turing's article in 1950, there are precursors of information theory in several areas, especially in Semiotics, such as the works of Charles S. Peirce (1865-1895). Some exemples can be given with the following proposals:

- Wiener (1954, p. 17): "The commands through which we exercise control over our environment are a type of information that we impose on it." In addition, for this author, information would be a third constituent element of the world, alongside matter and energy, and would not be reducible to them.
- Shannon & Weaver, (1949/1998): the authors establish, the Mathematical Theory of Communication, a technical notion of information conceived in probabilistic terms resulting from the reduction of possibilities of message choice, which can be understood objectively.
- Dretske (1981): information is understood as a commodity that exists objectively in the world, independent of a conscious mind of the first person who grasps it. The information would constitute an indicator of regularities in the environment, from which representations, beliefs, meaning, mind, mental states, among others, would be made.
- Stonier (1997, p. 21): information would be on the physical plane, objectively, and physics theorists, in turn, would have to expand their vocabulary and admit *infons* (information particles) as a constituent element of the world. «(...) information exists. It does not need to be perceived in order to exist. It does not need to be understood in order to exist. It doesn't require intelligence to interpret it."
- Floridi (2011, p. 106): «Information is a well-formed piece of data, with meaning and truth». Well-formed and meaningful data that refers to the intrinsic relationship that the data would need to possess in relation to the choice of the system, code, or language in question. These would have their aspect of "truth" and "truth" related to the proper provision of the content to which they refer in the world.
- Gonzalez (2014): conceives of information as an organizing process of dispositional (counter-factual) relations that bring together properties attributable to material/immaterial objects, structures or forms) in specific contexts.

Although the concepts of information indicated are different, there is in common the naturalistic stance in relation to the objective aspect of information. Moreover, proposals such as those of Dretske and Floridi denote an intrinsic relationship between information and truth. According to Dretske (1981, p. 45), characterizing "false information" as information would be the same as saying that "rubber ducks are types of ducks". Since the information could not be false, the information would be genuinely true and would necessarily tell about its source. This source can be interpreted as the world itself, making it possible to deal with another problem of IF, that is: what is the nature of knowledge? Regarding the nature of knowledge, the theories of knowledge stand out, from which it is analyzed through the relationship between the agent, the cognitive and the world. For Dretske (1981, p. 56), the information processors of the sensory systems of organisms are channels for the reception of information about the external world.

The naturalistic stance in Philosophy consists in disregarding the supernatural in the explanation of nature and mind, conceiving reality to consist only of natural elements and laws, which are explained through scientific methods. The term "natural" would encompass other terms such as "physical", "biological" or "informational" that express a rejection of transcendent assumptions in the foundation of a priori knowledge (Moraes, 2014), the acquisition of knowledge. (Adams, 2010), in turn, argues that knowledge acquires its properties from its informational base; Thus, if someone 'knows that P' it is because he is told 'that P'. In such a relationship, knowledge is about the world, about truth, constituting the bridge between the cognitive agent and the world.

In addition to the problems about the ontological and epistemological natures of information, and the nature of knowledge, the following questions are part of the IF research agenda: "what is meaning?", "what is the relationship between mental states and informational states?", "could reality be reduced to informational terms?", "can information be the basis of an ethical theory?", among others. After presenting the topics (problems) and theories (hypotheses and explanations) of IF, we highlight two methods specific to this area of investigation: the "synthetic method of analysis" and the "levels of abstraction".

Such methods come from the influence of Turing's work in Philosophy (marked, in particular, by the informational turn). The "synthetic method of analysis" is the result of the hypothesis of (Turing, 1950), according to which the study of the mind is appropriate when carried out through the use of mechanical functions that could be manipulated by digital computers (Gonzalez, 2005; Floridi, 2012). By means of such functions it would be possible to construct mechanical models of the structure and dynamics of intelligent thought. The understanding that underlies this conception is that the ability to manipulate information in a mechanical way constitutes thinking.

This understanding enabled the development of mechanical models of the mind, which initially generated two strands in Cognitive Science (Teixeira, 1998): strong Artificial Intelligence, which defends the thesis according to which mechanical models of the mind, when successful, not only simulate/emulate mental activities, but explain and instantiate such activities; and weak Artificial Intelligence, according to which the model is only a limited explanatory tool of intelligent mental activity. The common point of these notions is that they both accept the thesis that to simulate is to explain, in order to attribute to mechanical models, the value of theories. This is an example of an approach to another question specific to IF: what is the relationship between information and intelligent thinking?

The "levels of abstraction", in turn, derive from Turing's algorithmic approach, which is summarized by (Floridi, 2013b, p. 210) as follows: We have seen that questions and answers never occur in a vacuum, but are always embedded in a network of other questions and answers. Likewise, they cannot occur in any context, without any purpose, or independent of any perspective. According to this perspective, a philosophical question is analyzed considering its context and purpose, which delimit the field of possibilities for adequate answers.

Considering the topics, theories and methods of IF, Adams & Moraes (2014) propose the "argument from analogy" to analyze the autonomous aspect of IF. These authors point out that, like the Philosophy of Mathematics and the Philosophy of Biology, IF has characteristics such as:

- Proximity to the scientific approach, epistemological and metaphysical problems, as well as the presence of problems of its own not previously dealt with in other areas of Philosophy. Given that IF shares characteristics present in areas already recognized by philosophical society as legitimate, it would be counterintuitive not to accept IF as an autonomous area of investigation in philosophy.

As we have indicated, the development of information studies in the philosophical-scientific sphere contributed to the constitution of IF in the academic sphere. This is illustrated with the constitution of FI, as an autonomous and interdisciplinary area of Philosophy: interdisciplinary due to its relationship with Computing, Sociology, Engineering, among other areas, generating methods and theories to deal with its problems; and autonomous, due to its own (and new) problems. In line with the development of the academic field of IF, the influence on the social sphere is also highlighted, illustrated by the growing presence of ICTs in the daily lives of people and organizations. Such presence would be influencing the dynamics of contemporary society, constituting the "Information Society".

Social sciences

Although thinking and reflection on social reality and social relations has been a constant in the history of humanity, from Classical Greece, through the Middle Ages and during the Renaissance, it is only in the nineteenth century that it becomes possible to speak of "social sciences", since it is the set of reflections of this period that, Incorporating Baconian principles and the Cartesian method, it will consist of the form of knowledge historically known as "modern science". If the eighteenth century saw important thinkers of society, such as Montesquieu, Locke, Hume and Rousseau, it is with Auguste Conte that the beginning of the social sciences is usually identified.

Conte, a French thinker known as the father of Positivism, proposed to carry out studies on society with the utmost objectivity, in search of universal laws that would govern the behavior of social life everywhere. His theory, also called Social Physics, proposed that the whole of society should evolve in the same way and in the same direction. And so he proposed his Law of the Three States, according to which every society should evolve from a theological or fictitious state, to a metaphysical or abstract state, and from there, finally, to a positive or scientific state, Lakatos & Marconi, (1999, p. 45-46). Comte's Social Physics provides the theoretical foundation for a process that had already been taking place in Europe two centuries earlier, a process by which "the calculus of probabilities, the foundations of which are laid by Pascal and Huyghes around 1660, becomes a new form of objectification of human societies" Mattelart, (2002, p. 18).

The mathematical sociology of the Belgian Adolphe Quételet, the probabilistic theories, the application of statistics in the management of societies and the anthropometry of Alphonse Bertillon were developed. In a direction that is only partially different, since his direct influence comes from Darwin's work on the evolution of species, the Englishman Herbert Spencer initiated, at the same time, Social Biology, Lakatos & Marconi, Araújo, (1999, p. 47).

From the reflections on the division of labor (Smith & Stuart Mill), the models of material flows in social groupings (Quesnay, Babbage) and the theorization of networks (Saint-Simon), Spencer elaborates his organizational model of understanding social reality, promoting an analogy between society and a living organism, with the parts performing functions. for the proper functioning of the whole. Among the various impacts caused by this theoretical model is the foundation of the doctrine of Social Darwinism, which justified the European colonizing action in the nineteenth century in Africa and Asia, the elaboration of the Psychology of Crowds (Sighele, Le Bon) and the use, in the social sciences, of various terms and concepts "borrowed" from biology (isolation, contact, cooperation, competition and others).

The synthesis between the two pioneering theories and their systematization in a body of "sociological" knowledge was carried out by Émile Durkheim, "French, considered by many scholars to be the founder of sociology, as a science independent of the other social sciences", Lakatos & Marconi, (1999, p. 48). His proposal to consider social facts as "things" and a radical empiricism are in perfect harmony with the positivist spirit. His idea of "primitive societies" and "complex societies" takes up both elements of the Tri-State Law and Spencer's biological perspective, which is not taken without criticism. His study of suicide is the application of the rules of the sociological method he

had defined two years earlier: the exclusion of individual and psychological causes, the search for properly social causes, the elaboration of laws and quantification.
With Durkheim, Functionalist Sociology, also known as the Theory of Integration, was inaugurated, which sees society as a whole formed by constituent, differentiated and interdependent parts. The study of society must always be carried out from the point of view of the functions of its units. In the twentieth century, Functionalist Sociology developed and became the "*strong program*" of the social sciences, mainly with the works of Talcott Parsons (Harvard University), Robert Merton and Paul Lazarsfeld (Columbia University), inspiring the other social sciences, such as anthropology, political science and communication.
This is the trend of structured sociology courses throughout the century, the nature of the first professional associations, and the type of research funded by large foundations and government agencies. The first major split in the social sciences has its origin in the Hegelian dialectic, taken up by Marx for the understanding of social reality, Demo, (1989, p. 88). Applied to social life, dialectical thinking, which operates with the unity of opposites, sees social life from the presupposition of social conflict, realizing that "every social formation is sufficiently contradictory to be historically surmountable", Demo, (1989, p. 89-90). Also known as the Theory of Conflict, the Marxist perspective is the first model that is really proper to the social sciences – since functionalism has its concepts and methods borrowed from physics and biology – although an approximation with philosophy has been built.
Another approach from the social sciences poses a whole range of new concepts and objects to be studied: domination, ideology, alienation, reification. Its application, throughout the twentieth century, contributed to the construction of different perspectives: the Frankfurt School's Critical Theory, the Dependency Theory, the Theory of Cultural Imperialism, the Gramscian Political Theory, and, even in the United States, Wright Mills' formulations are sympathetic to the "critical" stance as opposed to the "sociology of the bureaucrat or the intelligence official", that is, to the positivist and functionalist social sciences.
Structuralism, which is often identified as a third approach to the social sciences (Demo, 1989, p. 171) can actually be understood as a specific perspective that is actually a manifestation of both functionalism and Marxism, as exemplified by the work of Manilowski, Radcliffe-Brown, and even the "structural-functionalism" of Parsons, in the first case, or the works of Levi-Strauss & Althusser, in the second.
The second split in the social sciences occurred from the merger of the works of two other precursors of the social sciences – Max Weber and Georg Simmel – both German. Weber is regarded as the founder of Interpretive Sociology or Comprehensive Sociology, insofar as he formulates the concept of social action, which is the action of the individual, endowed with meaning for him – in what differs radically from Durkheim's concept of social fact. His work on the *Protestant Ethic and the Spirit of Capitalism* seeks to explain the development of capitalism in the United States, not from the idea of linear progress of societies or the functions of each part in the whole (functionalism) or from the material, economic conditions, or from the class conflict caused by the distribution of modes of production (Marxism). but from the "spirit of capitalism", that is, from the *ethos,* from the atmosphere of values of a given population, from the beliefs and meanings attributed to their actions.
Simmel, on the other hand, proposed the study of social relations based on small everyday interactions, giving rise to a field known as microsociology. The importance of his work will take place at the beginning of the century, with the research of the Chicago School. One of its representatives, Robert Park, takes the city as a "social laboratory", installing a method of study in which subjects cannot be studied outside their environment. Ernest Burgess, in the same vein, carries out work in "social ecology" from an ethnographic perspective. The first major attempt at synthesis between the two possibilities of understanding social reality (the focus on the micro dimension and on the interpretative attitude of the subjects) was achieved by Symbolic Interactionism, a current that brought together researchers from different schools that have George Herbert Mead as a precursor. One of his students, Herbert Blumer, coined the term in 1937, publishing in 1969 its three basic assumptions:

- Human behavior is grounded in the meanings of the world.
- The source of meanings is social interaction.
- The use of meanings occurs through a process of interpretation (Blumer, 1980).

Berger &Luckmann (1985, 1966) addresses the social construction of reality, which is seen not only as a process of construction of objective/subjective/inter-subjective reality, in the context of infinite daily interactions, but also of processes of institutionalization and socialization.
Another current, along the same lines, is ethnomethodology, a discipline founded by Harold Garfinkel (1967), which aims to try to understand how individuals see, describe and propose, together, a definition of the situations in which they find themselves, Coulon, (1995). His proposal provoked great controversy against traditional sociology, for criticizing the idea of social fact as something stable and objective, proposing a vision in which it is understood, as a product of the continuous activity of men. Initiating a whole branch of studies, it spread first to the University of California (Sudnow, Schegloff, Zimmerman), then to the United States (Cicourel), England (Heritage) and France (Fornel, Ogien). If, until the 1970s, the social sciences found themselves in the clash between "administrative" and "critical" perspectives, Horkheimer, 1983), or in the face of the opposition between "apocalyptic" and "integrated" (Eco, 1985). Since that time, we have witnessed the growing influence of interpretive and micro-sociological currents.
Since the 1980s, this whole movement has led to an attempt to synthesize the different perspectives, their proposals and their concepts. Examples of this work are the Theory of Communicative Action by Jürgen Habermas, the Praxiological Model of Louis Quéré and Pierre Bourdieu, the Reflexive Sociology of Anthony Giddens, Scott Lash and Ulrich Beck, the Sociology of Everyday Life by Michel de Certeau and Michel Maffesoli, the Cultural Studies descended from the Birmingham School and which have today in Stuart Hall, Douglas Kellner and Fredric Jameson as its main representatives, the proposals for connection with Clifford Geertz's hermeneutics, among others.

Science of Psychology

Second, the On*ine Etymology Dictionary. Retrieved 23 May 2024.* word*psychology*It literally means, "Study of thesoul" (ψυχή,*Psyche*, "soul" — λογία,*logy*, "treatise", "study"). The word inLatin *Psychology*is credited to thehumanistCroatianMarkoMarulićIn his book,*Psichiologia de ratione animaehumanae*, dated between the fifteenth and sixteenth centuries.*Psychology*it designated studies or scholars of Aristotle's work*By Anima*(On the Soul).
Second, Bock, Ana, Furtado, Odair; Teixeira, Maria de Lourdes, (2009), American Psychological Association, (2015, 2016). Psychology is the science that treats, studies and analyzes the mental and behavioral processes of people and human groups, in different situations, For Dodge Fernald, (2007) psychology has as its immediate objective the understanding of groups and people, both by establishing universal principles and by studying specific cases. With the aim of benefiting society. A researcher or professional in this field is known as a psychologist, and can be classified as a social, behavioral, or cognitive scientist.
The role of psychologists is to try to understand the role of mental functions in individual and social behavior, also studying the physiological and biological processes that accompany behaviors and cognitive functions. According to the aforementioned authors, psychologists explore concepts such as: perception, cognition, attention, emotion, intelligence, phenomenology, motivation, the functioning of the human brain, personality, behavior, interpersonal relationships, including resilience, among other areas of human knowledge.
According to the Occupational Outlook Handbook, (2014-15Edition), psychological knowledge is built as a method of assessing and treatingpsychopathologies, it is also directed at understanding and solving problems in different forms of human behavior. The vast majority of psychologists practice some sort of therapeutic role, whether in clinical psychology or psychological counseling. Others engage in

ongoing scientific research related to mental processes and human behavior, typically within the psychological departments of universities. In addition to the therapeutic and academic fields, applied psychology is employed in other areas related to human behavior, such as work or organizational psychology, educational psychology, sports psychology, health psychology, human development psychology, forensic psychology, legal psychology, among others.

According to Zimbardo &Gerrig (2004), p.3-5; 5-8; 10-17, the basis of thinking from a biological perspective is the search for the causes of behavior, in the functioning of genes, the brain, and the nervous and endocrine systems. Behavior and mental processes are understood based on bodily structures and biochemical processes in the human body, so this school of thought is very close to the areas of genetics, neuroscience and neurology and is therefore closely linked to the important debate on the role of genetic predisposition and environment in the formation of the person. This perspective directs the researcher's attention to the bodily basis of the entire psychic process and contributes with basic knowledge about the functioning of psychic functions, such as thought, memory and perception.

Second, Gorayeb, Ricardo; Guerrelhas, Fabiana, (2003), the health-disease process has a special attention and can be understood in different ways, in addition to being directed to the treatment of the mental disorder itself. Initially approached by psychopathology, arising from the progressive distinction of the object of neurology and psychiatry, and the consolidation of the latter, as medical specialties, the perception of the importance of emotional factors in illness and recovery of health, were already present in Hippocratic medicine and homeopathy, however, it was only in the mid-twentieth century that applications of psychology emerged, in clinical interventions currently called psychosomatic medicine, medical psychology, hospital psychology and health psychology

According to Zimbardo &Gerrig (2004), p.3-5; 5-8; 10-17, the psychodynamic perspective, behavior is driven and motivated by a series of internal psychic forces, and describes the mind based on concepts of energy, tension, instincts, drives and desires, such as internal needs on the one hand and social demands on the other.

The psychodynamic perspective became better known in the form of psychoanalytic theory, from the work of the Viennese physician Sigmund Freud (1856–1939) with psychiatric patients; but he believed that these principles were also valid for normal behavior. The Freudian model is notoriously recognized for emphasizing that human nature is not always rational and that actions can be motivated by factors not accessible to consciousness. In addition, Freud gave a lot of importance to childhood, as a very important phase in the formation of personality. Freud's original theory, which was later expanded by several more recent authors, strongly influenced many areas of psychology, and has its origin not in scientific experiments, but in the capacity for observation of a creative man, inflamed by the idea of discovering the deepest mysteries of the human being.

The reaction to the Behaviorist and Psychodynamic currents emerged in the 50s of the twentieth century, the existential-humanist perspective, which sees man not as a being controlled by inner drives or by conditions imposed by the surrounding environment, but as an active and autonomous being, who consciously seeks his own growth and development, presenting a tendency to self-realization. The main source of knowledge of the humanistic psychological approach is the biographical study, with the purpose of discovering how the person lives his existence and understands his experience, through introspection. Unlike Behaviorism, which values external observation, the humanistic perspective seeks a holistic understanding of the human being and is closely related to phenomenological epistemology, Zimbardo &Gerrig (2004).

Computer Science

Prior to the 1920s, *computer* was a term associated with people who performed calculations, usually led by physicists. Thousands of computers were used in projects in commerce, government, and research sites. After the 1920s, the term *computational machine* began to be used to refer to any machine that performed the work of a professional, especially those according to the methods of the Church-Turing Thesis (1936).

The term *computational machine* eventually lost ground to the reduced *term computer* in the late 1940s, with digital machines becoming more and more widespread. Alan Turing, known as the father of computer science, invented the Turing machine, which later evolved into the modern computer

Computational Sciences studies computational techniques, methodologies and "instruments" as well as their technological applications, which computerize processes and develop solutions for processing input and output data in the computer, that is, not restricted only to the study of algorithms, their applications and implementation in the form of software. They also cover data modeling and database management techniques, involving telecommunications and their communication protocols. Computational Sciences also deals with the theoretical foundations of information, computation, and practical techniques for their applications.

As a science, it is classified as an exact science, although it inherits elements of Aristotelian philosophical logic, and therefore plays an important role in the mathematical formalization of algorithms, as a way of representing problems that are susceptible to reduction to basic elementary operations, capable of being reproduced through any device capable of storing and manipulating data. One of these devices is the digital computer, which is in widespread use today. Also of fundamental importance for the area of Computer Science are the methodologies and techniques related to software implementation that address the specification, modeling, coding, testing and evaluation of software systems.

The studies from Computer Science can be applied in any area of human knowledge in which it is possible to define methods of problem solving, based on previously observed repetitions. Recent advances in Computer Science have had a strong impact on contemporary society, in particular applications related to the areas of computer networks, Internet, Web, data science and mobile computing, which have been used worldwide by people.

The mathematical foundations of computer science began to be defined by Kurt Gödel (1931) with his incompleteness theorem. This theory shows that there are limits to what can be proven or not proven in a formal system; this led to later work by Gödel and other theorists to define and describe such formal systems, including concepts such as recursion and lambda calculus.

In 1936 Alan Turing and Alonzo Church introduced the formalization of an algorithm, defining the limits of what a computer and a purely mechanical model for computing can be. Such topics are addressed in what is now called the Church-Turing Thesis, a hypothesis about the nature of mechanical calculation devices. This thesis states that any possible calculation can be performed by an algorithm running on a computer, as long as there is enough time and storage to do so.

Until the 1930s, electrical engineers built electronic circuits to solve logical and mathematical problems, but most did so without any process, without theoretical rigor. Claude Shannon (1937), while teaching philosophy, was exposed to the work of George Boole, and realized that he could apply this learning to electromechanical assemblies to solve problems. Shannon (1948) developed the Mathematical Theory of Communication, *the content of which serves as a foundation for areas such as* data compression and cryptography.

Computer Science has given rise to several fundamental contributions to science and society. This science was responsible for the formal definition of computation and computability, and for proving the existence of computationally unsolvable or intractable problems. It was also possible to construct and formalize the concept of computer language, especially programming language, a tool for the precise expression of methodological information flexible enough to be represented at various levels of abstraction.

For other scientific fields and for society, Computer Science provided support for the Digital Revolution, giving rise to the Information Age. Scientific computing is an area of computing that allows the advancement of studies, such as the mapping of the human genome.

There are alternative definitions for Computer Science. It can be seen as a form of science, a form of mathematics, or a new discipline that cannot be categorized according to current models. Most computer scientists are interested in innovation or in theoretical aspects that go far beyond just programming, more related to computability.

Despite its name, Computer Science is not just about the study of computers. In fact, the well-known computer scientistEdsgerDijkstrais considered to be the author of the phrase*"Computer science has as much to do with computing as astronomy has to do with the telescope [...]"*. The design and development of computers and computer systems are generally considered disciplines outside the context of computer science. For example, the study of thehardwareIt is generally considered to be part of theComputer Engineering, while the study of commercial computer systems is usually part of theInformation Technology

Computer Science is also criticized for not being scientific enough, as exposed in the sentence*"Science is to computer science what hydrodynamics is to the construction of pipelines"*, creditsStan Kelly-Bootle. Despite this, his study often crosses other fields of research, such asArtificialIntelligencethephysicsandlinguistics.

She is considered by some to have a great relationship with mathematics, greater than in other disciplines. This is evidenced by the fact that early work in the field was heavily influenced by mathematicians such as Kurt Gödel and Alan Turing; the field remains useful for exchanging information with areas such as mathematical logic, category theory, and algebra. Despite this, unlike mathematics, Computer Science is considered a discipline that is more experimental than theoretical.

Data Science

Data Science is the study of data to extract meaningful insights for organizations. It is a multidisciplinary approach that combines principles and practices from the fields of mathematics, statistics, artificial intelligence, and computer engineering to analyze large amounts of data. This analysis helps data scientists ask and answer questions, such as what happened, why it happened, what will happen, and what can be done with the results.

Data Science is important because it combines tools, methods, and technology to generate meaning based on data. Modern organizations are inundated with data; There is a proliferation of devices that can automatically collect and store information. Online systems and payment portals capture more data in the areas of e-commerce, medicine, finance, and all other aspects of human life. We have text, audio, video, and image data available in large quantities.While the term Data Science is not new, the meanings and connotations have changed over time. The word first appeared in the 1960s, as an alternative name for statistics. In the late 1990s, computer science professionals formalized the term. A proposed definition for Data Science saw it as a separate field with three aspects: data design, collection, and analysis. It still took another decade for the term to be used outside of academia.

Artificial intelligence and machine learning innovations have made data processing faster and more efficient. The demand from the sector has created an ecosystem of courses, diplomas and positions in the field of Data Science. Due to the cross-functional skill set and expertise required, Data Science shows strong growth projected over the next few decades.

Data Science is used to study data in four ways:

1. **Descriptive analytics –** Descriptive analytics analyzes data to gain insights into what has happened or what is happening in the data environment. It is characterized by data visualizations such as pie charts, bar charts, line charts, tables, or generated narratives. For example, a flight booking service may record data such as the number of tickets booked per day. Descriptive analytics will reveal peaks in bookings, dips in bookings, and months of high performance for this service.
2. **Diagnostic analysis -** Diagnostic analysis is an in-depth or detailed analysis of data to understand why something happened. It is characterized by techniques such as drill-down, data discovery, data mining, and correlations. Various operations and data transformations can be performed on a given dataset to discover unique patterns in each of these techniques. For example, the flight service can drill down into a particularly high-performing month to better understand peak bookings. This can lead to the discovery that many customers visit a particular city to attend an event.
3. **Predictive analytics -** Predictive analytics uses historical data to make accurate predictions about data patterns that may occur in the future. It is characterized by techniques such as machine learning, prediction, pattern matching, and predictive modeling. In each of these techniques, computers are trained to reverse-engineer causal connections in the data. For example, flight service staff can use Data Science to predict flight booking patterns, for the next year, at the beginning of each year. The computer program or algorithm can analyze past data and predict booking spikes for certain destinations in May. Having anticipated the future travel needs of its customers, the company could start targeted advertising for these cities as early as February.
4. **Prescriptive analytics -** Prescriptive analytics takes predictive data to the next level. Not only does it predict what is likely to happen, but it also suggests an optimal response to that outcome. She can analyze the potential implications of different choices and recommend the best course of action. Prescriptive analytics uses graph analysis, simulation, complex event processing, neural networks, and machine learning recommendation engines.
5. Going back to the flight booking example, prescriptive analytics can analyze historical marketing campaigns to maximize the advantage of the next spike in bookings. A data scientist can project booking outcomes for different levels of marketing spend across various marketing channels. These data predictions would give the flight booking company more confidence to make its marketing decisions.

Data Science is revolutionizing the way businesses operate. Many businesses, regardless of size, need a robust data science strategy to drive growth and maintain a competitive edge. Some of the key benefits include:

Uncover unknown transformative patterns – Data Science enables businesses to uncover new patterns and relationships that have the potential to transform the organization. It can reveal low-cost changes in resource management for maximum impact on profit margins. For example, an e-commerce company uses Data Science to find that many customer inquiries are being generated after business hours. Research reveals that customers are more likely to buy if they receive an immediate response rather than a response the next business day. By implementing customer service 24 hours a day, seven days a week, the company increases its revenue.

Innovate new products and solutions - Data Science can reveal flaws and problems that would otherwise go unnoticed. More insights into purchasing decisions, customer feedback, and business processes can drive innovation in internal operations and external solutions. For example, an online payment solution uses Data Science to collect and analyze customer feedback about the company on social media. The analysis reveals that customers forget their passwords during peak purchase periods and are dissatisfied with their current password recovery system. The company can innovate a better solution and see a significant increase in customer satisfaction.

Real-time optimization - It is very challenging for businesses, especially large ones, to respond to changing conditions in real-time. This can cause significant losses or disruptions to business activity. Data Science can help businesses predict changes and react optimally to different circumstances. For example, a trucking company uses Data Science to reduce downtime when trucks break down. They identify the routes and patterns of change that lead to faster breakdowns and adjust truck schedules. They also set up an inventory of common spare parts that need to be replaced frequently so that trucks can be repaired faster.

A business problem typically kicks off the Data Science process. A data scientist will work with stakeholders in organizations to understand what the needs are. Once the problem is defined, the data scientist can solve it using the OSEMN Data Science process:

O: Get Data – Data can be pre-existing, newly acquired, or a data repository that can be downloaded from the Internet. Data scientists can pull data from internal or external databases, the organization's CRM software, web server logs, social media, or purchase it from trusted third-party sources.

S: Data suppression - Data suppression, or data cleansing, is the process of standardizing data according to a predetermined format. It includes dealing with missing data, correcting data errors, and removing any outliers. Some exemples of data deletion are: ·

- Change all date values to a common standard format. ·
- Fix spelling errors or additional spaces. ·
- Correct mathematical inaccuracies or remove commas from large numbers.

E: Explore data - Data exploration is a preliminary data analysis that is used to plan other data modeling ploys. Data scientists gain an initial understanding of data using descriptive statistics and data visualization tools. Then, they explore the data to identify interesting patterns that can be studied or acted upon.

M: Model data – Software and machine learning algorithms are used to gain deeper insights, predict outcomes, and prescribe the best plan of action. Machine learning techniques, such as association, classification, and clustering, are applied to the training dataset. The model can be tested against predetermined test data to assess the accuracy of the results. The data model can be adjusted multiple times to improve results.

N: Interpret results – Data scientists work together with analysts and organizations to convert data insights into action. They make diagrams, graphs, and tables to represent trends and forecasts. Data summarization helps stakeholders understand and implement results effectively.

Data Science professionals use computing systems to keep up with the Data Science process. The main techniques used by data scientists are:

Classification - Classification is the ordering of data into specific groups or categories. Computers are trained to identify and classify data. Known datasets are used to create decision algorithms on a computer that quickly processes and categorizes data. For exemple:

- Classify products as popular or not popular·
- Classify insurance applications as high-risk or low risk·
- Classify social media comments as positive, negative, or neutral.

Data Science professionals use computing systems to keep up with the Data Science process.

Regression – Regression is the method of finding a relationship between two seemingly unrelated data points. The connection is usually modeled around a mathematical formula and represented as a graph or curves. When the value of one data point is known, regression is used to predict the other data point. For exemple: ·

- The rate of spread of airborne diseases.
- The relationship between customer satisfaction and the number of employees. ·
- The ratio of the number of fire stations to the number of people injured because of a fire at a given location.

Clustering - Clustering is the method of grouping closely related data together to look for patterns and anomalies. Clustering is different from classification because data cannot be accurately classified into fixed categories. Therefore, the data is grouped into more likely relationships. New patterns and relationships can be discovered with clustering. For exemple:

- Group customers with similar buying behavior to improve customer service.
- Bundle network traffic to identify daily usage patterns and identify a network attack faster.
- Group articles into several different news categories and use that information to find fake news content.

The Basic Principle Behind Data Science Techniques

While the details vary, the underlying principles behind these techniques are:

- Teach a machine to classify data based on a known data set. For example, sample keywords are provided to the computer with their respective ranking values. "Happy" is positive, while "Hate" is negative.
- Provide unknown data to the machine and allow the device to classify the dataset independently.
- Allow for inaccuracies of results and deal with the probability factor of the outcome.

Data Science professionals work with complex technologies, such as:

- Artificial intelligence: Machine learning models and related software are used for predictive and prescriptive analytics.
- Cloud computing: Cloud technologies have given data scientists the flexibility and processing power needed for advanced data analytics.
- Internet of Things: IoT refers to various devices that can automatically connect to the internet. These devices collect data for Data Science initiatives. They generate large amounts of data that can be used for data mining and data extraction.
- Quantum computing: Quantum computers can do complex calculations at high speeds. Skilled data scientists use them to create complex quantitative algorithms.

Data Science is an umbrella term for other data-related functions and fields. Let's look at some of them here:

- **Difference Between Data Science and Data Analytics -** While the terms can be used interchangeably, data analytics is a subset of Data Science. Data Science is an umbrella term for all aspects of data processing, from collection to modeling and insights. On the other hand, data analysis mainly involves statistics, mathematics, and statistical analysis. It focuses only on data analysis, while Data Science is related to the big picture around organizational data. In most workplaces, data scientists and data analysts work together to achieve common organization goals. A data analyst may spend more time on routine analysis by providing regular reports. A data scientist can design the way data is stored, manipulated, and analyzed. Simply put, a data analyst makes sense of existing data, while a data scientist creates new methods and tools to process data to be used by analysts.
- **Difference Between Data Science and Business Analytics -** While there is an overlap between Data Science and business analytics, the main difference is the use of technology in each area. Data scientists work more closely with data technology than business analysts. Business analysts reconcile business and IT. They define business cases, gather input from stakeholders, or validate solutions. Data scientists, on the other hand, use technology to work with business data. They can write programs, apply machine learning techniques to create models, and develop new algorithms. Data scientists not only understand the problem, but they can also create a tool that provides solutions to the problem. It's not uncommon to find business analysts and data scientists working on the same team. Business analysts use the output of data scientists and use it to tell a story that the organization as a whole can understand.
- **Difference Between Data Science and Data Engineering -** Data engineers build and maintain the systems that allow data scientists to access and interpret data. They work more closely with the underlying technology than a data scientist. The role typically involves creating data models, building data pipelines, and overseeing extract, transform, and load (ETL). Depending on the layout and size of the organization, the data engineer may also manage related infrastructure, such as **big data** storage,

broadcasting, and processing platforms such as Amazon S3. Data scientists use the data that data engineers have processed to build and train predictive models. Data scientists can then hand the results over to analysts for further decision-making.

- **Difference Between Data Science and Machine Learning** - Machine learning is the science of training machines to analyze and learn from data in the same way that humans do. It is one of the methods used in Data Science projects to obtain automated insights from data. Machine learning engineers specialize in computing, algorithms, and coding skills specific to machine learning methods. Data scientists can use machine learning methods as a tool or work closely with other machine learning engineers to process data.
- **Difference Between Data Science and Statistics** - Statistics is a mathematical background area that seeks to collect and interpret quantitative data. In contrast, Data Science is a multidisciplinary field that uses scientific methods, processes, and systems to extract knowledge from data in a variety of ways. Data scientists use methods from many disciplines, including statistics. However, the scopes differ in their processes and the problems they study.

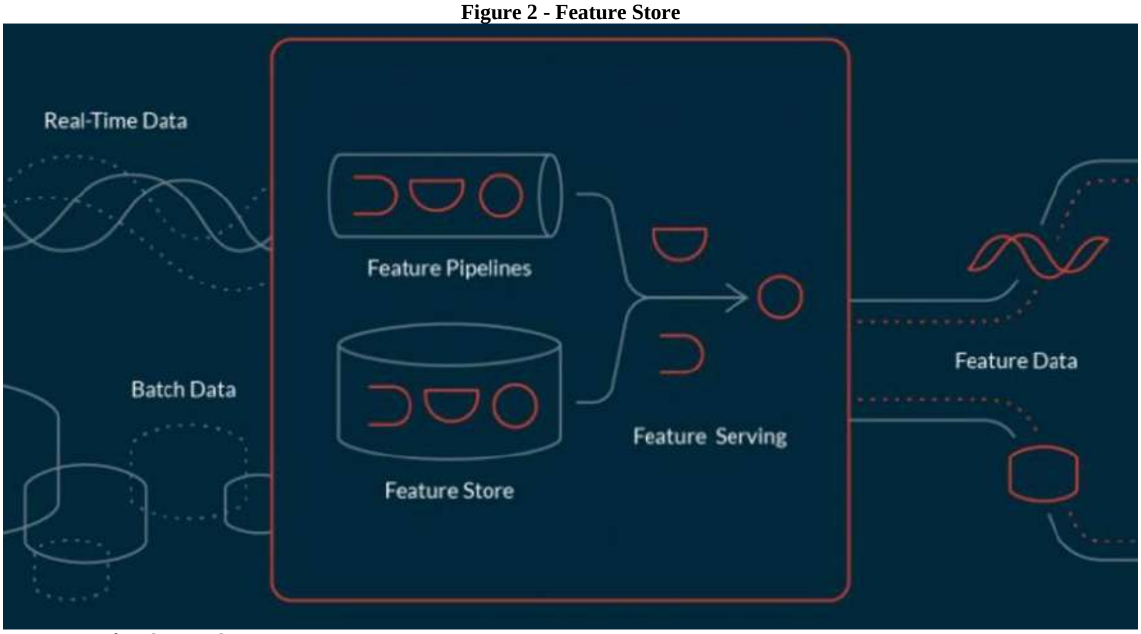
AWS has several tools to support data scientists around the world:

- **Physical data storage -** For data warehousing, Amazon Redshift can run complex queries on structured or unstructured data. Analysts and data scientists can use AWS Glue to manage and search data. AWS Glue automatically creates a unified catalog of all data in the Data Lake, with Meta data attached to make it discoverable.
- **Machine learning -** Amazon SageMaker is a fully managed machine learning service running on Amazon Elastic Compute Cloud (EC2). It enables users to organize data, build, train, and deploy machine learning models, and scale operations.

Analysis:

- OrAmazon Athenais an interactive query service that makes it easy to analyze data in theAmazon S3orGlacier. It's fast, serverless, and works using standard SQL queries.
- Amazon Elastic MapReduce (EMR) processes big data using servers such as Spark and Hadoop.
- Amazon Kinesis enables real-time aggregation and processing of streaming data. It uses website clickstreams, application logs, and telemetry data from IoT devices.
- Amazon OpenSearch enables you to search, analyze, and visualize petabytes of data.

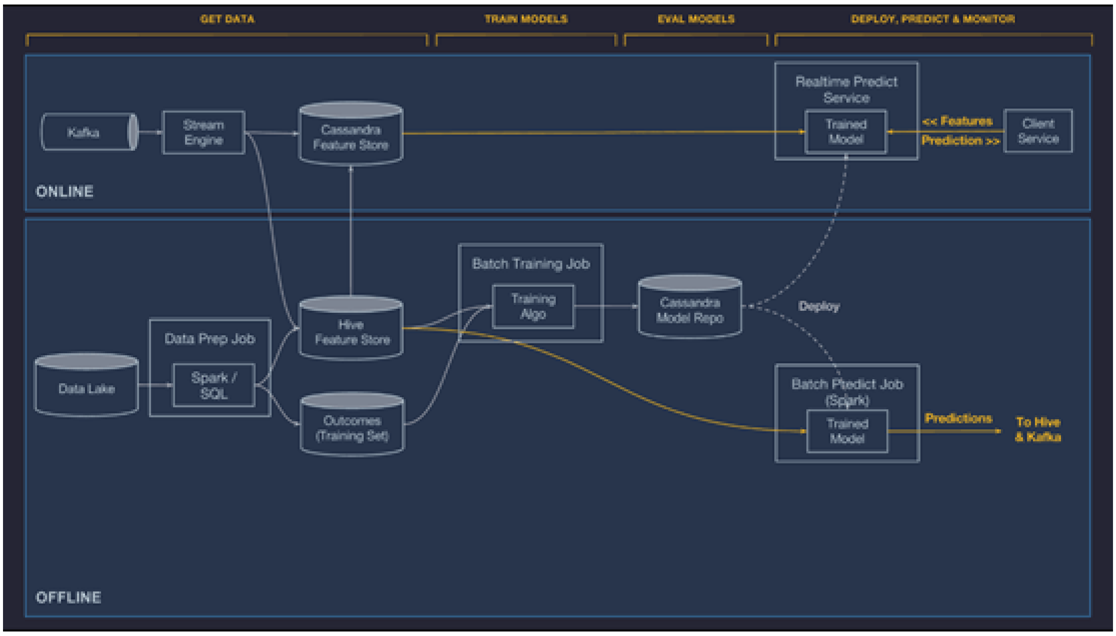
Figure 2 - Feature Store



Source: Microsoft Industry Blogs

The data can be stored in memory or in a database of very fast key-values. The process itself can be carried out in various cloud services or on one platform. Here's an example of an online and offline pipeline using data storage (Feature Store). It was designed by Uber, as part of its Michelangelo platform:

Figure 3 - Michelangelo Platform of the Uber Project



Source: Microsoft Industry Blogs

What Does a Data Scientist Do?

A data scientist can use a number of distinct techniques, tools, and technologies as part of the Data Science process. Based on the problem, it chooses the best combinations to get faster and more accurate results. The role and day-to-day work of a data scientist will vary depending on the size and requirements of the organization. While they typically follow the Data Science process, the details can vary. In larger Data Science teams, a data scientist may work with other analysts, engineers, machine learning specialists, and statistical technicians to ensure that the Data Science process is followed end-to-end and that business goals are achieved.

However, in smaller teams, a data scientist may have more than one role. Based on experience, skills, and academic background, he may wear multiple hats or have overlapping roles. In that case, your day-to-day responsibilities may include engineering, analytics, and machine learning, along with key Data Science methodologies.

Challenges for Data Scientists

Data sources - Different types of applications and tools generate data in various formats. Data scientists need to clean and prepare data to make it consistent. This can be tedious and time-consuming.

Understand the problem of organizations - Data scientists need to work with various stakeholders and managers of organizations to define the problem to be solved. This can be challenging, especially in large organizations with multiple teams with varying requirements.

Eliminate drift - Machine learning tools are not fully accurate, and as a result, there may be uncertainties or drifts. Deviations are disparities in the test data or prediction behavior of the model in different groups, such as age or income bracket. For example, if the tool is trained primarily on data from middle-aged people, it may be less accurate when making predictions involving younger and older people. The field of machine learning offers an opportunity to address deviations by detecting and measuring them in the data and model.

Online and offline data have different characteristics. Behind the scenes, offline data is mostly built in frameworks, such as Spark or SQL, where the actual data is stored in a database or as files. While online data may require access to data using APIs for streaming engines such as Kafka, Kinesis, or in-memory key-value databases such as Redis or Cassandra.

Working with a data store abstracts this layer, so that when a data scientist is looking for data, instead of writing engineering code, they can use a simple API to retrieve the data they need.

One of the main challenges in implementing machine learning (computer) in production arises from the fact that the data being used to test a model in the software development environment (programs) is not the same as the data in the production service layer. Therefore, enabling a consistent set of resources (machine and software) between the testing and service layer allows for a smoother deployment process, ensuring that the tested model truly reflects the way things will work in production.

In addition to the actual data, the data store maintains **additional meta data** for each resource. For example, a metric that shows the impact of the resource on the model it's associated with. This information can help Data Scientists tremendously select the resources for a new model, allowing them to focus on those who have achieved a better impact on similar existing models.

The reality today is that almost every business is based on Machine Learning, so the number of projects and resources is growing exponentially. This reduces our ability to have a good comprehensive overview of the resources available, since there are so many. Instead of developing in silos, data warehousing allows us to share our resources with our colleagues' **Meta data**. It's becoming a common problem in large organizations that different teams end up developing similar solutions, simply because they're not aware of each other's tasks. Data stores fill that gap and allow everyone to share their work and avoid duplication.

To meet guidelines and regulations, especially in cases where the generated Artificial Intelligence (AI) models serve industries such as healthcare, financial services, and security, it is important to trace the lineage of the algorithms under development. Achieving this requires end-to-end data flow visibility to better understand how the model is generating its results. As data is being generated, as part of the process, it is necessary to track the flow of the data generation process. In data warehousing, you can maintain the lineage of data and a resource. This provides the necessary tracking information, how the data was generated, and provides the insight and reporting needed for regulatory compliance.

MLOps is an extension of DevOps where the idea is to apply DevOps principles to Machine Learning pipelines. Developing a machine learning (computer) pipeline is different from developing software (programs), mainly because of the look and feel of the data. The quality of the model is not only based on the quality of the code. It is also based on the quality of the data and the resources that are used to run the model. According to Airbnb, about 60%-80% of Data Scientists' time is spent creating, training, and testing.

Data stores allow Data Scientists to reuse resources instead of rebuilding them over and over again for different models, saving valuable time and effort. Data stores automate this process, and resources can be triggered by code changes that are pushed to Git or by the arrival of new data. This automated feature engineering is an important part of the MLOps concept.

Some of the largest information and communication technology companies that deal extensively with AI have created their own Feature Stores (Uber, Twitter, Google, Netflix, Facebook, Airbnb, etc.). This is a good indication to the rest of the industry of how important it is to use data warehousing as part of an effective machine learning pipeline. Given the growing number of AI projects and the complexities associated with getting those projects into production, the industry needs a way to standardize and automate the core of feature engineering. Therefore, it is fair to assume that data storage is positioned to be a basic component of any machine learning pipeline (computer and software).

IV. ELEMENTS FOR REFLECTION ON HUMAN INTELLIGENCE AND ARTIFICIAL INTELLIGENCE AND THE DIGITAL SOCIETY

Human Intelligence

Second, *Haimovitz, Kyla; Dweck, Carol S. (2016),* **human intelligence** is the intellectual capacity of human beings, in terms of, complex cognitive feats and high levels of motivation and self-awareness. Through intelligence, humans possess the cognitive abilities to learn, form concepts, understand, apply logic and reason, including the abilities to recognize patterns, plan, innovate, solve problems, make decisions, retain information (memorize), and use language to communicate.

There is no consensus on how intelligence is measured, from the idea that intelligence is fixed at birth, to that it is malleable and can change depending on the individual's mindset and efforts. In psychometrics, human intelligence is assessed by intelligence quotient (IQ) tests, although the validity of these tests is disputed.

Second, *Salovey, Peter; Mayer, John D. (March 1990), Walker, Ronald E.; Foley, Jeanne M. (December 1973), Tirri, Nokelainen (2011), there are several* subcategories of intelligence, such as emotional intelligence and social intelligence. There is significant debate as to whether they represent distinct forms of intelligence, Second, *Brown, M.I.; Wai, J. (2021),* higher intelligence is associated with better life outcomes. Second, Triglia, A.; Regader, B.; & García-Allen, J.; (2018), intelligence is considered one of the most useful concepts in psychology because it relates to many relevant variables, e.g., the probability of having an accident, salary, etc.

According to, Ritchie, *Stuart J.; Tucker-Drob, Elliot M. (2018),* The effects of education on intelligence, education appears to be the "most consistent, robust, and enduring method" for increasing intelligence. Second, *Czepita, D.; Lodygowska, E.; Czepita, M. (2008), Rosenfield, Mark; Gilmartin, Bernard (1998), several* studies have demonstrated a correlation between IQ and myopia. Some suggest that the reason for the correlation is environmental, as people with higher IQs are more likely to impair their eyesight with prolonged reading, or the other way around, as people who read more are more likely to achieve a higher IQ, while others claim that there is a genetic link.

Second, Denise *C. Park; According to Gérard N. Bischof, (2017),* aging causes a decline in cognitive functions, as several cognitive functions decline by about 0.8% at the age of 20 to 50 years; cognitive functions include processing speed, memory, work speed, and long-term memory. To Duckworth, *A. L.; Quinn, P. D.; Lynam, D. R.; Loeber, R.; Stouthamer-Loeber, M. (2011),* motivation is a factor that influences IQ test results. People with higher motivation tend to get higher IQ scores.

Relevance of Intelligence Quotient (IQ) tests

Alfred Binet, (1859-1911), developed the first test to measure people's intellectual capacity. Initially, the test was applied in schools to identify children with learning difficulties. Psychologist William Stern (1871-1938) coined the term Intelligence Quotient (IQ), introducing the terms "MI (mental age) and CI (chronological age) to relate a person's intellectual capacity and their age.

Lewis Madison Terman, (1877-1956), proposed intelligence scales using the formula IQ = 100Xim/CI and classified a score higher than 140 as genius and a score below 70 as slow thinking. David Wechsler, (1896-1981), created the intelligence scale for adults, according to the following scale:

- Equal to or greater than 130 – Giftedness
- 120 – 129 – Higher intelligence.
- 110 – 119 – Above-average intelligence.
- 90 – 109 – Average intelligence.
- 80 – 89 – Weak normal.
- 70 – 79 – Limit of disability.
- Equal to or less than 69 – mentally disabled.

According to Shipstead, Zach; Redick, Thomas S.; Engle, Randall W. (2010), Simons, Daniel J.; Boot, Walter R.; Charness, Neil; Gathercole, Susan E.; Chabris, Christopher F.; Hambrick, David Z.; Stine-Morrow, Elizabeth A. L. (2016), Jaeggi, S. M., Buschkuehl, M., Jonides, J., Perrig, W. J. (2008),attempts to increase IQ with training of the human brain have led to increases in task-related aspects of training – e.g., working memory – but it remains unclear whether these increases generalize to the increase in intelligence itself.

Second, AlexisMadrigalWired, (2008) and,*Moody, D. E. (2009), u*m research paper that uses the practice of a task*n-back*dual, it can increase fluid intelligence (Gf), as measured in several different patterns. This finding received some attention from popular media, including an article in theWired. However, a later critique of the paper's methodology questioned the validity of the experiment and raised problems with the lack of uniformity in the tests used to evaluate the control and test groups. They were allowed 10 minutes to complete a normally 45-minute test.

Second, Borsboom, *D.; Mellenbergh, G. J.; van Heerden, J. (2004). Macintosh, Nicholas (2011), Weiten W (2016), n*psychology, human intelligence is assessed by IQ scores determined by IQ tests. However, IQ test scores show a high degree of reliability. While IQ tests are generally thought of as a measure of some forms of intelligence, they may not serve as an accurate measure of broader definitions of human intelligence, including creativity and social intelligence.

According to psychologist Wayne Weiten, (2016), "IQ tests are valid measures of the kind of intelligence needed to do well at academic work. But if the goal is to assess intelligence in a broader sense, the validity of IQ tests is questionable."

Theory of Multiple Intelligences

The Theory of Multiple Intelligences of Howard, (1983),It is based on studies not only ofchildrenandadultsnormal, but also of individuals Gifted(including the so-called "*Savants*"), from people who have suffered brain damage, from experts and virtuosos, and from individuals from diverse cultures. Gardner, (1983, 1995), divides intelligence into at least a number of different and distinct components of intelligence:

1. **Logical-mathematical** – refers to the ability to deal with mathematical operations and logical approaches. It implies good inductive and deductive approaches that involve sequential reasoning capable of perceiving relationships and connections between elements (e.g. mathematicians, researchers and scientists). They first acquire the knowledge, and then apply it to practical issues.
2. **Linguistics** – the ability to use words and language effectively, i.e., it involves the articulation of arguments and discourses in a clear and direct way, in the transmission of a message to achieve the objectives (e.g., writers, poets, journalists, speakers, politicians and other speakers).
3. **Visual-spatial** – the ability to understand the world in three dimensions. Ability to imagine things in three dimensions. That is, the ability to imagine something and think about the object from one or more points of view, artistic skills (e.g., painting, sculpture, designers, pilots, etc.).

4. **Musical** – ability to understand and identify sounds, timbres, rhythms, and everything related to sound. (e.g. musicians, songwriters, singers, conductors, DJs, etc.).
5. **Body-kinesthetics** – is related to the efficient use of the body, in the form of motor coordination, hand-eye and pedal coordination, and mind-body coordination. (e.g. athletes, craftsmen, dancers, acrobats and surgeons).
6. **Interpersonal** – the ability to understand and interact with others effectively. It involves attention and sensitivity to other people's moods, feelings, temperament, and understanding. (e.g. teachers, politicians, actors, salespeople, social workers, etc.).
7. **Intrapersonal** – the ability to know oneself, respecting one's own feelings, desires, limitations, motivations, and respect for the human condition. He has great willpower and independence. (e.g. psychologists, politicians, spiritual leaders and philosophers).
8. **Naturalist** – ease of understanding nature and its elements, living or not. (e.g. animals, plants, rain, sea, land – botanists, biologists, farmers, hunters, etc.).
9. **Existential** – ability to understand deep issues related to existence (life and spiritual themes). (e.g. spiritual leaders, theologians and philosophers)

Triarchic Theory of Intelligence

Robert Sternberg, (1978, 1985, 2003), proposed the Triarchic Theory of Intelligence to provide a more comprehensive description of intellectual competence than traditional differential or cognitive theories of human ability, which describes three fundamental aspects of intelligence:

- **Analytical intelligence** – comprises the mental processes through which intelligence is expressed.
- **Creative intelligence** is required when an individual is faced with a challenge that is almost, but not entirely new or when, an individual is involved in automating the execution of a task.
- **Practical intelligence** – is linked to a socio-cultural environment and involves adapting, selecting and shaping the environment, and to maximise fit into the context.

The Triarchic Theory posits that general intelligence is part of analytical intelligence, and only by considering all three aspects of intelligence can one fully understand the full range of intellectual functioning. Intelligence is defined, as a person's assessment of success in life, accordingly. with their own standards, within their socio-cultural context. Success is achieved through the use of combinations of analytical, creative, and practical intelligence. The three aspects of intelligence are called processing skills. Processing skills are applied to the pursuit of success through the three elements of practical intelligence: adaptation, modeling, and environment selection. The mechanisms that employ processing skills to achieve success include utilizing strengths and compensating for or correcting weaknesses.

Emotional Intelligence

According to Daniel Golema, (2010), emotional intelligence is a concept related to the so-called "social intelligence", present in psychology, that is, an emotional person can identify their emotions more easily. One of the advantages is that the person has the ability to self-motivate and move forward in the face of frustrations and disappointments. The person is able to control impulses, channel emotions into appropriate situations, practice gratitude, and motivate and encourage others. According to the same author, emotional intelligence can be subdivided into five skills:

1. Emotional self-awareness
2. Emotional control
3. Self-motivation
4. Empathy
5. Develop interpersonal relationships.

A person can concentrate on work and complete all tasks and obligations/responsibilities even if they feel sad, anxious or bored.

PASS Theory of Intelligence

According to Alexander Luria, (1966), the modularization of brain function is supported by decades of neuroimaging research. It proposes that cognition be organized into three systems and four processes. The first process is "planning," which involves executive functions responsible for controlling and organizing behavior, selecting, constructing, and controlling performance. The second is the process of "attention", which is responsible for maintaining levels of arousal, alertness and ensuring focus on relevant stimuli. The next two are called "concurrent" and "successive" processing, and they involve the encoding, transformation, and retention of information.

"Concurrent" processing is triggered when the relationship between items and their integration into entire units of information is required. Examples, figure recognition, triangle within a circle versus a circle within a triangle, or the difference between "he took a shower before breakfast" and "he had breakfast before a shower." "Successive" processing is necessary to arrange separate items in a sequence, such as remembering a sequence of words or actions in exactly the order in which they were just presented.

These four processes are functions of four areas of the brain. "Planning" is located in the front part of the brain, the frontal lobe. "Attention" and arousal are combined functions of the frontal lobe and the lower parts of the cortex, although the parietal lobes are also involved in attention. Both "simultaneous" and "successive" processing occur in the posterior region or back of the brain. "Simultaneous" processing is widely associated with the occipital and parietal lobes, while "successive" processing is widely associated with the frontotemporal lobes.

Piaget's Theory

According to Piaget (1953, 2001), in the theory of cognitive development the focus is not on mental abilities, but on mental models of the child's world. As the child develops, more and more accurate models of the world are developed, which allows them to interact better with the world. The child develops a model in which objects continue to exist even when they cannot be seen, heard, or touched. Piaget's theory described four main stages and many sub-stages in development. These four main stages are:

- Sensorimotor stage (birth - 2 years);
- Pre-operational stage (2 to 7 years);
- Concrete operational internship (7 years-11 years); and
- Formal Operations Internship (11 years-16 years).

The degree of progress through these stages is correlated, but not identical to, psychometric IQ. Piaget considers intelligence, as an activity, more than a capacity. Piaget focused on the discriminatory abilities of children between two-and-a-half and four-and-a-half years of age. He began the study by taking children of different ages and placing two lines of candy, one with the candies in a row farther away and the other with the same number of candies in a row closer. He found that "children aged 2 years and 6 months and 3 years and 2 months correctly discriminate the relative number of objects in two rows; between 3 years and 2 months and 4 years and 6 months, they indicate that a longer row with fewer objects has "more"; After 4 years and 6 months, they discriminate correctly again."

Initially, younger children weren't studied, because if at the age of four a child couldn't conserve the amount, then a younger child probably couldn't either. However, the results show that children under three years and two months retain the quantity, but as they get older, they lose this quality and do not regain it until they are four and a half years old.

First, younger children have a capacity for discrimination that shows that the logical capacity for cognitive operations exists earlier than recognized. This study also reveals that young children may be equipped with certain qualities for cognitive operations, depending on how logical the task structure is. Piaget's theory has been criticized for the fact that the age of appearance of a new model of the world, such as the permanence of the object, depends on how the test is done. More generally, the theory can be very difficult to test empirically, due to the difficulty of proving or disproving that a mental model is the explanation for the test results.

Evolution of the Concept of Artificial Intelligence

What is AI? What is AI in Justice? What is the Democracy of the Future? These questions have generated many reflections and debates. As the term "artificial intelligence" suggests, this scientific subject aims to give robots the ability to perform tasks such as logic, reasoning, planning, learning, and perception. It is an interdisciplinary discipline that replicates human capabilities and intellectual behavior through the use of AI. Stimulating human consciousness and thought through the retrieval and extraction of relevant material, as well as providing direct and reasonable answers to our questions, is the goal of the work of this technology Marwick, (2001). Computers that can learn, plan, problem-solve, reason, interact socially, be creative, and self-correcting are at the heart of AI Haleem et al., (2019).

In contrast to human intelligence, AI is just a demonstration of machine intellect. Robotics, machines, and programs with the ability to learn and understand on their own can be referred to as AI, according to certain definitions Van Wynsberghe, (2021). Robotics, natural language processing, expert systems, and automated reasoning are just a few of the most recent AI technologies Murphy, (2019).

Marvin Lee Minsky, one of the founding fathers of AI, describes it as the study of getting robots to perform tasks that would require intelligence if they were man-made (Sidner et al., (2005). High-level mental functions, such as perception, memory, and critical thinking, are all necessary for success. Machine learning is a broad term that includes many subfields of computer science that allow computers to perform functions traditionally performed by humans, such as problem-solving and decision-making Shinde & Shah, (2018). The term AI refers to a computer system that is able to learn from its environment and adapt its behavior to achieve its goals Sarker, (2022). In the end, its goal is to transform seemingly diverse problems into a group of generally similar problem types, after which the problem can be approached using various algorithms and eventually generalize the method to examples, in addition to those in the whole of Frey & Osborne, (2017).

According to Hobbes, (2020), the concept of Artificial Intelligence was influenced by mechanical materialism that began with the work "Discourse on Method" by René Descartes in 1637. René Descartes suggested that the animal is a kind of complex mechanism, thus formulating a mechanistic theory.

It is important to understand that mechanistic materialism differs from ancient materialism, whose views are captured in the works of Aristotle, and Hegel's subsequent dialectic, dialectical and historical materialism (Feuerbach, Karl Marx, Friedrich Engels, V. I. Lenin). The truth is that mechanistic materialism is directed to the mechanistic origin of organisms, while ancient materialism is directed to the mechanistic origin of nature, and dialectical and historical materialism refers to the manifestations of mechanism in society.

Schickard, (1623), built the first mechanical digital computing machine, followed by the machines of Blaise Pascal (1643) and Leibniz (1671). Leibniz was also the first to describe the modern **binary system of numbers**, although many great scientists periodically took an interest in this system (Leibniz, 1671). Korsakov, (1832), presented the principle of developing scientific methods and devices to improve the capabilities of the mind and proposed a series of "intelligent machines", in the design of which, for the first time in the history of computer science, he used punch cards. In the nineteenth century, Charles Babbage and Ada Lovelace worked on a programmable mechanical computer Hammerman, (2016).

Bertrand Russell and A. N. Whitehead, (1910-1913), published the paper "Principles of Mathematics", which revolutionized formal logic. Konrad Zuse, (1941), built the first software-controlled computer. Warren McCulloch and Walter Pitts, (1943), published "A Logical Calculus of the Ideas Immanent in Nervous Activity", which laid the foundation for neural networks.

McCulloch and Pitts, (1943), in their paper "The Logical Calculation of Ideas Related to Nervous Activity", proposed the concept of an artificial neural network. In particular, they proposed a model of an artificial neuron. Hebb (1949), in his work "Organization of Behavior," described the basic principles of neuron learning. These ideas were developed several years later by the American neurophysiologist Frank Rosenblatt who proposed a diagram of a device that simulates the process of human perception, and called it a "perceptron".

Artificial intelligence

Philosophical premises

Although research into artificial intelligence began in 1956, its philosophical roots go deep into the past. The question of whether a machine can think it has a long history. It is closely related to the differences between dualistic and materialistic views. From the point of view of dualism, thought is not material (or at least has no material properties), so the mind cannot be explained with the help of physical concepts alone. On the other hand, materialism says that the mind can be explained physically, thus leaving the possibility of the existence of artificially created minds.

The philosopher, Alfred Iyer, (1936), addressed a common philosophical question about other minds: How do we know that other people have the same conscious experience as we do? In his book Language, Truth and Logic, he proposed an algorithm to recognize a conscious person and an unconscious machine: that it cannot pass one of the empirical tests, according to which the presence or absence of consciousness is determined Swiechowski, (2020). This statement is very similar to Turing's test, but it is not known for sure whether Iyer's popular philosophical classics were known to Turing.

Although more than 50 years have passed, the Turing test has not lost its significance. But these days, artificial intelligence researchers aren't pretty much committed to solving the problem of passing the Guiding test, believing that it's far more important to study the fundamental principles of intelligence than to duplicate one of the carriers of natural intelligence. In particular, the problem of "artificial flight" was only successfully solved after the Wright brothers and other researchers stopped imitating birds and began studying aerodynamics. In scientific and technical works on aeronautics, the objective of this area of knowledge is not defined as "the creation of machines that, in their flight, resemble pigeons so much that they can even deceive real birds".

Role of Artificial Intelligence (AI)

Second, Builtin, (2022), artificial intelligence is the property of intelligent systems to perform creative functions that are traditionally considered a person's prerogative (not to be confused with artificial consciousness, IP); science and technology of creating intelligent machines, especially intelligent computer programs.

AI is related to the similar goal of using computers to understand human intelligence, but it is not necessarily limited to biologically plausible methods. Today's existing intelligent systems have very narrow areas of application. For example, programs that can beat a person at chess can't answer questions, etc.

According to Dartmouth (1956), the definition of artificial intelligence is not directly related to the understanding of intelligence in humans. AI researchers are free to use methods that are not observed in humans if necessary to solve specific problems. He points out that the problem is that we can't determine which computational procedures we want to call intelligent. We understand some of the mechanisms of intelligence and we don't understand others. Therefore, within the scope of this science, intelligence is understood only as the computational component of the ability to achieve goals in the world. At the same time, there is a view that intelligence can only be a biological phenomenon.

In English, the expression artificial intelligence does not have an anthropomorphic connotation: the word intelligence in the context used rather means "the ability to reason" rather than "intelligence" (for which there is an analogue of the intellect. The following definitions of artificial intelligence are given:

- **Scientific direction** - within which the hardware or software modelling problems of those types of human activity traditionally considered intellectual are defined and solved.
    - **The ownership of intelligent systems to perform (creative) functions** – which are traditionally considered a person's prerogative. At the same time, an intelligent system is a technical or software system capable of solving problems traditionally considered creative, belonging to a specific area, knowledge about which is stored in the memory of such a system.
    - The structure of an intelligent system includes three main building blocks – **a knowledge base, a solver, and an intelligent interface** that allows it to communicate with a computer without special programs for data entry.
- **Directing information technologies** is the task of recreating intelligent reasoning and actions using computer systems and other artificial devices.
    - The ability of the IT system to correctly interpret external data – to learn from that data and use the knowledge gained to achieve specific goals and objectives through flexible adaptation.

One of the definitions of intelligence, common to humans and "machines", can be formulated as follows: "Intelligence is the ability of a system to create, in the course of self-learning, programs (mainly heuristics) to solve problems of a certain class of complexity and to solve these problems" (Business Horizons, 2019).

According to Anglin, (1995), the history of artificial intelligence, as a doctrine of the development of modern science and technology for the creation of intelligent machines, has its roots in early philosophical studies of human nature and the process of knowing the world, later expanded by neurophysiologists and psychologists in the form of a series of theories about the work of the human brain and thought. The modern phase in the development of artificial intelligence science is the development of the mathematical theory of computation – the theory of algorithms – and the creation of computers.

As an applied science, "Artificial Intelligence" has both theoretical and experimental parts. In practice, the problem with the creation of "Artificial Intelligence" lies in the intersection of information technologies (software) with computer technology (hardware) and with neurophysiology, cognitive and behavioral psychology. The Philosophy of Artificial Intelligence serves as a theoretical basis, but only with the appearance of significant results did the theory acquire an independent meaning. So far, the theory and practice of "Artificial Intelligence" is distinguished from the mathematical disciplines, algorithmic, robotic, physiological and other theoretical and experimental techniques that have an independent meaning.

The largest number of young innovative companies developing AI are in the US, Europe, China, Israel, Britain and Canada. Among the companies that have filed the highest number of patents in the field of AI are IBM, Microsoft, Toshiba, Samsung, NEC, Fujitsu, Hitachi, Panasonic, Canon Deutsche Welle, (2019).

Turing test

The Turing test is an empirical test, which was proposed by Alan Turing in the article "Computing Machines and the Mind", (1950), in the philosophical journal Mind. Turing set out to determine whether a machine can think (The Alan Turing Internet Scrapbook, 1950).

The standard interpretation of this test is as follows: "A person interacts with a computer and a person. Based on the answers to the questions, he must determine who he is talking to: a person or a computer program. The task of a computer program is to induce a person to make the wrong choice",Swiechowski,(2020).

All test takers cannot see each other. If the judge cannot say for sure which of the interlocutors is a human being, then the machine is considered to have passed the test. To test the machine's intelligence, rather than its ability to recognize speech, the conversation is conducted in a "text-only" mode, for example using a keyboard and a screen (intermediate computer). Correspondence must be carried out at controlled intervals, so that the judge cannot draw conclusions on the basis of the speed of the answers. In Turing's time, computers responded more slowly than humans. Now this rule is also necessary because they react much faster than humans.

Turing has been particularly concerned with the problem of machine intelligence since at least 1941. One of the first mentions of "computer intelligence" was made in 1947. In his lecture "Intelligent Machines", Turing explored the question of whether a machine could detect intelligent behavior, and in that study he suggested what could be considered the precursor to his future research: "It is not difficult to design a machine that plays chess well. Now let's take three people-subjects of the experiment. A, B, and C. Let A and C not play chess well, and B the machine operator. Two rooms are used, as well as some mechanism for transmitting messages about movements. Competitor C plays with A or with a machine. Participant C may have difficulty responding to who he is playing with (Turing, 1950)."

Turing began his paper with the statement: "I propose to consider the question 'Can machines think?'" It points out that the traditional approach to this question is to first define the concepts of "machine" and "intelligence". Turing, however, took a different path; Instead, it replaced the original question with another, "which is closely related to the original and is formulated relatively unambiguously." Essentially, it proposes to replace the question "Do machines think?" with the question "Can machines do what we (as thinking creatures) can do?" The advantage of the new question, according to Turing, is that it draws "a clear line between a person's physical and intellectual capacities" (Turing, 1950).

In the same report, Turing later proposes an alternative "equivalent" formulation, involving a judge who only talks to a computer and a person. Although none of these formulations exactly correspond to the version of the Turing test that is best known today, in 1952 the scientist proposed a third. In this version of the test, which Turing discussed on BBC Radio, the jury asks for a computer, and the computer's role is to make a significant part of the jury believe that it is human.

According to Güzeldere (2008), there are four major turning points in the history of the Turing test:

- The publication of Computing Machines and the Mind in 1950,
- The report on the creation of Eliza by Joseph Weizenbaum in 1966,
- The Making of Parry by Kenneth Colby (1972);
- Turing Colloquium in 1990.

Eliza's role is to examine the comments entered by the user for the presence of keywords. If **a keyword** is found, the rule is applied, whereby the user's comment is converted and a **result phrase is returned**. If the keyword is not found, Eliza returns a general response to the user or repeats one of the previous comments. In addition, Weisenbaum programmed Eliza to mimic the behavior of a client-centered therapist. This allows Eliza to "pretend she knows almost nothing about the real world." By using these methods, Weisenbaum's program could have misled some people who thought they were talking to a real person, and some found it "very difficult to convince Eliza [...] who weren't human. On this basis, some argue that Eliza is one of the programs (possibly the first) that were able to pass the Turing test. However, this claim is highly controversial, since the people who "ask the questions" were told to think that a real psychotherapist would talk to them, and were unaware that they could talk to a computer.

Parry has been described as "Eliza with Opinions": the show attempted to model the behavior of a paranoid schizophrenic using a similar (if not more advanced) approach. To test the program, Parry was tested in the early 1970s using a modification of the Turing test. A team of experienced psychiatrists analyzed a group of real patients and computers controlled by Parry using a TTY. Later, the transcripts of the interviews were shown to 33 psychiatrists. Next, both teams were asked to determine which of the "patients" is a human and which is a computer program. Psychiatrists could only make the right decision in 48% of cases. This value is consistent with the probability of random selection. These experiments were not full-fledged Turing tests, since in order to make a decision, this test requires that questions can be asked interactively, rather than reading the transcript of the past conversation (Güzeldere, 2008).

AI Approaches

The symbolic approach was the first in the era of digital machines, since it was after the creation of LISP, (the first language for symbolic computing), that it was possible to start in practice to implement these means of intelligence. The symbolic approach allowed him to operate with formalized representations and their meanings.

The success and effectiveness of solving new problems depended on the ability to highlight only the essential information, which required flexibility in abstraction methods. While a common program establishes one of its ways of interpreting data, it seems biased and purely mechanical. An intellectual problem in this case is only solved by a person, an analyst or a programmer, not knowing how to entrust it to a machine. As a result, a single abstraction model, a system of entities, and constructive algorithms are created.

According to Haugeland, (1985), computational algebra (as opposed to numerical methods) develops and implements analytical methods to solve mathematical problems on a computer and assumes that the initial data, like the results of the solution, are formulated in an analytical (symbolic) way. When analyzing a mathematical model, the result can be general and analytical solutions of the formulated mathematical problem and its interpretation.

The logical approach to creating artificial intelligence systems is based on modelling reasoning. The theoretical basis is logic, which can be illustrated using Prolog's language and logic programming system for these purposes. Programs written in the Prolog language represent sets of facts and inference rules without rigidly specifying an algorithm as a sequence of actions leading to the desired result.

In the early 1990s, the agent-based approach, or the approach based on the use of intelligent (rational) agents, emerged. According to this approach, intelligence is the computational (roughly speaking, planning) part of the ability to achieve the goals set for an intelligent machine. Such a machine itself will be an intelligent agent that perceives the world around it with the help of sensors and is able to influence objects in the environment with the help of executive mechanisms. This approach focuses on the methods and algorithms that will help an intelligent agent survive in the environment while performing its task. An agent is everything that can be considered as perceiving its environment with the **help of sensors** and acting in this environment with the help of executive mechanisms, Shoham, (1990).

Rassel (1990) defines the concept of an agent, as opposed to a simple object, endowed with various mental constructs, such as faith, responsibilities, and abilities. Therefore, various mental categories will appear in the programming language, and the semantics of programming will be associated with the semantics of mental constructs.

Related Concepts

- **An object -** A programmatic entity of a given structure and mechanisms concretized to interact with other objects through the transmission of messages. Messages are formed and sent in response to incoming messages. Messages are generated by data-driven procedures.
- **Actor -** The software essence of a given structure and interaction mechanisms. Contains data and procedures. It has encapsulation, relationships, inheritance, and can generate messages.
- **Agent -** A programmatic entity to perform assigned tasks. It has behavior, namely: it interacts with a complex and dynamically developing external environment, capable of being modified or modified by other agents depending on specific conditions. Interaction means: perception of the dynamics of the environment; actions that change the environment; reasoning to interpret observed phenomena, solve problems, draw conclusions, and determine actions.

Depending on the degree of freedom of the environment, implying the presence of the corresponding type of agent in it, the environments are subdivided into:

- **Closed -** A finite deterministic or probabilistic description of the entire environment, which is known to the agent a priori or through research.
- **Open -** A finite, deterministic, or probabilistic description of the local area of the environment in which the agent is located and in which he knows a priori or resorts to research.
- **Transformable -** Dynamically developing environments, the evolving structure of which it is the agent.

The hybrid approach assumes that only a synergistic combination of neural and symbolic models achieves the full range of cognitive and computational capabilities. For example, expert inference rules can be generated by neural networks, and generative rules are obtained through statistical learning. Proponents of this approach believe that hybrid systems (software) will be significantly more powerful than the sum of different concepts separately.

Intelligent hybrid system (HIS) is generally understood as a system in which more than one method of mimicking human intellectual activity is used to solve a problem. Thus, HIS is a combination of: analytical models, expert systems, artificial neural networks, fuzzy systems, genetic algorithms, statistical simulation models.

According to Wermter, (2000), the interdisciplinarity of "intelligent hybrid systems" brings together scientists and experts who study the applicability of not one, but several methods, usually of different classes, to solve control and design problems.

According to Castillo, (2006), the term "intelligent hybrid systems" appeared in 1992. The authors put into it the meaning of hybrids of intelligent methods, such as specialized systems, neural networks, and genetic algorithms. The specialized systems represented symbolic and artificial neural networks and genetic algorithms – adaptive methods of artificial intelligence. However, the term referred to a fairly narrow area of integration – expert systems and neural networks. The following are several interpretations of this area of integration according to other authors:

- The "hybrid approach" assumes that only a synergistic combination of neural and symbolic models achieves the full range of cognitive and computational capabilities.
- The term "hybrid" is understood as a system composed of two or more integrated subsystems (software), each of which may have different presentation languages and output methods. The subsystems are combined, semantically and in effect, with each other.
- Scientists at the Centre for Artificial Intelligence at Cranfield University (England) define a "hybrid integrated system" as a system that uses more than one information technology. In addition, the technologies cover areas such as knowledge-based systems, connection models and databases. The integration of technologies makes it possible to use the individual power of technology to solve specific parts of the problem. The choice of technologies (software) implemented in a hybrid system depends on the specifics of the problem being solved.
- Experts from the University of Sunderland (England), members of the HIS (Hybrid Intelligent Systems) group, define "intelligent hybrid systems" as large, complex systems that seamlessly integrate knowledge and traditional processing. They can provide the ability to store, search, and manipulate traditional data, knowledge, and technologies. Intelligent hybrid systems (software) will be significantly more powerful than extrapolating concepts from existing systems (Negnevitsky, 2005).

The research objectives of HIS include the creation of methods to increase the efficiency, expressive power and inference power of intelligent systems, predominantly more complete, developed with less development effort than applications (software) using autonomous methods. From a fundamental perspective, HIS can help understand cognitive mechanisms and patterns.

Methods used in AI.

Without intending to be exhaustive in its description, some of the main methods used in Artificial Intelligence are presented.

- **Symbolic modelling of thought processes -** Looking at the history of AI, one can highlight an area as extensive as modelling reasoning. For many years, the development of this science has been following this path, and it is now one of the most developed areas in modern AI. Modeling reasoning implies the creation of symbolic systems, at the input of which a given task is defined, and at the output, its solution is required. As a rule, the proposed problem is already formalized, i.e. translated into a mathematical form, but either it does not have a solution algorithm, or it is too complicated, time-consuming, etc. This area includes theorem proof, decision-making and game theory, planning and scheduling, forecasting (Diakonov, 2009).
- **Working with natural languages -** An important area is natural language processing, which looks at the possibilities of understanding, processing, and generating texts in "human" language. Within the scope of this direction, the goal of such natural language processing is established, which could acquire knowledge on its own, through the reading of existing text available on the Internet (Young, 2018). Some direct applications of natural language processing include information retrieval (including deep text analysis) and machine translation.
- **Representation and use of knowledge -** The direction of knowledge engineering combines the tasks of obtaining knowledge from simple information, its systematization and use. This direction is historically associated with the creation of expert systems – programs that use specialized knowledge bases to draw reliable conclusions about any problem (Gorban, 2015).

The production of knowledge from data is one of the basic problems of data extraction. There are several approaches to solve this problem, including those based on neural network technology, using procedures to verbalize neural networks.

- **Machine learning -** The problem of machine learning concerns the process of independent acquisition of knowledge by an intelligent system in the process of operation. This direction has been pivotal since the beginning of AI development. In 1956, at the Dortmund Summer Conference, Ray Solomonoff wrote a paper on the unsupervised probabilistic machine, calling it the "Inductive Inference Machine."
- **Unsupervised learning** – This allows you to recognize patterns in the input flow. Supervised learning also includes classification and regression analysis. Classification is used to determine which category an image belongs to. Regression analysis is used to find a continuous function in a series of numerical input/output patterns from which output can be predicted. In training, the agent is rewarded for good answers and punished for bad ones. They can be analysed from a decision theory perspective using concepts such as utility. The mathematical analysis of machine learning algorithms is a branch of theoretical computer science known as Computational Learning Theory (Witten, 2006).

  A large class of image recognition problems belong to the field of machine learning. For example, this is character recognition, handwriting, speech, text analysis. Many problems are successfully solved using biological modeling. Computer vision is especially reference, which is also associated with robotics.
- **Biological Simulation of Artificial Intelligence -** It differs from the understanding of artificial intelligence according to John McCarthy when it proceeds from the premise that artificial systems are not obliged to repeat in their structure and function the structure and processes that occur in them inherent to biological systems. Proponents of this approach believe that the phenomena of human behavior, its ability to learn and adapt is a consequence of biological structure and the characteristics of its functioning (Russell, 2003).

  This includes several areas. Neural networks are used to solve complex and fuzzy problems, such as recognizing geometric shapes or clustering objects. The genetic approach is based on the idea that an algorithm can become more efficient if it contracts better traits from other algorithms ("parents") (Conrad, 2005). A relatively new approach, where the task is to create an autonomous program – an agent that interacts with the external environment, is called an agent-based approach.
- **Robotics -** The fields of robotics and artificial intelligence are closely related to each other. The integration of these two sciences, the creation of intelligent robots, is another direction of AI. Intelligence is needed for robots to manipulate objects, navigate with location problems (locate, study nearby areas), and plan movement (how to get to a target). Examples of smart robotics include Pleo robot toys, AIBO, QRIO.
- **The nature of** human creativity is even less studied than the nature of intelligence. However, this area exists, and here the problems of computer writing, literary works (often - poems or fairy tales), artistic creations are posed. Creating realistic images is widely used in the film and gaming industry.

Separately, the study of the problems of technical creativity of artificial intelligence systems is highlighted. The theory of inventive problem solving, proposed in 1946 by G. S. Altshuller, laid the groundwork for such research.

Adding this capability to any intelligent system allows you to clearly demonstrate what exactly the system perceives and how it understands it. Adding noise instead of lack of information or filtering out noise with the knowledge available in the system produces concrete images of abstract knowledge that are easily perceived by a person, this is especially useful for intuitive and low-value knowledge, verifying that it is a formal form requires significant mental effort.

There are two directions for AI development:

- Solving problems related to the approach of specialized AI systems to human capabilities, and their integration, which is implemented by human nature (Intellect improvement);
- Creation of artificial intelligence, representing the integration of AI systems already created into a single system capable of solving humanity's problems (strong and weak artificial intelligence).

But right now, in the field of artificial intelligence, there is an engagement of many subject areas that are more of a practical relationship with AI, rather than fundamental. Many approaches have been tried, but no research group has yet addressed the emergence of artificial intelligence. Below are just a few of the most famous developments in the field of AI.

Remarkable AI systems

Some of the most famous AI systems are:

- Deep Blue - developed by IBM, defeated the world chess champion. Kasparov's game against the supercomputer brought neither computer scientists nor chess players any satisfaction, and the system was not recognized by Kasparov. The IBM line of supercomputers then emerged in BluGene brute force (molecular modeling) and pyramidal cell system modeling projects at Blue Brain, Switzerland (Morphy, 2011).
- AlphaGo - developed by Google DeepMind, won a game against Korean 9 dan pro-Lee Sedol.
- Watson is a promising development from IBM, capable of perceiving human speech and performing probabilistic search using a large number of algorithms. To demonstrate the work, Watson participated in the American game "Jeopardy!"
- MYCIN is one of the first specialized systems that could diagnose a small set of diseases, often as accurately as doctors.
- 20Q - a project based on the ideas of AI, based on the classic game "20 Questions". It became very popular after appearing on the Internet in 20q.net.

- Voice recognition. Systems like Via Voicecan serve consumers.
- The robots in the annual RoboCup compete in a simplified form of football.

Banks use artificial intelligence (AI) systems in insurance (actuarial mathematics), stock market trading, and property management. Pattern recognition methods (including the most complex and specialized ones, as well as neural networks) are widely used in optical and acoustic recognition (including text and speech), medical diagnostics, spam filters, in air defense systems (target determination), as well as to ensure various other national security tasks.

Computer game developers use AI to varying degrees of sophistication. This forms the concept of "Game Artificial Intelligence". The standard tasks of AI in games are to find a path in two-dimensional or three-dimensional space, mimicking the behavior of a combat unit, calculating the correct economic strategy, and so on.

Research Centers

The largest scientific and research centers in the field of artificial intelligence:

- **United States of America** - the Massachusetts Institute of Technology; the Institute for Automatic Intelligence Research
- **Germany** - the German Research Center for Artificial Intelligence
- **Japan** - the National Institute of Contemporary Industrial Science and Technology (AIST)
- **Russia** - the Scientific Council on the Methodology of Artificial Intelligence of the Russian Academy of Sciences
- **India** - the Indian Institute of Technology in Madras.

Programming languages.

The first logical programming language was the Planner language, in which it established the possibility of automatic output of the result from data and gave rules for enumerating options (the combination of which was called a plan). The planner was used to reduce computational requirements (using backtracking) and provide the ability to display facts without actively using the stack. Next, the Prolog language was developed, which did not require an iteration plan and was, in this sense, a simplification of the Planner language (McCarthy, 1958).

The Planner language also gave rise to the logical programming languages QA-4, Popler, Conniver, and QLISP. The programming languages Quicksilver, Visual Prolog, Oz, and Fril are descended from the Prolog language. Based on the Planner language, several alternative logical programming languages have been developed that are not based on the backtracking method.

Agent-based approach

According to Yoav Shoham, (1990), an approach based on intelligent (rational) agents was developed. With this approach, intelligence is the computational part of the ability to achieve the goals set for an intelligent machine (computer), that is, a computer that perceives the world around it with the help of sensors, being able to influence objects in the external environment with the help of executive mechanisms.

This agent-based approach (hereinafter AOP) to programming is a kind of presentation program or programming paradigm, in which the fundamental concepts are the concepts of an agent and its mental behavior, depending on the environment in which it is located. This approach focuses on the methods and algorithms that will help an intelligent agent survive in the environment while performing its task, based on the algorithms to find a path and make decisions.

This new rational programming paradigm of object-oriented programming has shifted the paradigm from writing procedures to the creation of objects, rational programming has shifted the paradigm from the creation of information objects to the creation of motivated agents (Shoham, 1990). An agent is anything that can be considered as perceiving its environment with the help of sensors and acting in this environment with the help of executive mechanisms.

For Shoham, he understands an agent as a software agent. It is based on the theory of artificial intelligence, the concept of which already existed but was vague, and it sets itself the goal of turning it into a more formal application in programming by offering a special AOP framework. The concept of agent is endowed with several mental constructions, such as faith, responsibilities and abilities, and several mental categories appear in the programming language and the semantics of programming will be associated with the semantics of mental constructions.

Related Concepts

Without pretending to be exhaustive in its characterization:

- An object – is a programmatic entity of a certain structure and mechanisms concretized to interact with other objects through the transmission of messages. Messages are formed and sent in response to incoming messages. Messages are generated by data-driven procedures.
- **Actor – is the** software essence of a given structure and interaction mechanisms. It contains data and procedures and is one of the pillars of object programming, it is useful in simplifying programming, as well as in protecting sensitive or confidential data and with the possibility of reuse, relationships, inheritance and can generate messages.
- **Agent –** is a programmatic entity to perform assigned tasks. It has behavior, interacts with a complex environment and dynamically in external development, capable of being modified or modified by other agents depending on specific conditions. Interaction means perception of the dynamics of the environment; actions that change the environment; reasoning to interpret observed phenomena, solve problems, draw conclusions, and determine actions. It is transformable in dynamically developing environments, the evolving structure of which it is the agent.

Robotics and AI

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Digital Society

It will not be an exaggeration or blatant mistake to say that the current society is increasingly qualified by the adjective digital, where the new information and communication technologies (ICTs) have a constant daily influence, configuring themselves as mediators of social relations, the economy and even in the way of producing/disseminating knowledge. There are forms of absorption of knowledge about users in a ubiquitous way, in which ICTs can be seen as new forms of surveillance Lupton, (2015, p. 02; p. 189). Digital ICTs play a crucial role in the globalization process, as a phenomenon characterized by the wide circulation of people, ideas and habits, which, although it did not begin historically with technologies, develops at high speed through them De Mul, (2015, p. 106).

The growing insertion of Information and Communication Technologies (ICTs) in people's daily lives has promoted a relationship of deep dependence between them. In this context, everyday actions have become essentially informational, given the need for mediation for their performance.

The digital society is a complex society of technological innovation and communication, in which there is the creation of new environments and changes in the organizational dynamics of people, in the way people understand reality, modifying the way, how they relate to the environment, with other people and how they conceive themselves in the face of their own reality. Both meanings can be understood as a result of the informational revolution, promoted mainly from the attempts to understand human intelligence, via computational bases.

The works developed by Turing (1950) had a great influence on the studies of the second half of the twentieth century, including in Philosophy, mainly due to his algorithmic approach to the nature of thought, in which he proposed the thesis according to which "thinking is calculating" (Turing, 1950, p. 436). This is that since digital computers operate from calculations and manipulate rules for the organization of symbols, if we consider that thinking consists in the activity of manipulating symbols according to a set of logical rules, constituting algorithms, then digital computers could, in principle, think. Once intelligent thinking is understood in a mechanical way, it would be possible to construct mechanical models of the structure and dynamics of this type of thinking. This understanding enabled the development of mechanical models of the mind, which initially generated two strands in Cognitive Science Teixeira, (1998):

- Strong Artificial Intelligence – is one in which mechanical models of the mind, when successful, not only simulate/emulate mental activities, but explain and instantiate such activities.
- Weak Artificial Intelligence is one in which the model is only an explanatory, limited tool of intelligent mental activity.

The common point of these notions is that both accept the thesis that to simulate is to explain, in order to attribute to mechanical models, the value of theories, in which the computer is employed, as a fundamental tool. As for the social sphere, the development of information theory studies has promoted the social changes that we are currently experiencing and that have generated new types of problems, especially those related to the relationship between action / technology / environment. Given its impact on the academic and social spheres, the approximation between Philosophy and Information Science, and the role of computers in the development of theories, theoretical production occurred concomitantly with technological improvement.

Floridi (2008, p. 3-4) states that during the second half of the twentieth century there were events such as: the massification of the computer, which promoted the generation of the "personal computer"; the advancement of scientific discoveries due to the use of ICTs; and the emergence of new ways of experiencing the world, based on such technologies. These events illustrate the influence of ICTs in various spheres of society (sociological, economic, scientific and cultural), providing elements for the characterization of it as an information and knowledge society. According to Floridi (2002, p. 127): "Post-industrial societies live on information."

ICTs play a central role in the characterization of the digital society, to the extent that they are present and related to the person and their well-being, and in their continuous use in everyday situations (e.g., leisure, work, etc.). It is a relationship of dependence between the person and ICTs. This relationship is strengthened, according to Floridi, by the following factors:

- Increasing the power of ICTs, while reducing their cost of production and marketing.
- Improvement of ICTs in their potential for interaction (machine-machine and human-machine);
- Emergence of the Age of "zettabytes" (dated 2010).

The indicated factors are responsible for the approximation between people and ICTs, generating a deep relationship of dependence for the performance of routine actions in today's world. Such dependence is based on the digital presence, as a mediator of common actions, such as financial transactions (home banking), the acquisition of products and services (virtual stores, e-commerce), personal and professional interrelationship (via social networks, such as Facebook, Twitter, or dating apps, such as Tinder), access to movies (via streaming, YouTube, Netflix, etc.), urban mobility (via app, etc.). Uber, Taxi 99), making calls (using the network, via Skype, Whatsapp), the practice of physical activity (Runkeeper, for example), professional activities via SOHO (small office / home office), political organization (via websites or social networks), among others. Situations in which there is no mediation of artifacts connected to the **Internet** by people, but which require technological mediation by the service to be requested, such as: payment by credit card for face-to-face purchases, biometric systems for the withdrawal of books in libraries, among others, can also be highlighted.

To understand the influence of ICTs on the constitution and alteration of people's self, the three types of self-highlighted by Floridi (2014, p. 60) are explained:

- **Personal Identity** – refers to "who we are". We live in an era where people spend a great deal of time transmitting information about themselves, interacting digitally with other people, and this is a good example of how ICTs are affecting and shaping people's personal identity.
- **Self-conception** – consists of "who we think we are".
- **Social self** - refers to who we are from other people's thoughts.

It is mainly this third notion of self that ICTs have a deeper channel of action in the conception of people's identity, as there is a growing adhesion and overvaluation of social networks, illustrated, for example, by the intensification of a "narcissistic culture".

The Web enhances the narcissistic culture, typical of our time, by expanding the forms of self-celebration and self-promotion. Social networking sites, on the other hand, end up encouraging vanity and competition. [...] Young people strive to show in their profiles, photos and texts that value them and promote the increase in the number of people they add as "friends". [...] This type of behavior is justified by a constant search for attention and recognition. The ease of access to information about oneself generated by third parties, fosters self-understanding from others (social self), constitutes a scenario in which people, especially those who correspond to Generation Z, feed the network with personal information in an intense way.

The greatest change of all is the transformation of the information and knowledge society into the digital society. The focus of work has shifted to 'remote working - teleworking'. In societies in developed countries, increasingly, access to good jobs and a professional career will depend on a university degree with remote work, anywhere, in a country, in the globalized world. That is, the logical result, since we stopped working in the office and in large urban centers, we went through intellectual work and arrived at telework at home or elsewhere, outside the large urban centers. This last stage represents a break with the past.

- The fact that knowledge and education have been a passport to good jobs and a career, has meant above all that in society, companies are no longer the only means for someone to progress in life and have become one of the many opportunities available.
- Knowledge has become the capital of developed economies and knowledge workers, and it is knowledge workers who determine the values and norms of society.

The great challenge for developed countries is to maintain the commitment to the economic performance necessary for organizations and countries to remain competitive. Governance and entrepreneurship contain the entrepreneurial spirit. They are not antagonistic concepts, nor are they mutually exclusive. Both are always necessary and at the same time. Both have to be coordinated, that is, both have to work together. No existing organization can survive without innovation and at the same time without being managed.

V. DISCUSSION, CONCLUSION and CLUES for FURTHER INVESTIGATIONS

Discussion

Globalization of Information

In the age of globalization, information is the link that unites us. By being able to transmit it in large quantities quickly from continent to continent, we have transformed a widely separated and diverse world into a single global megalopid. The foot messenger has given way to the world's information superhighways. Anything can be a valuable asset, to be compiled, stored, duplicated, sold, stolen and sometimes a source of murder. Many people around the world spend their workday gathering, studying, and processing information. Industries have developed to produce equipment (and software) to store and process information.

Information about the globalized world today demands permanent attention and can be considered as the most asset, so in knowledge-based economies, information is assuming an increasing share of the cost of doing business successfully and simultaneously a source of peace and local and/or global conflicts. Although we can store it using various physical supports, the information itself is not physical, but abstract and not purely mental. Knowledge is stored in people's memories, but information is out there in the world. Whatever it is, there is somewhere between the physical world around people and the mental world of human thoughts.

In industrial society, oil (crude *oil)* was an important source of energy used to drive engines and power factories. But before the chemical energy of petroleum could be unleashed, crude *oil* had to be refined, that is, into usable forms such as gasoline and heating fuel. Similarly, information is the source of the energy that drives the "*engines*" of the so-called digital society, but in order to use it we need to convert it into a usable form: **knowledge**. But when we refine information to turn it into knowledge, quality outweighs quantity. When we convert information into knowledge, we add value to it and make it more expensive.

During the last few years, in most Western countries it has been seen that the industrial sector, responsible largely for the wealth they have accumulated since the nineteenth century, is losing weight in the Gross Domestic Product (GDP) compared to the services sector, as a result of the transformation of the industrial society into the informational society, Moore, (1997) for three reasons:

- Countries and organizations depend more and more on the intelligent use of information and are becoming information-intensive countries/organizations.
- People consume large amounts of information in their daily lives, whether in terms of leisure, business, peace or conflict.
- The information industry is emerging disguised within the diversity of the service sector, as a sufficient entity to be a sector (perhaps the best) of the major sectors of the economy (primary, secondary, and tertiary sectors). Industry can consist of three sectors: information content, information distribution (access centers and distribution channels, such as telecommunications operators and the Internet) and information processing (computer technology).

The transformation of organizations into informationally intensive ones is perhaps the clearest trigger of the shift to the informational society. The analysis of the most successful organizations in the world seems to indicate that this originated in the best management of information and knowledge about the world (global and immediate), i.e. those that were able to better detect the needs of the market and that best adapted in terms of configuration, methods, processes and cultural forms that allowed to combine external information with that generated internally to generate distinctive competitive advantages. Porter, (1998).

Globalization has to be seen beyond the opening or not of borders, countries, markets and organizations themselves. Information, regardless of its geographical origin or time moment, is at our fingertips through the telephone keypad, a computer or the television screen.

Countering disinformation

According to Koblentz, (2019), the proliferation of weapons of mass destruction raises serious concerns for global peace and security. They have been used in attacks by presumably state agents on dissidents, causing even more concern, such as in Britain in 2018, Vale, Marrs and Maynard, (2018) and, more recently, in Russia in 2020, Masterson, (2020). Chemical weapons are chemical substances with toxic properties that are employed to cause intentional harm or death through their toxic properties. The Organization for the Prohibition of Chemical Weapons (OPCW) is the international body tasked with eradicating chemical weapons.

To do this, political actors use coordinated disinformation. Misinformation is information designed to be deliberately misleading or misleading, Jack, (2017). The level and effectiveness of disinformation in recent times is such that it can be considered a threat to global peace, Stewart, (2021). The method of spreading disinformation varies and ranges from nation-led initiatives to groups and individuals acting covertly and overtly to misinform. Covert manners involve some form of disguise using techniques and technology, for example, and disguising themselves as citizens expressing their legitimate opinions without ulterior motives. Overt disinformation is often carried out by the government-backed media, as was the case with Russia, Wilson & Starbird, (2020).

According to Starbird, Arif and Wilson, (2019), people unwittingly are the ones who spread misinformation the most. The wide reach, ease of use, and design of social media make it the preferred tool for disinformation, whose content is sensationalized, generates high levels of attention, and distorts facts into outright lies. Second, Nemr &Gangware, (2019), the characteristic and/or design algorithm of social networks, makes them particularly vulnerable to misinformation that is often spread in a sensationalist way. Sensationalist content generates high levels of attention and ranges from conspiracy theories, distortion of facts to outright lies

According to Hoffman, (2009), the different tools are used by "political actors" to discredit evidence, deceive the public and divert citizens' attention, with the aim of sowing division and influencing politics by attacking citizens' emotions.

Main Differences between Human Intelligence and Artificial Intelligence

Artificial intelligence (AI) has increasingly become present in people's daily lives, performing tasks that were previously exclusive to human intelligence. However, despite technological advancements, there are fundamental differences between artificial intelligence and human intelligence. There is no exhaustive characterization of the main differences, highlighting the capacities and limitations of each one. Understanding these differences is essential for the development of AI, as well as for reflecting on the role and impact of technology on society. Artificial intelligence and human intelligence are two forms of intelligence, the main differences of which can be summarized in the following:

Table nº 4 - Main Differences between Human Intelligence and Artificial Intelligence

Key differences	Human Intelligence	Artificial intelligence
Apprenticeship	To acquire knowledge, you need interactions and experiences	Learns quickly with large amounts of data
Creativity	It is unique in that it involves emotions, intuition, and abstract thinking	AI can't replicate accurately
Empathy	Humans' ability to understand their emotions and put themselves in other people's shoes	AI can't do it
Decision-making	It takes into account various aspects, including moral and ethical values	It is based on algorithms and data
Adaptability	_Os human beings have the ability to adapt to new situations and learn from	AI can't do this effectively yet

	them	
Institution	It is based on past experiences and feelings	AI doesn't have
Conscience	Human beings are aware of themselves and the world	AI doesn't have

Source: *https://maestrovirtuale.com/inteligencia-artificial-vs-inteligencis-humana-7-diferenas/?expand_article=1*

Table nº 5 - AI operates based on algorithms and has no ability to make ethical decisions on its own.

Key differences	Human Intelligence	Artificial intelligence
Flexibility	Humans have the ability to adapt and change goals with new information	AI is programmed to follow certain rules and parameters
Creativity	Humans think creatively and find innovative solutions to achieve their goals	AI follows the pre-defined algorithms without the ability to think
Empathy	Humans have feelings and emotions when pursuing their goals, taking into consideration the impact of their decisions on people	AI lacks empathy and makes decisions based on data and (pre-programmed) logic
Intituition	To set their goals, humans rely on their intuition and experience	AI bases its decisions on the analysis of data and patterns
Continuouslearning	Humans learn from their experiences and mistakes and adjust their goals over time	AI needs to be constantly updated and reprogrammed to improve its performance
Self-awareness	_Os humans have the ability to reflect on their own thoughts and actions, which influences their goals and motivations	AI lacks self-awareness and operates according to instructions programmed by the AI's creators
Humanandethicalvalues	Humans t^^in ability to tr into consideration human and ethical beings in decision-making and action to achieve their goals	AI operates based on algorithms and has no ability to make ethical decisions on its own.

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Table nº 6 - Technology has no emotions and cannot assign emotional meanings to its stored "memories."

Key differences	Human Intelligence	Artificial intelligence
Creativity	Human eres are able to remember, associate/relate, and create ideas from their past experiences	Technology can only store and process data in a pre-programmed way, without the ability to innovate or create something new.
Adaptability	Human beings have the ability to adapt to new situations, learn from mistakes and modify their behavior according to circumstances	AI is dependent on technology and stored algorithms and data to perform its tasks, with no ability to adjust autonomously.
Emotion	Humans have the ability to remember past events based on the associated emotions, which influences how they process and store information (knowledge)	Technology has no emotions and cannot assign emotional meanings to its stored "memories"

Source: *https://maestrovirtuale.com/inteligencia-artificial-vs-inteligencis-humana-7-diferenas/?expand_article=1*

Artificial Intelligence to develop computer systems capable of performing some tasks, were achieved based on human intelligence, Artificial Intelligence is based on four fundamental concepts:

- **Technology learning** – the ability of systems to learn and improve their performance without being explicitly programmed and to make decisions based on the algorithms and data stored.
- **Natural programming language processing**. – Enables technology to understand and interpret human language (speech recognition, machine translation, and text analysis).
- **Computer vision** – the ability of technology to interpret and understand the visual world (object recognition, motion detection, and pattern image identification)
- **Automated reasoning** – the ability of technology to process stored data, reach logical conclusions, and make decisions based on these "reasonings" using inference and logic algorithms to solve complex problems,

V. Conclusion

In conclusion, the above discussion describes the main differences between Human Intelligence and Artificial Intelligence, in a summarized way. Human Intelligence plays a vital role in people's lives. Artificial intelligence represents a huge challenge for people, organizations, and society in general, in the Digital Society.

Human Intelligence emphasizes the importance of human values and individualism, of human beings, having contributed to the development of art, culture, literature, and society in general. Human intelligence can be seen in the pursuit of knowledge and the exploitation of human potential. Overall, human intelligence has left a profound impact on shaping the course of history, emphasizing the importance of human dignity, critical thinking, and the pursuit of a complete ethical life.

Artificial Intelligence is the technology that describes the future and will affect the lives of people, organizations, and society in general, in which technology will be able to reproduce skills similar (not the same) to humans, such as reasoning, learning, planning and creativity. The technology receives the data (already prepared or collected through its own sensors, e.g. the use of a camera), processes it and responds to different situations, based on the amount of data stored and the algorithms.

Artificial Intelligence technology needs to be regulated regarding:

- Software, virtual assistants, image analysis software, search engines, facial and voice recognition systems.
- Technology embedded in hardware: robots, self-driving cars, *drones* or applications within the scope of the Internet of Things.

Some examples of applications that are powered by Artificial Intelligence:

- **Online shopping and advertising** – important in the commercial area for product optimization, logistics, stock planning, etc.
- **Web searches** – search engines learn from the vast data entry/collection, providing searchers with relevant results.
- **Digital personal assistants** – providing a product that is as relevant and personalized as possible. Virtual assistants answer questions, provide recommendations, and help organize daily routines and have become ubiquitous.
- **Machine translations** – language translation software, based on written or spoken texts, relies on artificial intelligence to offer the best translation. Ditto automatic subtitling.
- **Smart homes, cities, and infrastructure** – smart thermostats learn from human behavior to save energy, control, and improve traffic in cities, improve connectivity and reduce traffic jams.
- **Cars** – autonomous vehicles are a reality, in terms of road safety, powered by automated sensors that detect potentially dangerous situations and accidents.
- **Cybersecurity** – help recognize and combat cyberattacks and other threats based on continuous data collection, pattern recognition, and rewinding attacks.
- **Health** – helping to recognize the infection through computer x-rays, as well as in locating health problems. Finding patterns that can lead to new discoveries in medicine and other ways to improve individual diagnosis (e.g. answering emergency calls to recognise cardiac arrest and dispatch medical staff quickly).
- **Countering disinformation** – detecting fake news and disinformation by monitoring information on social media, searching for sensationalist or alarming words, and identifying reliable sources.
- **Transport** – improving the safety, speed and efficiency of road and rail traffic by minimizing wheel friction, maximizing speed and enabling autonomous driving.
- **Manufacturing** – helping companies become more efficient using robots in manufacturing, optimizing sales routes, forecasting, maintenance, and smart factory failures.
- **Food and agriculture** – Creating a sustainable food system that ensures healthy food by minimizing the use of fertilizers, pesticides, and irrigation, increasing productivity and reducing environmental impact. Robots can remove weeds or decrease the use of herbicides
- **Public administration and services** – by using stored data and pattern recognition, it allows you to warn of natural disasters, prepare for and mitigate the consequences.

Clues for Future Investigations

The reflection on Human Intelligence and Artificial Intelligence in the Digital Society (from Theory to Practice), can contribute to enlighten World Leaders/Officials and individuals about the consequences and the need to define rules and norms, on the one hand humans and on the other hand those responsible for technology, in the change of paradigms, in economic, political and social terms and to focus their attitudes and behaviors, on ethical decision-making, in the different areas of activity, influencing all organizational levels/companies (public and private), involving politicians, technical commissions and other members of governance, and with that, provide responsible and transparent decision-making, more assertive and supportive, at all levels of the World Power structure (legislative, judicial, and executive).

The following questions already arise:

1. Could artificial intelligence vs human intelligence answer the question: why isn't the human brain a computer?
2. Could artificial intelligence in its entirety of input and output of data transformed into information be a receiver of data and a transmitter of information, knowing the direction of information, ramifications, and endless loops in the world of neurons?
3. What will be the channel through which the data (hardware) and the information itself can be distinguished, i.e., the material medium through which it travels?
4. Could the data that the human brain works with be stored and used by Artificial Intelligence?
5. Will artificial intelligence easily adapt to the context of the human brain, i.e. to the same unpredictable context?
6. Will artificial intelligence ever work like the nerve cells in the human brain?
7. Will artificial intelligence ever be able to distinguish the rational from the irrational in the human brain?

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